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UMTS XX.14 V1.0.0 (1999-02)

Technical Report

UMTS Terrestrial Radio Access Network (UTRAN); UTRA TDD: Additional features description (UMTS XX.14 version 1.0.0)

UMTS

Universal Mobile Telecommunications System

Reference

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Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Special Mobile Group (SMG).

The present document provides an overview of the additional and optional features for UTRA. The contents of the present document are subject to continuing work 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 is to collate the key additional and optional features considered and agreed to be included as part of the UTRA System Description during the course of UTRA discussion within the Layer 1 Expert Group. Additional and optional features are features which are optional for but fully compatible to UTRA and could improve system performance when applied appropriately. These features are usually not mandatory in nature.

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] UTRA FDD (V0.1): "Additional features description Tdoc SMG2 UMTS L1 517/98".

[2] UTRA (V0.2): "Physical Layer Description, TDD parts, Tdoc UMTS L1 274/98".

3 Definitions, symbols 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 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:

A1 Abbreviation 1

4 Status

The relevant working assumptions are the TDM component, that joint detection will not be prevented by the standard, and that there is flexibility in the implementation of the switching points. None of the described techniques has been adopted as a working assumption. Further clarification is required on possible changes required in XX.11 to accommodate predistortion.

5 Adaptive antennas

Adaptive antennas are recognised as a way to enhance capacity and coverage of the system. Solutions employing adaptive antennas are already supported in the UTRA/TDD concept through the use of connection-dedicated midamble bits on both uplink and downlink.

6 Multi-user detection

Three techniques have been proposed that deal with the interference by other users on the same slot.

6.1 Joint detection

A channel estimate is required for all the users on the same slot. This provides all the necessary information on the exact way in which each user interferes with each other and it is possible to remove the effects of MAI. It is a precise method that applies to both the uplink and the downlink. Complexity is associated with the number of users in the slot and the maximum delay spread.

6.2 Joint Predistortion

The base station utilises the channel estimates from the relevant sources made during reception of the uplink to predistort the signal in a downlink slot. The result is that MAI and ISI need not be accounted for at the receiver which allows for a simpler receiver implementation reducing power consumption and complexity. This technique is effective when transmission and reception to and from the mobile stations that use the same slot takes place within the coherence time of the channel. For this reason it benefits from multiple switching points implementation as this increases the range of mobile velocities for which the aforementioned condition holds.

6.3 Single user detection

Primarily for use on the downlink. The channel transfer function and a frequency domain representation of the received signal are used to equalise the signal, in essence restoring orthogonality hence removing the effects of intracell interference. This method relies on the use of FFTs making it relatively inexpensive in terms of complexity. The complexity is the same irrespective of the delay spread, the spreading factor used and the number of users in the slot.

7 Downlink transmit diversity

Transmitter diversity in the downlink provides a means to significantly improve capacity and coverage of UTRA/TDD, without the requirement for a second receiver chain in the mobile station that receiver diversity would entail. However, a typical transmit diversity technique, such as delay transmit diversity, has two main drawbacks: self-interference at locations with good SINR; and the requirement for additional receiver fingers in the mobile receiver. In order to overcome these drawbacks, diversity schemes have been proposed for UTRA/FDD, that maintain the orthogonality between diverse downlink transmit antennas, whilst offering significant advantages in the downlink performance.

7.1 Techniques common to FDD

Most techniques investigated for use in FDD are applicable to TDD and should be compatible with the TDD working assumptions. Once the techniques to be used have been decided upon, they should be compared with the same cost/performance criteria against the following techniques.

7.2 Techniques specific to TDD

The reciprocity of the channel allows the introduction of techniques in TDD that cannot be used in FDD. One them is described below.

7.2.1 Transmit Antenna selection diversity

During every uplink slot period the signal strength from each antenna at the BTS is measured for each transmitting source (after the MRC function). During the next downlink slot the signal to each mobile is transmitted from that antenna from which it was received with the highest signal strength during the previous uplink period. This method benefits from the multiple switching point implementation that allows reception from and transmission to a user to take place within the coherence time of the channel for a useful range of mobile velocities. It requires no explicit support from the mobile station and very small complexity overhead at the BTS.

8 Locationing function support

The wideband nature of the UTRA/TDD facilitates the high resolution in position location as the resolution achievable is directly proportional to the channel symbol rate, in this case chip rate. The duration of one chip corresponds to approximately 73 meters in propagation distance and if the delay estimation operates on the accuracy of 4 samples/chip then the achievable maximum accuracy is approximately 18 meters with the 4.096 Mcps chip rate. Naturally there are other inaccuracies that will cause degradation to the positioning but 18 meters can be considered as a lower bound for the positioning performance. With a higher sampling rate or chip rate the bound will be lower.

The inherent requirement for synchronisation of the TDD base stations could be exploited in obtaining time delay or delay difference measurements to the base stations. These measurements are commonly used as inputs to location positioning algorithms.

History

Document history		
Date	**Version**	**Comment**
14-12-1998	0.0.1	Proposed first draft presented at the Espoo L1 meeting
18-01-1999	0.0.2	Second version presented at L1#10 which incorporates editorial changes based on comments made at L1#9

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