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GEO-Mobile Radio Interface Specifications (Release 3);
Third Generation Satellite Packet Radio Service;
Part 5: Radio interface physical layer specifications;
Sub-part 2: Multiplexing and Multiple Access;
Stage 2 Service Description;
GMR-1 3G 45.002

Reference

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Contents

Intellectual Property Rights 7
Foreword 7
Modal verbs terminology 8
Introduction 8
1 Scope 10
2 References 10
2.1 Normative references 10
2.2 Informative references 11
3 Definitions and abbreviations 11
3.1 Definitions 11
3.2 Abbreviations 11
4 General 11
5 Logical channels 11
5.1 General 11
5.2 Traffic channels 11
5.2.1 General 11
5.2.2 Speech traffic channels 12
5.2.3 Data traffic channels 12
5.2.4 Summary of traffic channel characteristics 12
5.2.5 Packet Data Traffic CHannels (PDTCH) (A/Gb mode only) 12
5.2.5a Packet Data Traffic Channels (PDTCH3) (Iu mode only) 13
5.2.6 Packet Mode Dedicated Channels (Iu mode only) 14
5.3 Control channels 15
5.3.1 General 15
5.3.2 Broadcast channels 15
5.3.2.1 Frequency Correction CHannel (FCCH) 15
5.3.2.2 GPS Broadcast control CHannel (GBCH) 15
5.3.2.3 Broadcast Control CHannel (BCCH) 15
5.3.3 Common Control Channel (CCCH) 15
5.3.4 Dedicated control channels 15
5.3.5 Cell Broadcast CHannel (CBCH) 15
5.3.6 Packet Common Control CHannels (PCCCH) 15
5.3.7 Packet dedicated control channels 16
6 The physical resource 16
6.1 General 16
6.2 Radio frequency channels 16
6.2.1 Spot beam allocation 16
6.2.2 Downlink and uplink 16
6.3 Timeslots and TDMA frames 16
6.3.1 General 16
6.3.2 Timeslot number 16
6.3.3 TDMA frame number 16
7 Bursts 16
7.1 General 16
7.2 Timing 17
7.2.1 Half-symbol period 17
7.2.2 Useful duration 17
7.2.3 Guard period 17
7.3 Multiple unique word patterns in bursts 18
7.4 Types of bursts 18
7.4.0 General 18
7.4.1 BACH burst 18

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7.4.1.0 General 18
7.4.1.1 BACH3 burst 18
7.4.2 BCCH burst 18
7.4.3 CICH burst 18
7.4.4 DC2 burst 18
7.4.5 DC6 burst 18
7.4.6 DKAB bursts 19
7.4.6.0 General 19
7.4.6.1 KAB3 burst 19
7.4.7 FCCH burst 20
7.4.7.0 General 20
7.4.7.1 FCCH3 burst 20
7.4.8 NT3 burst 20
7.4.8.0 General 20
7.4.8.1 NT3 burst for encoded speech 20
7.4.8.2 NT3 burst for FACCH 20
7.4.9 NT6 burst 20
7.4.10 NT9 burst 20
7.4.11 RACH burst 21
7.4.11.0 General 21
7.4.11.1 RACH3 burst 21
7.4.12 SDCCH burst 21
7.4.13 Packet Normal Bursts (PNB) 21
7.4.13.0 General 21
7.4.13.1 Burst header 25
7.4.13.1.0 General 25
7.4.13.1.1 Guard bits 25
7.4.13.1.2 Unique Word (UW) 25
7.4.13.1.3 PUblic Information (PUI) field 26
7.4.13.1.4 Transition symbols 26
7.4.13.2 Encoded PRivate Information (PRI) 26
7.4.13.3 Formats of packet normal burst 27
7.4.13.3.0 General 27
7.4.13.3.1 Void 27
7.4.13.3.2 PNB(4,3) 27
7.4.13.3.3 PNB(5,3) 27
7.4.13.3.4 PNB(1,6) 28
7.4.13.3.5 PNB(2,6) 28
7.4.13.3.6 LDCP coded PNB2(5,12)/Downlink 29
7.4.13.3.7 LDPC coded PNB2(5,12)/Uplink 30
7.4.13.3.8 LDPC coded PNB2(5,3)/Downlink 30
7.4.13.3.9 LDPC coded PNB2(5,3)/Uplink 31
7.4.13.3.10 PNB3(5,12)/Uplink 32
7.4.13.3.11 PNB3(5,12)/Downlink 32
7.4.13.3.12 PNB3(5,3)/Uplink 33
7.4.13.3.13 PNB3(5,3)/Downlink 34
7.4.13.3.14 PNB3(10,3) Downlink 35
7.4.13.3.15 PNB3(1,3) Burst 36
7.4.13.3.16 PNB3(1,6) burst 37
7.4.13.3.17 PNB3(1,8) burst 38
7.4.13.3.18 PNB3(2,6) 39
7.4.14 Packet Access Burst (PAB) 40
7.4.15 Packet Keep-Alive Burst (PKAB) 40
7.4.16 DC12 burst 42

8 Logical-physical channel mapping 43
8.1 General 43
8.1.0 Abstract 43
8.1.1 Frequency-domain description 43
8.1.2 Time-domain description 43
8.1.2.1 Physical channels 43
8.1.2.2 Logical channels 43

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8.2 Physical Channel (PC) types and names 43
8.3 Logical channel parameters 43
8.4 Permitted channel configurations 44
8.5 Logical channel frame sequencing concepts 44
8.5.0 General 44
8.5.1 Simple frame sequence 44
8.5.1.0 General 44
8.5.1.1 Simple frame sequence subchannels 44
8.5.2 Simple paired-frame sequence 44
8.5.2.0 General 44
8.5.2.1 Simple paired-frame sequence subchannels 44
8.5.3 Configured paired-frame sequence (A/Gb mode only) 44
8.5.3.0 General 44
8.5.3.1 CBCH configuration 44
8.5.3a CBCH configuration (Iu mode only) 44
8.5.4 Statistically multiplexed paired-frame sequence (A/Gb mode only) 45
8.5.4.0 General 45
8.5.4.1 Pool size 45
8.5.4.2 Statistically multiplexed paired-frame sequence subchannels 45
8.5.4.3 Example using SDCCH 45
8.5.5 System information cycle sequencing 45
8.5.5.0 General 45
8.5.5.1 Physical-Channel-Relative Timeslot Number (PCRTN) 45
8.5.5.2 System-Information-Relative Frame Number (SIRFN) 45
8.5.5.3 Graphical representation of system information cycle timeslots 45
8.6 Mapping of logical channels to BCCH/CCCH 45
8.6.0 General 45
8.6.1 Fixed reserved-slot logical channels 45
8.6.1.0 General 45
8.6.1.1 FCCH 45
8.6.1.1a FCCH3 45
8.6.1.2 CICH 46
8.6.1.3 BCCH 46
8.6.2 Optional reserved-slot logical channels 46
8.6.2.0 General 46
8.6.2.1 PCH 47
8.6.2.2 BACH 48
8.6.3 Unreserved-slot logical channels 48
8.6.4 Mapping of CBCH (Iu mode) 48
8.7 Mapping of logical channels to normal CCCH 48
8.7a Mapping of logical channels to SI extended/AGCH/CCCH (Iu mode only) 49
8.8 Mapping in time of packet logical channels onto physical channels 50
8.8.1 General 50
8.8.2 Mapping of the uplink channels 50
8.8.2.1 Mapping of uplink packet traffic channel (PDTCH/U) and PACCH/U 50
8.8.2.2 Mapping of the packet timing advance control channel (PTCCH/U) (A/Gb mode only) 51
8.8.2.3 Mapping of the uplink PCCCH, i.e. PRACH (A/Gb mode only) 51
8.8.2.3a Mapping of the uplink PCCCH, i.e. PRACH3 (Iu mode only) 51
8.8.3 Mapping of the downlink channels 52
8.8.3.1 Mapping of the (PDTCH/D) and PACCH/D 52
8.8.3.2 Mapping of the PTCCH/D (A/Gb mode only) 52
8.8.3.3 Mapping of the PBCCH 52
8.8.3.4 Mapping of the PCCCH 52
8.8.4 Mapping of PBCCH data 52
8.8.5 Permitted combination of packet data channels 52
8.9 Multislot configurations 53
8.9.0 General 53
8.9.1 Multislot configurations for circuit switched connections 53
8.9.2 Multislot configurations for packet switched connections 53

9 Operation of channels 53
9.0 General 53

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9.1 PC6d and PC12u pairing 53
9.1a PC12d and PC12u pairing 53
9.2 Bidirectional channel timeslot assignments....54
9.3 GBCH....54
9.3a GBCH3....54
9.4 DKABs....54
9.5 FCCH and CICH 54
9.6 TACCH/2 54
9.7 MES monitoring of paging and alerting groups 54
9.7.0 General....54
9.7.1 Determination of assigned CCCH 54
9.7.2 Determination of assigned paging group 54
9.7.3 Determination of alerting group....55
9.7.4 Determination of PCCCH_GROUP and PAGING_GROUP for MES in GMPRS attached mode 55
9.8 MES selection of PC12U 55
9.9 SDCCH vs. CBCH 55
9.10 MES monitors paired CCCH for AGCH....55
9.11 Additional air interface constraints....55

10 BCCH parameters 55
10.0 General 55
10.1 Types of BCCH parameters....55
10.2 Information used to obtain synchronization 55
10.3 Channel meta-information....55
10.4 Beam-configurable multichannel information....56
10.5 Information specific to one instance of a channel 56

Annex A (normative): Multislot capability....57

A.1 MES classes for multislot capability....57

A.2 Constraints imposed by the service selected 58

A.3 Network requirements for supporting MES multislot classes....58

Annex B (informative): Asymmetrical pairing of PDCH/D(2,m) with PDCH/U(1,m)....59

Annex C (normative): GMR-1 3G Terminal Types....60

Annex D (informative): Bibliography....77

History 78

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The present document is part 5, sub-part 2 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service, as identified below:

Part 1: "General specifications";

Part 2: "Service specifications";

Part 3: "Network specifications";

Part 4: "Radio interface protocol specifications";

Part 5: "Radio interface physical layer specifications":

Sub-part 1: "Physical Layer on the Radio Path: General Description";

Sub-part 2: "Multiplexing and Multiple Access; Stage 2 Service Description";

Sub-part 3: "Channel Coding";

Sub-part 4: "Modulation";

Sub-part 5: "Radio Transmission and Reception";

Sub-part 6: "Radio Subsystem Link Control";

Sub-part 7: "Radio Subsystem Synchronization";

Part 6: "Speech coding specifications";

Part 7: "Terminal adaptor specifications".

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Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for Mobile Satellite Services (MSS) utilizing geostationary satellite(s). GMR is derived from the terrestrial digital cellular standard GSM and supports access to GSM core networks.

The present document is part of the GMR Release 3 specifications. Release 3 specifications are identified in the title and can also be identified by the version number:

- Release 1 specifications have a GMR 1 prefix in the title and a version number starting with "1" (V1.x.x).
- Release 2 specifications have a GMPRS 1 prefix in the title and a version number starting with "2" (V2.x.x).
- Release 3 specifications have a GMR-1 3G prefix in the title and a version number starting with "3" (V3.x.x).

The GMR release 1 specifications introduce the GEO Mobile Radio interface specifications for circuit mode Mobile Satellite Services (MSS) utilizing geostationary satellite(s). GMR release 1 is derived from the terrestrial digital cellular standard GSM (phase 2) and it supports access to GSM core networks.

The GMR release 2 specifications add packet mode services to GMR release 1. The GMR release 2 specifications introduce the GEO Mobile Packet Radio Service (GMPRS). GMPRS is derived from the terrestrial digital cellular standard GPRS (included in GSM Phase 2+) and it supports access to GSM/GPRS core networks.

The GMR release 3 specifications evolve packet mode services of GMR release 2 to 3rd generation UMTS compatible services. The GMR release 3 specifications introduce the GEO-Mobile Radio Third Generation (GMR-1 3G) service. Where applicable, GMR-1 3G is derived from the terrestrial digital cellular standard 3GPP and it supports access to 3GPP core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM or 3GPP standard are necessary. Some GSM and 3GPP specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM and 3GPP specifications do not apply, while some GMR specifications have no corresponding GSM or 3GPP specification.

Since GMR is derived from GSM and 3GPP, the organization of the GMR specifications closely follows that of GSM or 3GPP as appropriate. The GMR numbers have been designed to correspond to the GSM and 3GPP numbering system. All GMR specifications are allocated a unique GMR number. This GMR number has a different prefix for Release 2 and Release 3 specifications as follows:

- Release 1: GMR n xx.zyy.
- Release 2: GMPRS n xx.zyy.
- Release 3: GMR-1 3G xx.zyy.

where:

- xx.0yy (z = 0) is used for GMR specifications that have a corresponding GSM or 3GPP specification. In this case, the numbers xx and yy correspond to the GSM or 3GPP numbering scheme.
- xx.2yy (z = 2) is used for GMR specifications that do not correspond to a GSM or 3GPP specification. In this case, only the number xx corresponds to the GSM or 3GPP numbering scheme and the number yy is allocated by GMR.
- n denotes the first (n = 1) or second (n = 2) family of GMR specifications.

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A GMR system is defined by the combination of a family of GMR specifications and GSM and 3GPP specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM or 3GPP specification (if any). This precedence rule applies to any references in the corresponding GSM or 3GPP specifications.

NOTE: Any references to GSM or 3GPP specifications within the GMR specifications are not subject to this precedence rule. For example, a GMR specification may contain specific references to the corresponding GSM or 3GPP specification.

- If a GMR specification does not exist, the corresponding GSM or 3GPP specification may or may not apply. The applicability of the GSM or 3GPP specifications is defined in ETSI TS 101 376-1-2 [2].

The clause numbering and the table numbering and figure numbering in the present document are aligned to the corresponding numbering of ETSI TS 101 376-5-2 (Release 1) [10] as far as possible. In several places, this means that the table numbering and figure numbering is non-continuous in the present document in order to maintain this alignment, the following rules apply:

- A table that uses the same table number replaces the corresponding table in ETSI TS 101 376-5-2 (Release 1) [10].

- A table that uses a different table number is a new additional table.

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1 Scope

The present document defines the structure of the physical channels for the radio subsystem in the GMR-1 3G Mobile Satellite System. It describes the GMR-1 3G concept of logical channels and the timing concepts of TDMA frames, timeslots, and bursts. It defines the relationship between logical and physical channels, and defines the logical channels in terms of size, structure and timing relationships.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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The following referenced documents are necessary for the application of the present document.

In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest release and the latest version of that document up to and including Release 7.

In the case of a reference to a GMR-1 3G document, a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.

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[1] ETSI TS 101 376-1-1: "GEO-Mobile Radio Interface Specifications (Release 2) General Packet Radio Service; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms; GMPRS-1 01.004".

NOTE: This is a reference to a GMR-1 Release 2 specification. See the introduction for more details.

[2] ETSI TS 101 376-1-2: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 1: General specifications; Sub-part 2: Introduction to the GMR-1 family; GMR-1 3G 41.201".

[3] ETSI TS 101 376-4-8: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 8: Mobile Radio Interface Layer 3 Specifications; GMR-1 3G 44.008".

[4] ETSI TS 101 376-5-3: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 3: Channel Coding; GMR-1 3G 45.003".

[5] ETSI TS 101 376-5-4: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 4: Modulation; GMR-1 3G 45.004".

[6] ETSI TS 101 376-5-5: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 5: Radio Transmission and Reception; GMR-1 3G 45.005".

[7] ETSI TS 101 376-5-7: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 5: Radio interface physical layer specifications; Sub-part 7: Radio Subsystem Synchronization; GMR-1 3G 45.010".

[8] ETSI TS 101 376-3-22: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 3: Network specifications; Sub-part 22: Overall description of the GMPRS radio interface; Stage 2; GMR-1 3G 43.064".

[9] ETSI TS 101 376-4-12: "GEO-Mobile Radio Interface Specifications (Release 3); Third Generation Satellite Packet Radio Service; Part 4: Radio interface protocol specifications; Sub-part 12: Mobile Earth Station (MES) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; GMR-1 3G 44.060".

[10] ETSI TS 101 376-5-2: "GEO-Mobile Radio Interface Specifications; Part 5: Radio interface physical layer specifications; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description; Sub-part 2: Multiplexing and Multiple Access; Stage 2 Service Description; GMR-1 05.002".

NOTE: This is a reference to a GMR-1 Release 1 specification. See the introduction for more details.

2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in GMR-1 3G 41.201 [2] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in GMPRS-1 01.004 [1] apply.

4 General

Same as clause 4 in ETSI TS 101 376-5-2 [10].

5 Logical channels

5.1 General

Same as clause 5.1 in ETSI TS 101 376-5-2 [10].

5.2 Traffic channels

5.2.1 General

TCHs are intended to carry either encoded speech or user data. Three general types of traffic channels are defined:

1) TCH3: This channel carries data at a gross rate of 5,20 kbps.

2) TCH6: This channel carries data at a gross rate of 10,75 kbps.

3) TCH9: This channel carries data at a gross rate of 16,45 kbps.

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The data gross rate is defined as the number of encoded bits in NT3, NT6 and NT9 burst, respectively, excluding the number of power control bits, divided by 40 ms frame time.

All traffic channels are bidirectional.

The types of traffic channels capable of speech and user data are identified in the following clauses.

5.2.2 Speech traffic channels

Same as clause 5.2.2 in ETSI TS 101 376-5-2 [10].

5.2.3 Data traffic channels

Same as clause 5.2.3 in ETSI TS 101 376-5-2 [10].

5.2.4 Summary of traffic channel characteristics

Table 5.1 summarizes the characteristics of traffic channels, where the gross transmission rate is the channel transmission bit rate (2 times channel transmission symbol rate) multiplied by the duty cycle of the channel.

Table 5.1: Summary of traffic channel characteristics

Channel type	User information capability	Gross transmission rate
TCH3	Encoded speech	5,85 kbps (= 46,8 / 8)
TCH6	User data: 4,8 kbps Fax: 2 kbps, 4 kbps or 4,8 kbps	11,70 kbps (= 46,8 / 8 x 2)
TCH9	User data: 9,6 kbps Fax: 2 kbps, 4 kbps, 4,8 kbps, or 9,6 kbps	17,55 kbps (= 46,8 / 8 x 3)

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5.2.5 Packet Data Traffic CHannels (PDTCH) (A/Gb mode only)

The following Packet Data Traffic CHannels (PDTCH) apply to A/Gb mode.

A PDTCH corresponds to the resource allocated to a single MES on one physical channel for user data transmission. Different logical channels may be dynamically multiplexed on to the same PDTCH. The PDTCH uses π/2-BPSK, π/4-QPSK,16 APSK, or 32 APSK modulation. All packet data traffic channels are unidirectional, either uplink (PDTCH/U), for a mobile-originated packet transfer or downlink (PDTCH/D) for a mobile-terminated packet transfer. PDTCH and PDTCH2 traffic data channels may be multiplexed on the same physical carrier.

PDTCHs are used to carry packet data traffic. Different PDTCHs are defined by the suffix (m,n) where m indicates the bandwidth of the physical channel in which the PDTCH is mapped, m × 31,25 kHz, and n defines the number of timeslots allocated to this physical channel. Table 5.2 summarizes different types of packet traffic data channels, PDTCH (m, 3), (m = 4 and 5), where the burst duration is 5 ms, PDTCH (m, 6), (m = 1, 2), where the burst duration is 10 ms, and PDTCH (m, 12), (m = 5), where the burst duration is 20 ms.

Table 5.2: Packet Traffic Data Channels (Peak Transmission Rates)

Channels	Direction (U: Uplink, D: Downlink)	Transmission symbol rate (ksps)	Channel Coding	Modulation	Peak payload transmission rate (without CRC) (kbps)	Peak payload transmission rate (with CRC) (kbps)
PDTCH(4,3)	U/D	93,6	Conv.	π/4-QPSK	113,6	116,8
PDTCH(5,3)	U/D	117,0	Conv.	π/4-QPSK	145,6	148,8
PDTCH(1,6)	U	23,4	Conv.	π/4-QPSK	27,2	28,8
PDTCH(2,6)	D	46,8	Conv.	π/4-QPSK	62,4	64,0
PDTCH2(5,12)	D	117,0	LDPC	π/4-QPSK	199,2	199,6
PDTCH2(5,12)	D	117,0	LDPC	16-APSK	354,8	355,2
PDTCH2(5,12)	D	117,0	LDPC	32-APSK	443,6	444,0
PDTCH2(5,12)	U	117,0	LDPC	π/4-QPSK	199,2	199,6
PDTCH2(5,12)	U	117,0	LDPC	16-APSK	399,2	399,6
PDTCH2(5,3)	U/D	117,0	LDPC	π/4-QPSK	169,6	171,2
PDTCH2(5,3)	U/D	117,0	LDPC	16-APSK	342,4	344,0
PDTCH2(5,3)	U/D	117,0	LDPC	32-APSK	380,8	382,4

The payload is the Private Information (PRI) delivered to the physical layer by the link layer. The PRI includes the MAC header and the other higher layer overhead. The peak payload transmission rate (without CRC) is defined as the maximum attainable PRI data rate with continuous transmission, i.e. using all 24 timeslots in a frame. The above peak-rates are achieved with rate 3/4 coding for PDTCH(4,3) and PDTCH(5,3) and are achieved with rate 4/5 for PDTCH(1,6) and PDTCH(2,6). The peak rates of LDPC coded PDTCH2(5,12) and LDPC coded PDTCH2(5,3) are achieved for different modulation schemes with the following coding rate combinations:

- Downlink: 32 APSK Rate 4/5, 16 APSK Rate 4/5, π/4-QPSK Rate 9/10.
- Uplink: 16 APSK Rate 9/10, π/4-QPSK Rate 9/10.

NOTE: All the above coding rates are approximate rates. Refer to ETSI TS 101 376-5-3 [4] for the exact coding rates.

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5.2.5a Packet Data Traffic Channels (PDTCH3) (Iu mode only)

The following Packet Data Traffic Channels3 (PDTCH3) apply to Iu mode.

A PDTCH3 corresponds to the resource allocated to a single MES on one physical channel for user data transmission. Different logical channels may be dynamically multiplexed on to the same PDTCH3. The PDTCH3 uses π/2-BPSK, π/4-QPSK,16 APSK, or 32 APSK modulation. All packet data traffic channels are unidirectional, either uplink (PDTCH3/U), for a mobile-originated packet transfer or downlink (PDTCH3/D) for a mobile-terminated packet transfer. PDTCH3 may not be multiplexed with PDTCH and PDTCH2 on the same physical carrier.