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Technical Specification

**Satellite Earth Stations and Systems (SES);
Satellite Component of UMTS/IMT-2000;
Part 1: Physical channels and mapping of transport channels into physical channels;
Sub-part 2: A-family (S-UMTS-A 25.211)**

Reference

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Keywords

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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

The present document is specifying the Satellite Radio Interface referenced as SRI Family A at ITU-R, in the frame of ITU-R Recommendation M.1457 [9].

The present document is part 1, sub-part 2 of a multi-part deliverable covering Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; A-family, as identified below:

Part 1: "Physical channels and mapping of transport channels into physical channels";

Sub-part 1: "G-family (S-UMTS-G 25.211)";

Sub-part 2: "A-family (S-UMTS-A 25.211)";

Part 2: "Multiplexing and channel coding";

Part 3: "Spreading and modulation";

Part 4: "Physical layer procedures";

Part 5: "UE Radio Transmission and Reception";

Part 6: "Ground stations and space segment radio transmission and reception".

Introduction

S-UMTS stands for the Satellite component of the Universal Mobile Telecommunication System. S-UMTS systems will complement the terrestrial UMTS (T-UMTS) and inter-work with other IMT-2000 family members through the UMTS core network. S-UMTS will be used to deliver 3rd generation mobile satellite services (MSS) utilizing either low (LEO) or medium (MEO) earth orbiting, or geostationary (GEO) satellite(s). S-UMTS systems are based on terrestrial 3GPP specifications and will support access to GSM/UMTS core networks.

NOTE 1: The term T-UMTS will be used in the present document to further differentiate the Terrestrial UMTS component.

Due to the differences between terrestrial and satellite channel characteristics, some modifications to the terrestrial UMTS (T-UMTS) standards are necessary. Some specifications are directly applicable, whereas others are applicable with modifications. Similarly, some T-UMTS specifications do not apply, whilst some S-UMTS specifications have no corresponding T-UMTS specification.

Since S-UMTS is derived from T-UMTS, the organization of the S-UMTS specifications closely follows the original 3rd Generation Partnership Project (3GPP) structure. The S-UMTS numbers have been designed to correspond to the 3GPP terrestrial UMTS numbering system. All S-UMTS specifications are allocated a unique S-UMTS number as follows:

S-UMTS-n xx.yyy

Where:

- The numbers xx and yyy correspond to the 3GPP-numbering scheme;
- n (n = A, B, C, …) denotes the family of S-UMTS specifications.

A S-UMTS system is defined by the combination of a family of S-UMTS specifications and 3GPP specifications, as follows:

- If an S-UMTS specification exists it takes precedence over the corresponding 3GPP specification (if any). This precedence rule applies to any references in the corresponding 3GPP specifications.

NOTE 2: Any references to 3GPP specifications within the S-UMTS specifications are not subject to this precedence rule. For example, an S-UMTS specification may contain specific references to the corresponding 3GPP specification.

- If a S-UMTS specification does not exist, the corresponding 3GPP specification may or may not apply. The exact applicability of the complete list of 3GPP specifications shall be defined at a later stage.

1 Scope

The present document defines the Layer 1 transport channels and physical channels used for family A of the satellite component of UMTS (S-UMTS-A).

It is based on the FDD mode of UTRA defined by TS 125 211 [4], TS 125 212 [5], TS 125 213 [6], TS 125 214 [7] and adapted for operation over satellite transponders.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
  - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
  - for informative references.

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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] ETSI TS 101 851-2-2: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Part 2: Multiplexing and channel coding; Sub-part 2: A-family (S-UMTS-A 25.212)".

[2] ETSI TS 101 851-3-2: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Part 3: Spreading and modulation; Sub-part 2: A-family (S-UMTS-A 25.213)".

[3] ETSI TS 101 851-4-2: "Satellite Earth Stations and Systems (SES); Satellite Component of UMTS/IMT-2000; Part 4: Physical layer procedures; Sub-part 2: A-family (S-UMTS-A 25.214)".

[4] ETSI TS 125 211: "Universal Mobile Telecommunications System (UMTS); Physical channels and mapping of transport channels onto physical channels (FDD) (3G TS 25.211 version 3.3.0 Release 1999)".

[5] ETSI TS 125 212: "Universal Mobile Telecommunications System (UMTS); Multiplexing and channel coding (FDD) (3G TS 25.212 version 3.3.0 Release 1999)".

[6] ETSI TS 125 213: "Universal Mobile Telecommunications System (UMTS); Spreading and modulation (FDD) (3G TS 25.213 version 3.3.0 Release 1999)".

[7] ETSI TS 125 214: "Universal Mobile Telecommunications System (UMTS); Physical layer procedures (FDD) (3G TS 25.214 version 3.3.0 Release 1999)".

[8] ETSI TS 125 302: "Universal Mobile Telecommunications System (UMTS); Services provided by the Physical Layer (3G TS 25.302 version 3.5.0 Release 1999)".

2.2 Informative references

[9] ITU-R Recommendation M.1457 (2006): "Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)".

3 Abbreviations

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

3GPP	Third Generation Partnership Project
AP	Access Preamble
BCH	Broadcast Channel
CCPCH	Common Control Physical Channel
CCTrCH	Coded Composite Transport Channel
CPICH	Common Pilot Channel
DCH	Dedicated Channel
DPCCH	Dedicated Physical Control Channel
DPCH	Dedicated Physical Channel
DPDCH	Dedicated Physical Data Channel
DSCH	Downlink Shared Channel
DTX	Discontinuous Transmission
FACH	Forward Access Channel
FSW	Frame Synchronization Word
GEO	Geostationary Orbit
HPPICH	High Penetration Page Indicator Channel
ICH	Indicator Channel
LEO	Low Earth Orbit
MEO	Medium Earth Orbit
PCH	Paging Channel
P-CCPCH	Primary Common Control Physical Channel
PCPCH	Physical Common Packet Channel
PDSCH	Physical Downlink Shared Channel
PI	Page Indicator
PICH	Page Indication Channel
PRACH	Physical Random Access Channel
PSC	Primary Synchronization Code
RACH	Random Access Channel
S-CCPCH	Secondary Common Control Physical Channel
SCH	Synchronization Channel
SF	Spreading Factor
SFN	System Frame Number
TFCI	Transport Format Combination Indicator
TPC	Transmit Power Control
UE	User Equipment
USRAN	UMTS Satellite Radio Access Network

4 Services offered to higher layers

4.1 Transport channels

Transport channels are services offered by Layer 1 to the higher layers. General concepts about transport channels are described in [8].

A transport channel is defined by how and with what characteristics data are transferred over the air interface. A general classification of transport channels is into two groups:

- Dedicated channels, using inherent addressing of UE;
- Common channels, using explicit addressing of UE if addressing is needed.

4.1.1 Dedicated transport channels

There exists only one type of dedicated transport channel, the Dedicated Channel (DCH).

4.1.1.1 DCH - Dedicated Channel

The Dedicated Channel (DCH) is a downlink or uplink transport channel. The DCH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas.

4.1.2 Common transport channels

There are six types of common transport channels: BCH, FACH, PCH, RACH, CPCH and DSCH.

4.1.2.1 BCH - Broadcast Channel

The Broadcast Channel (BCH) is a downlink transport channel that is used to broadcast system and cell-specific information. The BCH is always transmitted over the entire cell and has a single transport format.

4.1.2.2 FACH - Forward Access Channel

The Forward Access Channel (FACH) is a downlink transport channel. The FACH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas. The FACH can be transmitted using slow power control.

4.1.2.3 PCH - Paging Channel

The Paging Channel (PCH) is a downlink transport channel. The PCH is always transmitted over the entire cell. The transmission of the PCH is associated with the transmission of physical-layer generated Paging Indicators, to support efficient sleep-mode procedures.

4.1.2.4 RACH - Random Access Channel

The Random Access Channel (RACH) is an uplink transport channel. The RACH is always received from the entire cell. The RACH is characterized by a collision risk and by being transmitted using open loop power control.

4.1.2.5 CPCH – Common Packet Channel

This channel is not used in S-UMTS-A.

4.1.2.6 DSCH – Downlink Shared Channel

The Downlink Shared Channel (DSCH) is a downlink transport channel shared by several UE. The DSCH is associated with one or several downlink DCH. The DSCH is transmitted over the entire cell or over only a part of the cell using e.g. beam-forming antennas.

4.2 Indicators

Indicators are means of fast low-level signalling entities that are transmitted without using information blocks sent over transport channels. The meaning of indicators is implicit to the receiver.

The indicators defined in the current version of the specifications are: Page Indicator (PI).

Indicators may be either Boolean (two-valued) or three-valued. Their mapping to indicator channels is channel specific.

Indicators are transmitted on those physical channels that are indicator channels (ICH).

5 Physical channels and physical signals

Physical channels are defined by a specific carrier frequency, scrambling code, channelization code (optional), time start & stop (giving a duration) and, on the uplink, relative phase (0 or π/2). Scrambling and channelization codes are specified in TS 101 851-3-2 [2]. Time durations are defined by start and stop instants, measured in integer multiples of chips. Suitable multiples of chips also used in specification are:

Radio frame: A radio frame is a processing duration which consists of 15 slots. The length of a radio frame corresponds to 38 400 chips.

Slot: A slot is a duration which consists of fields containing bits. The length of a slot corresponds to 2 560 chips.

The default time duration for a physical channel is continuous from the instant when it is started to the instant when it is stopped. Physical channels that are not continuous will be explicitly described.

Transport channels are described (in more abstract higher layer models of the physical layer) as being capable of being mapped to physical channels. Within the physical layer itself the exact mapping is from a composite coded transport channel (CCTrCH) to the data part of a physical channel. In addition to data parts there also exist channel control parts and physical signals.

5.1 Physical signals

Physical signals are entities with the same basic on-air attributes as physical channels but do not have transport channels or indicators mapped to them. Physical signals may be associated with physical channels in order to support the function of physical channels.

5.2 Uplink physical channels

5.2.1 Dedicated uplink physical channels

There are two types of uplink dedicated physical channels, the uplink Dedicated Physical Data Channel (uplink DPDCH) and the uplink Dedicated Physical Control Channel (uplink DPCCH).

The DPDCH and the DPCCH are I/Q code multiplexed within each radio frame (see TS 101 851-3-2 [2]).

The uplink DPDCH is used to carry the DCH transport channel. There may be zero, one, or several uplink DPDCHs on each radio link.

The uplink DPCCH is used to carry control information generated at Layer 1. The Layer 1 control information consists of known pilot bits to support channel estimation for coherent detection, transmit power-control (TPC) commands and an (optional) transport-format combination indicator (TFCI). The transport-format combination indicator informs the receiver about the instantaneous transport format combination of the transport channels mapped to the simultaneously transmitted uplink DPDCH radio frame. There is one and only one uplink DPCCH on each radio link.

Figure 1 shows the frame structure of the uplink dedicated physical channels. Each radio frame of length 10 ms is split into 15 slots, each of length T_{slot} = 2 560 chips, corresponding to one power-control period.