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Technical Report

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Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project, Technical Specification Group Radio Access Network, Working Group 1 (3GPP TSG RAN WG1).

The contents of this TR may be subject to continuing work within the 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.x.y

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 report.

1 Scope

This technical report describes the Physical Layer Study Items for UTRA. A study item can either be for further study as proposed but not yet accepted by the group, or subject to some verifications (performance, complexity….).

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

<Editor's Note: Relevant references should be discussed>

[1] TS S1.02 (V1.0.0): "UE capabilities"

[2] TS S1.11 (V1.0.0): "Transport channels and physical channels (FDD)"

[3] TS S1.12 (V1.0.0): "Multiplexing and channel coding (FDD)"

[4] TS S1.13 (V1.0.0): "Spreading and modulation (FDD)"

[5] TS S1.14 (V1.0.0): "Physical layer procedures (FDD)"

[6] TS S1.21 (V1.0.0): "Transport channels and physical channels (TDD)"

[7] TS S1.22 (V1.0.0): "Multiplexing and channel coding (TDD)"

[8] TS S1.23 (V1.0.0): "Spreading and modulation (TDD)"

[9] TS S1.24 (V1.0.0): "Physical layer procedures (TDD)"

[10] TS S1.31 (V1.0.0): "Measurements"

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.

<defined term>: <definition>.

example: text used to clarify abstract rules by applying them literally.

3.2 Symbols

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

<symbol> <Explanation>

3.3 Abbreviations

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

<ACRONYM> <Explanation>

ARQ Automatic Repeat Request
BCCH Broadcast Control Channel
BER Bit Error Rate

BLER	Block Error Rate
BS	Base Station
CCPCH	Common Control Physical Channel
DCH	Dedicated Channel
DL	Downlink (Forward link)
DPCH	Dedicated Physical Channel
DPCCH	Dedicated Physical Control Channel
DPDCH	Dedicated Physical Data Channel
DS-CDMA	Direct-Sequence Code Division Multiple Access
FACH	Forward Access Channel
FDD	Frequency Division Duplex
FER	Frame Error Rate
Mcps	Mega Chip Per Second
MS	Mobile Station
ODMA	Opportunity Driven Multiple Access
OVSF	Orthogonal Variable Spreading Factor (codes)
PCH	Paging Channel
PG	Processing Gain
PRACH	Physical Random Access Channel
PUF	Power Up Function
RACH	Random Access Channel
RX	Receive
SCH	Synchronisation Channel
SF	Spreading Factor
SIR	Signal-to-Interference Ratio
TDD	Time Division Duplex
TFCI	Transport Format Combination Indicator
TFI	Transport-Format Indicator
TPC	Transmit Power Control
TX	Transmit
UL	Uplink (Reverse link)
VA	Voice Activity

4 Physical Layer Study Items

4.1 Transport channels and physical channels (FDD) (S1.11)

RACH study items

- Detailed structure of the 3 valued AICH
- RACH preamble structure
- Emergency calls handling
- Path-loss estimation for the random access

Packet transmission study items

- Develop and refine specific parameters associated with the proposals for Uplink Shared Channel (USCH) , and for Common Packet Channel(CPCH)

Transmit diversity study items:

- Applicability of closed loop Transmit Diversity to PDSCH when associated with PSCCCH

Slot structure study items :

- Simulations for 4bits TPC field (considered for SF 32 and 64)
- Lowest SF in SCCPCH
- pilot patterns in downlink : further investigations for downlink pilot patterns when Transmit Diversity is applied

Handover preparation study items:

- Idle period obtained by grouping rate matching DTX
- Use long idle lengths typically 5ms with SF/2 compared to non slotted mode, or use shorter idle lengths typically 2.5ms with puncturing and thus holding the same SF
- Impact of idle length and idle periods on other links in slotted mode and links in non slotted mode, in the same cell or not

Synchronisation channels study items

- Selection of second synchronisation code between 3GPP, TI and Nortel .

<Editor' note : the study items in the end of this paragraph were identified in ETSI, and are either not yet closed or are subject to verification in 3GPP>

Uplink dedicated channel

- granularity of downlink DPDCH still to be confirmed (smallest bandwidth 32 kbit/s)

- clarification of the use of pilot bit pattern (pilot bits different according to slot number)

Uplink Common physical channel

- Provisions for fast closed loop power control for the message part of the PRACH burst – what is the performance improvement and what new physical channels are needed to enable its operation.
- Verification of preamble detection probability and false alarm rate in the preamble detection, and part of link level simulation for minimum requirements setting.
- Power ratio between preamble and message, implications for coverage.
- Pilot pattern on PRACH message control

Downlink dedicated physical channel

- Verification of the interaction with SCH

In the case of multi-code for downlink dedicated physical channel, the following items should be studied :

- structure of the DPDCH when SF different on the difference codes ? Should it be identical to the single code case ?
- clarification and validation of working assumption in FDD document in case of identical SF

4.2 Multiplexing and channel coding (FDD) (S1.12)

Rate matching, channel interleaving and multiplexing study items

- Use of code multiplexing in uplink
- Mandatoriness of Blind Rate Detection implementation in the UE
- Maximum number of transport formats combination, and data rates on which BRD can be applied
- Additional CRCS
- Specific Services coding, rate matching, multiplexing scheme : should it be integrated in the general scheme or kept as a separate scheme?
- Channel Interleaver method
- Rate matching on a 10ms basis or on a transport channel time interval basis, in particular for multiplexing of transport channels with different transmission time intervals.

Channel coding:

- Puncturing for Turbo Codes
- Use of Turbo Codes for low data rates

- Need for ARQ Type II/III
- Physical layer scheme in order to include a prospective Hybrid ARQ mechanism,

<Editor' note : the study items in the end of this paragraph were identified in ETSI, and are either not yet closed or are subject to verification in 3GPP>

Mapping of PCH and FACH to be studied in relation with

- paging capacity evaluation needed from Layer 2 group as a result of service characteristics and Mobility management procedures (location areas, routing areas...)
- sleep mode and battery saving
- Granularity of the sleep mode on a cell by cell basis or mobile per mobile basis in relation with paging response time

- introduction of a rate ¼ convolutional code in addition to the rate ½ and 1/3.

TFCI design

- Verification and link level results to set the minimum performance requirements of the interaction between detection performance of TFCI alone, and the user data (assuming error free TFCI) to fulfil the overall service requirements.

- Transport channel multiplexing in the case of variable rate transmissions using multicodes, for both uplink and downlink

4.3 Spreading and modulation (FDD) (S1.13)

- Study possibility of having polynomials with degree 24 for uplink long scrambling codes
- New cyclic hierarchical sequences for secondary SCH
- New cyclic hierarchical sequences for primary SCH
- Use and generation of secondary scrambling codes

4.4 Physical layer procedures (FDD) (S1.14)

Power Control Study Items

- Level of standardisation for downlink step sizes
- How should a UE in soft handover react to to TPC commands originating in cells with different step sizes
- Step sizes in uplink Power Control (number, smallest step size, mandatoriness of step sizes)
- Performances needs for SIR estimation : definition of needed confidence in TPC commands
- Range of possible power differences between downlink DPCCH and DPDCH fields unclear
- Uplink and downlink power control in multicode
- Uplink and downlink power control in variable rate

- Uplink power control in DTX
- Uplink and downlink power control in Downlink Slotted Mode
- Uplink and downlink power control in Uplink Slotted Mode
- Power control for the DSCH when associated with a DCH
- Power control for DSCH when associated with a DSCH control channel and an uplink DCH

Downlink study items:

- Support of closed mode mandatoriness in UE, with possible distinction between UE categories: mandatory if no more than 2 txd antenna used for txd, else ffs
- Simultaneous application of SSDT Power Control and closed loop mode of Transmit Diversity
- Use of more than two antennas.: ffs
- 4th closed loop mode of txd: ffs

Handover preparation study items:

- Dual receiver approach

4.5 Transport channels and physical channels (TDD) (S1.21)

- Improvement of the current RACH scheme for higher payload
- ODMA
- Possible inclusion of Uplink shared channel on the physical channel

4.6 Multiplexing and channel coding (TDD) (S1.22)

- Use of non fixed service bits positions in case where there is no TFCI
- TFCI coding is still open, to be aligned with FDD
- Support of H ARQ Type II/III

4.7 Spreading and modulation (TDD) (S1.23)

- Verification that there is no problem with Downlink scrambling sequences

4.8 Physical layer procedures (TDD) (S1.24)

- Joint pre-distortion
- Open Loop power control for RACH
- Use of Slotted Mode in TDD for monitoring purposes

- Refinement of DTX scheme according to editor's note : transmission of mid-amble and tpc, tfci bits while DTX : ffs
- Further study of more sophisticated scheme than the current included (STD)
- Uplink synchronisation
- ODMA
- Fast open loop Power Control for uplink: simulations parameters to be agreed first
- Adaptive antenna
- Inter system (inter operator) interference management
- Uncoordinated operation
- Txd : new mid-amble period proposed to reduce complexity of joint channel estimation: ffs
- Synchronisation solution of Node B

4.9 Physical Layer Measurements (S1.31)

Handover preparation study items:

- Inputs to the scenarios as services, idle lengths, idle length position, idle periods, level of power transmission of SCH and common control channels, and compressed bits, radio environment

- Cell reselection scenarios and consequence on the cell reselection monitoring set
- Handover scenarios and its consequence on the cell sets parameters (number of cells in each set, distribution of the cell types in each of the set).
- Measurement for handover preparation triggering criterion
- Co-ordination between the uplink and downlink slotted mode
- Parametrisation of the slotted mode for FDD (set of possible idle length, idle periods for each type of cell to monitor). This item is partly covered in list of items for S1.12. Only a limited set of parameters should be supported, which might lead to a reduction of the idle lengths currently specified.
- Overall handover preparation in FDD mode at the UE (e.g. setting of idle periods to monitor FDD cells, TDD cells, acquire FCCH/SCH, reconfirm SCH and perform power measurements for GSM in sequence)
- Measurements for handover preparation in FDD mode at the UTRAN
- Introduction of free continuous idle periods in TDD and its practical use
- Monitoring of FDD cells when in TDD mode
- Monitoring of TDD cells when in TDD mode
- Overall handover preparation in TDD mode at the UE
- Measurements to support DCA
- Measurements for adjacent protection rule
- Soft Handover in TDD

5 History

Document history

Editor for R1.01, Physical Layer Study Items, is:

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V0.0.1	1999-03-26	First version created by the editor on the basis of ad hoc reports reviewed during WG1#3 and ETSI UMTS XX.18 Document
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V0.1.0	1999-04-20	Version including remarks after presentation at WG1#4
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