

**UMTS Terrestrial Radio Access Network (UTRAN);
UTRA physical layer general description
(UMTS XX.02 version 1.0.0)**

UMTS

Universal Mobile
Telecommunications System



Reference

DTR/SMG-02XX02U (00o00i04.PDF)

Keywords

Digital cellular telecommunications system,
Universal Mobile Telecommunication System
(UMTS), UTRAN

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Contents

Intellectual Property Rights	4
Foreword	4
1 Scope	5
2 References	5
3 Definitions and abbreviations	5
3.1 Definitions	5
3.2 Abbreviations	5
4 Multiple Access	5
4.1 UTRA frames	5
5 Coding and Interleaving	6
5.1 General	6
6 Modulation & Spreading	6
7 Transmission and reception	6
8 Physical Layer Procedures	6
History	7

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Special Mobile Group (SMG). The present document contains the general description of the UTRA physical layer, covering both UTRA modes. The contents of the present document are subject to change as the work continues within SMG2 and SMG2 UMTS layer 1 expert group and may change following approval by either of these two groups

1 Scope

This Technical Report contains the general description of the UTRA physical layer.

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, subsequent revisions do apply.
- 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] Reference 1.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document the following terms and definitions apply:

Definition 1: to be completed

3.2 Abbreviations

For the purposes of the present document the following terms and definitions apply:

A1 Abbreviation 1

4 Multiple Access

The access scheme is Direct-Sequence Code Division Multiple Access (DS-CDMA) with information spread over approximately 5 MHz bandwidth, thus also often denoted as Wideband CDMA (WCDMA) due that nature.

UTRA has two modes, FDD & TDD, for operating with paired and unpaired bands respectively. In UTRA TDD there is TDMA component in the multiple access in addition to DS-CDMA. Thus the multiple access has been also often denoted as TDMA/CDMA due added TDMA nature.

The carrier separation is 4,6 MHz to 5 MHz depending on the deployment scenario with 200 kHz carrier raster. A 10 ms radio frame is divided into 16 0,625 ms slots. A physical channel is therefore defined as a code (or number of codes) and additionally in TDD mode the sequence of 0,625 ms time slots completes the definition of a physical channel.

The information rate of the channel varies with the symbol rate being derived from the 4.096 Mchips/s chip rate and the spreading factor. Spreading factors from 256 to 4 with FDD and from 16 to 1 for TDD. Thus the respective modulation symbol rates vary from 1.024 Msymbols/s to 16 ksymbols for FDD and for TDD the momentary modulation symbol rates shall vary from 4.096 Msymbols/s to 256 ksymbols/s.

Furthermore, relaying between nodes can be used by means of Opportunity Driven Multiple Access (ODMA) in TDD mode.

4.1 UTRA frames

The both UTRA modes use 72-frame multiframe structure. The resulting longer frame duration is under discussion (hyperframe etc.) (Editor's note: Some discussion on the terminology between multiframe/superframe etc. needed)

5 Coding and Interleaving

5.1 General

For the channel coding in UTRA two options are supported:

- Convolutional coding, either 1/2 rate or 1/3 rate for packet data and services requiring less than 10E-6 quality level over the physical layer with forward error correction (FEC).
- Turbo coding (Editor note: coding method under refinement) for the services requiring quality level 10E-6 or higher.

6 Modulation & Spreading

The UTRA modulation scheme is QPSK with root raised cosine pulse shaping with roll-of factor 0.22.

With CDMA nature the spreading (& scrambling) process is closely associated with modulation. In UTRA different families of spreading codes are used to spread the signal.

- For separating channels from same source, channelisation codes derived with the code tree structure as given in XX.05 and XX.11 are used.
- For separating different base station the following solutions are supported:
 - FDD Mode: Gold codes with 10 ms period of 40960 chips used, with the actual code itself length $2^{41}-1$ chips, as defined in XX.05.
 - TDD Mode: Scrambling codes with the length 16 used as defined in XX.11.
- For separating different mobiles the following code families are defined:
 - FDD codes with 10 ms period (Gold code), or alternatively codes 256 chip period (VL-Kasami).
 - TDD codes with period of 16 chips and midamble sequences of different length depending on the environment.

7 Transmission and reception

The UTRA frequency bands assumed for operation are:

- a) Unpaired spectrum at 1 900 MHz to 1 920 MHz and at 2 010 MHz to 2 025 MHz for TDD mode operation
Used for both base and mobile transmission.
- b) Paired spectrum:
 - at 1 920 MHz to 1 980 MHz for mobile transmit, base station to receive;
 - at 2 110 MHz to 2 170 MHz for base station transmit, mobile to receive.
- c) Other bands, such as:
 - GSM 900 band, and GSM 1 800 band and other bands that can be used being currently occupied by other cellular systems.
- d) Possible new spectrum allocations that may become available.

Several power classes being defined currently.

8 Physical Layer Procedures

There are several physical layer procedures involved with UTRA operation. Such a procedures covered by physical layer description are:

- 1) The power control, with both fast closed loop and slow quality loop for FDD mode and for TDD mode open loop power control together with slow closed loop.
- 2) Handover measurements for handover within UTRA. Specific features being determined in addition to the relative strength of the base station, for the FDD mode the timing relation between for the base stations for support of asynchronous soft handover.
- 3) The measurement procedures for preparation for handover to GSM900/GSM1800.
- 4) The measurements procedures for MS before random access process.
- 5) Dynamic Channel Allocation (DCA) with TDD mode operation.
- 6) ODMA specific procedures such as probing.

History

V.0.0.1	10-12-1998	First version created by the editor on the basis of the XX-documents. This is intended for discussions what is desired level of details of the xx.02 are desired for completion of the xx-documents for next SMG2.
V.0.0.2	29-12-1998	Second version. ODMA added and the roll-off factor for the modulation section has been corrected. 72-multiframe structure has been introduced following the decision on UMTS-L1 678/98.
V.0.0.3	5-1-1999	Editorial error in the FDD BS transmit frequency band corrected.
V.0.0.4	20-1-1999	Editorial corrections to spelling, GSM900/GSM1800 related terminology aligned.
V. 0.1.0	20-1-1999	As approved by SMG2 UMTS-L1 Meeting #10 and forwarded for SMG2 for approval.

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The present document is written in Microsoft Word 97.

Document history		
<Vm.t.e>	<MMMM yyyy>	Publication