



**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
General requirements on interworking between
the Public Land Mobile Network (PLMN)
and the Integrated Services Digital Network (ISDN)
or Public Switched Telephone Network (PSTN)
(3GPP TS 29.007 version 16.0.0 Release 16)**

Reference

RTS/TSGC-0329007vg00

Keywords

GSM,UMTS

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 - Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2020.

All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

3GPP™ and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

oneM2M™ logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

GSM® and the GSM logo are trademarks registered and owned by the GSM Association.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	8
1 Scope	9
2 References	9
3 Definitions and abbreviations.....	14
3.1 Definitions	14
3.2 Abbreviations	15
4 Introduction	15
5 Void.....	16
6 Network Characteristics	16
6.1 Key Characteristics of Networks Concerned.....	16
6.1.1 Characteristics of PLMNs.....	16
6.1.2 Characteristics of PSTNs	16
6.1.3 Characteristics of ISDN	17
7 Interworking classifications	17
7.1 Service interworking	17
7.2 Network interworking	17
7.3 Signalling interworking.....	18
7.4 Numbering.....	18
7.5 Supplementary service interworking.....	18
8 Compatibility and subscription checking.....	18
9 Interworking to PSTN	19
9.1 Speech Calls.....	19
9.1.1 Interworking indications to PLMN terminal.....	19
9.1.2 Transmission aspects	19
9.1.3 Generation of In-band Tones and Announcements (PLMN-PSTN).....	19
9.2 Data Calls	19
9.2.1 Network interworking mobile originated.....	20
9.2.1.1 Selection of interworking function.....	20
9.2.1.2 Modem Selection	20
9.2.1.3 Mapping of BC-IE from PLMN to ISUP (or other).....	21
9.2.2 Network Interworking Mobile terminated PSTN Originated	21
9.2.2.1 Multi-numbering Scheme.....	21
9.2.2.2 Single-numbering Scheme	23
9.2.3 Transparent service support.....	24
9.2.3.1 Structure of the MSC/IWF for Iu mode	25
9.2.3.2 Structure of the MSC/IWF for A/Gb mode.....	25
9.2.3.3 Mapping of signalling UE/MSC/IWF to modem interface requirements.....	25
9.2.3.4 Establishment of end-to-end terminal synchronizations	26
9.2.3.4.1 Terminating side (towards the UE).....	27
9.2.3.4.1.1 Traffic channel types TCH/F4.8 and TCH/F9.6 for A/Gb mode	27
9.2.3.4.1.2 Traffic channel type TCH/F14.4 for A/Gb mode.....	27
9.2.3.4.2 Transit side (towards the fixed network)	28
9.2.3.5 Network Independent Clocking (NIC)	28
9.2.4 Non-transparent service support	29
9.2.4.1 Structure of the MSC/IWF for Iu mode	29
9.2.4.2 Structure of the MSC/IWF for A/Gb mode.....	29
9.2.4.3 Re-constitution of user data.....	29
9.2.4.4 Layer 2 relay functionality	29

9.2.4.5	In band signalling mapping flow control	30
9.2.4.5.1	Conditions requiring flow control towards the fixed network.....	30
9.2.4.5.2	Conditions requiring flow control towards the UE.....	30
9.2.4.6	Data buffers.....	30
9.2.4.6.1	Transmit buffers (towards UE).....	30
9.2.4.6.2	Receive buffers (from UE)	31
9.2.4.7	Transportation of the Break condition.....	31
9.2.4.8	In band signalling mapping modem status information	31
9.2.4.9	Support of out-band flow control	32
9.2.4.10	Establishment of end-to-end terminal synchronizations	32
9.2.4.10.1	Terminating side (towards the UE).....	32
9.2.4.10.2	Transit side (towards the fixed network)	32
9.2.4.11	Data compression.....	33
9.2.4.12	Service level up and down grading	33
9.2.5	DTE/DCE interface (Filtering)	33
9.3	Interworking Alternate Speech / Facsimile Group 3 Calls	34
9.3.1	General.....	34
9.3.2	Mobile originated PSTN terminated calls.....	35
9.3.3	PSTN originated mobile terminated calls	35
9.3.4	BICC network architecture	35
9.4	3G-H.324/M calls over 3,1kHz audio	35
9.4.1	Mobile originated multimedia call.....	36
9.4.1.1	Call setup	36
9.4.1.2	Fallback to speech after setup	36
9.4.2	Mobile terminated multimedia call.....	36
9.4.2.1	Call setup	36
9.4.2.2	Fallback to speech after setup	37
9.4.3	Seamless data rate change.....	37
10	Interworking to the ISDN.....	37
10.1	Speech Calls	38
10.2	Data Calls	38
10.2.1	Network interworking mobile originated.....	38
10.2.2	Network interworking mobile terminated.....	38
10.2.2.1	General	38
10.2.2.2	Functions in GMSC.....	39
10.2.2.3	Functions in HLR.....	39
10.2.2.4	Functions in VMSC.....	40
10.2.2.4A	Functions in VLR.....	41
10.2.2.5	Call Flows	43
10.2.2.6	Mapping Functions	44
10.2.2.7	Creation of Backup Bearer Capability Information Element	62
10.2.3	Transparent service support	69
10.2.3.1	Structure of the MSC/IWF for Iu mode	69
10.2.3.2	Structure of the MSC/IWF for A/Gb mode.....	69
10.2.3.3	Mapping of signalling UE/MSC/IWF to modem or ISDN (V.110) TA-function interface requirements.....	70
10.2.3.4	Establishment of end-to-end terminal synchronizations	71
10.2.3.4.1	Terminating side (towards the UE).....	71
10.2.3.4.1.1	Traffic channel types TCH/F4.8 and TCH/F9.6 in A/Gb mode.....	71
10.2.3.4.1.2	Traffic channel type TCH/F14.4 for A/Gb mode.....	71
10.2.3.4.1.3	User Plane for Iu mode	72
10.2.3.4.2	Transit side (towards the fixed network).	72
10.2.3.5	Network independent Clocking (NIC)	72
10.2.4	Non-transparent service support	72
10.2.4.1	Structure of the MSC/IWF for Iu mode	72
10.2.4.2	Structure of the MSC/IWF for A/Gb mode.....	73
10.2.4.3	Re-constitution of user data.....	73
10.2.4.4	Layer 2 relay functionality	73
10.2.4.5	In band signalling mapping flow control	74
10.2.4.5.1	Conditions requiring flow control - if flow control is provided - towards the fixed network.....	74
10.2.4.5.2	Conditions requiring flow control towards the UE.....	74

10.2.4.6	Data buffers.....	75
10.2.4.6.1	Transmit buffers (towards UE).....	75
10.2.4.6.2	Receive buffers (from UE)	75
10.2.4.7	BREAK Indication.....	75
10.2.4.8	Signalling mapping of modem or ISDN (V.110, V.120 or PIAFS) TA-function status information.....	75
10.2.4.9	Support of out-band flow control.....	76
10.2.4.10	Synchronizations.....	76
10.2.4.10.1	V.110 and V.120 Frame synchronizations.....	76
10.2.4.10.2	RLP Frame start indication.....	76
10.2.4.10.3	L2R Frame synchronizations.....	77
10.2.4.10.4	Establishment of end-to-end terminal synchronizations.....	77
10.2.4.10.4.1	Terminating side (towards the UE).....	77
10.2.4.10.4.2	Transit side (towards the fixed network)	77
10.2.4.11	Data compression.....	77
10.2.4.12	Additional aspects of V.120 Interworking	78
10.2.4.12.1	V.120 Signalling parameters	78
10.2.4.12.2	V.120 Protocol parameters	78
10.2.4.12.3	Data compression on the ISDN	78
10.2.4.12.4	Use of the V.120 Control State (header extension) octet.....	78
10.2.4.13	Interworking with restricted 64 kbit/s networks.....	78
10.2.4.13.1	Rate adaptation	78
10.2.4.13.2	MSC - ISDN signalling	79
10.2.4.14	Service level up and down grading	79
10.2.4.15	Interworking in Frame Tunneling Mode.....	79
10.2.4.16	Additional aspects of PIAFS Interworking	79
10.2.5	DTE/DCE interface (Filtering)	80
10.3	Interworking Alternate speech facsimile group 3 calls.....	80
10.3.1	Alternate speech data bearer interworking.....	80
10.3.1.1	General	80
10.3.1.2	Mobile originated ISDN terminated.....	80
10.3.1.3	ISDN originated mobile terminated	80
10.4	3G-H.324/M calls over UDI/RDI.....	80
10.4.1	Mobile originated multimedia call.....	81
10.4.1.1	Call setup	81
10.4.1.2	Fallback after setup	81
10.4.1.3	User initiated service change after setup.....	81
10.4.2	Mobile terminated multimedia call.....	81
10.4.2.1	Call setup	81
10.4.2.2	User initiated service change after setup.....	82
11	Interworking between A/Gb mode MSC and Iu mode MSC	82
11.0	Signalling issues.....	82
11.0.1	Loss of BC Information during Handover from A/Gb mode to UTRAN Iu mode	82
11.0.2	Handover from UTRAN Iu mode to A/Gb mode	82
11.0.3	Loss of BC Information during Handover from A/Gb mode to GERAN Iu mode	82
11.0.4	Handover from GERAN Iu mode to A/Gb mode	83
11.0.5	Handover from UTRAN Iu mode to GERAN Iu mode	83
11.0.6	Handover from GERAN Iu mode to UTRAN Iu mode	83
11.1	Handover to A/Gb mode MSC	83
11.2	Handover from A/Gb mode MSC to UTRAN Iu mode MSC	84
11.3	Handover from A/Gb mode MSC to GERAN Iu mode MSC	84
11.3.1	User plane for transparent services	84
11.3.2	User plane for non-transparent services.....	84
11.4	Handover within Iu mode PLMNs	85
11.5	Handover for 56kbit/s.....	86
11.6	Void.....	86
11a	Transport Protocols	86
11a.1	Core Network	86
11a.1.0	Overview	86
11a.1.1	Void	87

11a.1.2	Transport beyond the IWF	87
11a.1.2.1	UDI and RDI.....	87
11a.1.2.2	Modem	87
11a.1.3	Transport on the access side of the IWF	87
11a.1.3.0	Inter MSC-Relocation	87
11a.1.3.0a	Several MGWs controlled by same MSC server.....	88
11a.1.3.1	Non-Transparent CSD.....	90
11a.1.3.2	Transparent CSD	92
11a.2	NT services.....	95
11a.2.1	Iu interface and Nb interface at access side of IWF in a BICC based CS CN	95
11a.2.2	Nb interface at access side of IWF in a BICC based CS CN for Inter-MSR relocation	95
11a.2.3	Nb interface at network side of IWF in a BICC based CS CN	95
11a.2.4	Nb interface at access side of IWF in a SIP-I based CS CN.....	95
11a.2.5	Nb interface at network side of IWF in a SIP-I based CS CN	96
11a.2.6	A interface with IP transport.....	96
11a.3	T services.....	96
11a.3.0	Iu interface	96
11a.3.0a	Nb interface in BICC based CS CN	96
11a.3.1	Avoidance of delay at RNC.....	96
11a.3.2	Recovery from the loss of ATM cells.....	97
11a.3.3	A interface with IP transport.....	97
11a.3.4	Nb interface at access side of IWF in a SIP-I based CS CN	97
11a.3.5	Nb interface at network side of IWF in a SIP-I based CS CN	97
12	Frame Synchronization.....	97
12.1	Initial frame synchronization.....	98
12.1.1	Terminating side (towards the UE).....	98
12.1.2	Transit side (towards the fixed network)	98
12.1.2.1	Interworking to the PSTN	98
12.1.2.2	Interworking to the ISDN.....	98
12.2	Action on loss of frame synchronization	98
12.2.1	Loss on the transit side (towards the fixed network)	98
12.2.2	Loss on the terminating side (towards the UE)	98
13	Call Clearing	99
14	The A-TRAU Framing Protocols	99
14.1	A-TRAU' Protocol.....	99
14.1.1	Frame layout for the different transparent user rates	99
14.1.2	A-TRAU' frame format	100
14.2	A-TRAU'' Protocol	102
15	RTP Payload Type Negotiation for Data Calls within a SIP-I based CS Core Network	104
15.1	RTP payload type negotiation at access side of IWF	104
15.2	RTP payload type negotiation at network side of IWF	104
Annex A (informative):	SDLs	105
Annex B (informative):	General mapping of V.24 circuits to channel status bits.....	107
Annex C (normative):	RTP payload type for SCUDIF in SIP-I based CS core network.....	108
C.1	Scope	108
C.2	RTP payload Type definition	108
C.3	Describing the RTP payload Type in SDP	108
C.4	SDP Offer-Answer considerations	108
C.5	SDP Example	109
Annex D (informative):	IANA registration information for RTP payload types for SCUDIF in SIP-I based CS core network.....	110
D.1	Introduction	110
D.2	IANA Registration information.....	110
D.2.1	Media Type Name	110
D.2.2	Subtype Name.....	110
D.2.3	Required parameters	110

D.2.4	Optional parameters	110
D.2.5	Encoding considerations	110
D.2.6	Security considerations	110
D.2.7	Interoperability considerations.....	110
D.2.8	Published specification	110
D.2.9	Applications which use this media type.....	110
D.2.10	Additional information	111
D.2.10.1	Magic number(s)	111
D.2.10.2	File extension(s).....	111
D.2.10.3	Macintosh File Type Code(s)	111
D.2.10.2	Object Identifier(s) or OID(s)	111
D.2.11	Intended usage	111
D.2.12	Other Information/General Comment	111
D.2.13	Person to contact for further information.....	111
Annex E (informative):	Change history	112
History		115

ITeH STANDARD PREVIEW
(standards.iteh.ai)

Full standard:
<https://standards.iteh.ai/catalog/standards/sist/ca29-adf0-5a1f-4167-8b68-93a787df4fa6/etsi-ts-129-007-v16.0.0-2020-08>

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

The present document identifies the Mobile-services Switching Centre/Interworking functions (MSC/IWFs) and requirements to support interworking between:

- i) PLMN and PSTN;
- ii) PLMN and ISDN;

within the 3GPP system.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document identifies the Mobile-services Switching Centre/Interworking Functions (MSC/IWFs) and requirements to support interworking between:

- a) PLMN and PSTN;
- b) PLMN and ISDN;

for circuit switched services in the PLMN. It is not possible to treat ISDN and PSTN as one type of network, even when both ISDN and PSTN subscribers are served by the same exchange because of the limitations of the PSTN subscribers access i.e. analogue connection without D-channel signalling.

Within the present document, the requirements for voice and non-voice (data) calls are considered separately.

From R99 onwards the following services are no longer required by a PLMN:

- the dual Bearer Services "alternate speech/data" (BS 61) and "speech followed by data" (BS 81);
- the dedicated services for PAD (BS 4x) and Packet access (BS 5x);
- the single asynchronous and synchronous Bearer Services (BS 21..26, BS 31..34).

From Rel-4 onwards the following services are no longer required by a PLMN:

- the synchronous Bearer Service non-transparent (BS 30 NT);
- the Basic Packet access;
- Non-transparent facsimile (TS 61/62 NT) for the A/Gb mode and GERAN Iu mode.

If a PLMN still provides these services it shall fulfil the specification of former releases.

The present document is valid for a PLMN in A/Gb mode as well as in Iu mode. If text applies only for one of these systems it is explicitly mentioned by using the terms "A/Gb mode" and "Iu mode". If text applies to both of the systems, but a distinction between the ISDN/PSTN and the PLMN is necessary, the term "PLMN" is used.

NOTE: The Gb interface does not play any role in the scope of the present document although the term "A/Gb mode" is used.

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, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] ITU-T Recommendation G.711 (11/88): "Pulse Code Modulation (PCM) of voice frequencies".
- [2] ITU-T Recommendation I.460 (02/99): "Multiplexing, rate adaption and support of existing interfaces".
- [3] ITU-T Recommendation I.464 (02/99): "Multiplexing, rate adaption and support of existing interfaces for restricted 64 kbit/s transfer capability".
- [4] ITU-T Recommendation Q.922 (1992): "DSS 1 Data link layer: ISDN data link layer specification for frame mode bearer services".

- [5] ITU-T Recommendation Q.931 (05/98): "DSS 1 - ISDN user network interface layer 3 specification for basic call control".
- [6] ITU-T Recommendation V.22 (11/88): "1200 bits per second duplex modem standardized for use in the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".
- [7] ITU-T Recommendation V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".
- [8] ITU-T Recommendation V.25 (10/96): "Automatic answering equipment and general procedures for automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls".
- [9] ITU-T Recommendation V.32 (03/93): "A family of 2-wire, duplex modems operating at data signalling rates of up to 9600 bit/s for use on the general switched telephone network and on leased telephone-type circuits".
- [10] ITU-T Recommendation V.32bis (02/91): "A duplex modem operating at data signalling rates of up to 14 400 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits".
- [11] ITU-T Recommendation V.34 (02/98): "A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits".
- [12] ITU-T Recommendation V.42 (03/02): "Error-correcting procedures for DCEs using asynchronous-to-synchronous conversion".
- [13] ITU-T Recommendation V.42bis (01/90): "Data compression procedures for Data Circuit Terminating Equipment (DCE) using error correction procedures".
- [14] ITU-T Recommendation V.90 (09/98): "A digital modem and analogue modem pair for use on the Public Switched Telephone Network (PSTN) at data signalling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream".
- [15] ITU-T Recommendation V.110: "Support by an ISDN of data terminal equipments with V-Series type interfaces".
- [16] ITU-T Recommendation V.120 (10/96): "Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing".
- [17] ETSI ETR 018 (11/95): "Integrated Services Digital Network (ISDN); Application of the Bearer Capability (BC), High Layer Compatibility (HLC) and Low Layer Compatibility (LLC) information elements by terminals supporting ISDN services".
- [18] ETSI ETS 300 102-1 Edition 1 (1990): "Integrated Services Digital Network (ISDN); User-network interface layer 3; Specifications for basic call control".
- [19] ETSI EN 300 403-1 V1.2.2 (1998-04): "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification".
- [20] 3GPP TS 41.103: "GSM Release 5 specifications".
- [21] 3GPP TR 21.905: "Vocabulary for 3GPP specifications"
- [22] 3GPP TS 22.001: "Principles of circuit telecommunication services supported by a Public Land Mobile Network (PLMN)".
- [23] 3GPP TS 22.003: "Circuit teleservices supported by a Public Land Mobile Network (PLMN)".
- [24] 3GPP TS 43.010: "GSM Public Land Mobile Network (PLMN) connection types".
- [25] 3GPP TS 43.045: "Technical realization of facsimile group 3 service - transparent".

- [26] 3GPP TS 43.050: "Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system".
- [27] 3GPP TS 44.021: "Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".
- [28] 3GPP TS 48.020: "Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".
- [29] 3GPP TS 48.060: "Inband control of remote transcoders and rate adaptors for full rate traffic channels".
- [30] 3GPP TS 09.02 : "Mobile Application Part (MAP) specification GSM Phase 1".
- [31] 3GPP TS 49.003: "Signalling requirements on interworking between the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) and the Public Land Mobile Network (PLMN)".
- [32] 3GPP TS 21.103: "3rd Generation mobile system Release 5 specifications ".
- [33] 3GPP TS 22.002: "Circuit Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)".
- [34] 3GPP TS 22.004: "General on supplementary services".
- [35] 3GPP TS 23.003: "Numbering, addressing and identification".
- [36] 3GPP TS 23.008: "Organization of subscriber data".
- [37] 3GPP TS 23.011: "Technical realization of supplementary services".
- [38] 3GPP TS 23.146: "Technical realization of facsimile group 3 non-transparent".
- [39] Void.
- [40] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core network protocols; Stage 3".
- [41] 3GPP TS 24.022: "Radio Link Protocol (RLP) for circuit switched bearer and teleservices ".
- [42] 3GPP TS 25.415: "UTRAN Iu interface user plane protocols".
- [43] 3GPP TS 27.001: "General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".
- [44] 3GPP TS 27.002: "Terminal Adaptation Functions (TAF) for services using Asynchronous bearer capabilities".
- [45] 3GPP TS 27.003: "Terminal Adaptation Functions (TAF) for services using Synchronous bearer capabilities".
- [46] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".
- [47] 3GPP TS 24.002: "GSM - UMTS Public Land Mobile Network (PLMN) access reference configuration "
- [48] ISO/IEC 3309 (1993): "Information technology - Telecommunications and information exchange between systems - High-level Data Link Control (HDLC) procedures - Frame structure".
- [49] IETF RFC 1662: "PPP in HDLC-like framing".
- [50] Mobile Internet Access Forum: "PIAFS Specification Ver. 1.1, 2.1".
- [51] ITU-T Recommendation V.8: "Procedures for starting sessions of data transmission over the public switched telephone network".
- [52] 3GPP TS 26.111: "Codec for circuit switched multimedia telephony service; Modifications to H.324".

- [53] Void
- [54] ITU-T Recommendation H.223 (03/96): "Multiplexing protocol for low bit rate multimedia communication".
- [55] ITU-T Recommendation H.223 (Annex A) (02/98): "Multiplexing protocol for low bit rate multimedia communication over low error-prone channels".
- [56] ITU-T Recommendation H.223 (Annex B) (02/98): "Multiplexing protocol for low bit rate multimedia communication over moderate error-prone channels".
- [57] ITU-T Recommendation H.223 (Annex C) (02/98): "Multiplexing protocol for low bit rate multimedia communication over highly error-prone channels".
- [58] ITU-T Recommendation H.324: "Terminal for low bit-rate multimedia communication".
- [59] ITU-T Recommendation H.221: "Frame structure for a 64 to 1920 kbit/s channel in audiovisual teleservices".
- [60] ITU-T Recommendation H.242: "System for establishing communication between audiovisual terminals using digital channels up to 2 Mbit/s".
- [61] ITU-T Recommendation H.245: "Control protocol for multimedia communication".
- [62] ITU-T Recommendation V.8 bis: "Procedures for the identification and selection of common modes of operation between data circuit-terminating equipments (DCEs) and between data terminal equipments (DTEs) over the public switched telephone network and on leased point-to-point telephone-type circuits".
- [63] ITU-T Recommendation V.21 (11/88): "300 bits per second duplex modem standardized for use in the general switched telephone network".
- [64] ITU-T Recommendation V.22bis (1988): "2400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".
- [65] ITU-T Recommendation V.23 (11/88): "600/1200-baud modem standardized for use in the general switched telephone network".
- [66] ITU-T Recommendation V.26 (11/88): "2400 bits per second modem standardized for use on 4-wire leased telephone-type circuits".
- [67] ITU-T Recommendation V.26 bis (11/88): "2400/1200 bits per second modem standardized for use in the general switched telephone network".
- [68] ITU-T Recommendation V.26 ter (11/88): "2400 bits per second duplex modem using the echo cancellation technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".
- [69] ITU-T Recommendation V.27 (11/88): "4800 bits per second modem with manual equalizer standardized for use on leased telephone-type circuits".
- [70] ITU-T Recommendation V.27 bis (11/88): "4800/2400 bits per second modem with automatic equalizer standardized for use on leased telephone-type circuits".
- [71] ITU-T Recommendation V.29 (11/88): "9 600 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits".
- [72] ITU-T Recommendation Q.921 (09/97): "ISDN user-network interface - Data link layer specification".
- [73] ITU-T Recommendation X.21 (09/92): "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for synchronous operation on public data networks".