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Contents

Foreword

This Global System for Mobile communications Technical Specification (GTS) has been produced by the Special Mobile Group (SMG) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI).

A GSM PLMN may be described by a limited set of access interfaces (refer to TS GSM 04.02 and 02.01) and a limited set of GSM PLMN connection types to support the telecommunication services described in the GSM 02-series of specifications. This GTS identifies and defines these connection types in so far as they relate to the particular network capabilities for a GSM PLMN within the digital cellular telecommunications system (Phase 2/Phase 2+).

This GTS is a TC-SMG approved GSM technical specification version 5, which contains GSM Phase 2+ enhancements/features to the version 4 GSM technical specification. The European Telecommunicatios Standard from which this Phase 2+ GTS has evolved is Phase 2 GSM ETS 300 528 (GSM 03.10 version 4.3.1).

GTS are produced by TC-SMG to enable the GSM Phase 2+ specifications to become publicly available, prior to submission for the formal ETSI standards approval procedure to become European Telecommunications Standards (ETS). This ensures the earliest possible access to GSM Phase 2+ specifications for all Manufacturers, Network operators and implementors of the Global System for Mobile communications.

The contents of this GTS are subject to continuing work within TC-SMG and may change following formal TC-SMG approval. Should TC-SMG modify the contents of this GTS it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 5.x.y

where:

- y the third digit is incremented when editorial only changes have been incorporated in the specification;

- x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

The specification from which this GTS has been derived was originally based on CEPT documentation, hence the presentation of this GTS may not be entirely in accordance with the ETSI rules.

Reference is made within this GTS to GSM-TSs (note).

NOTE: TC-SMG has produced documents which give the technical specifications for the implementation of the digital cellular telecommunications system. Historically, these documents have been identified as GSM Technical Specifications (GSM-TSs). These TSs may have subsequently become I-ETSs (Phase 1), or ETSs/ETSI Technical Reports (ETRs) (Phase 2). TC-SMG has also produced ETSI GSM TSs which give the technical specifications for the implementation of Phase 2+ enhancements of the digital cellular telecommunications system. These version 5.x.x GSM Technical Specifications may be referred to as GTSs.

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1 Scope

A GSM PLMN may be described by a limited set of access interfaces (refer to TS GSM 04.02 and 02.01) and a limited set of GSM PLMN connection types to support the telecommunication services described in the GSM 02-series of specifications. This Global System for Mobile communications Technical Specification (GTS) identifies and defines these connection types in so far as they relate to the particular network capabilities for a GSM PLMN.

The basic lower layer capabilities of a GSM PLMN are represented by a set of GSM PLMN connection types. The definition of a set of GSM PLMN connection types provides the necessary input to identify network capabilities of a GSM PLMN. In addition to describing network capabilities of a GSM PLMN, the identification of connection types facilitates the specification of network-to-network interfaces. It may also assist in the allocation of network performance parameters.

This specification should be considered in conjunction with other GSM specifications with particular reference to TS GSM 01.02, 02.01, 02.02, 02.03, 03.01, 03.02, 04.02 and 04.03.

This specification provides a bridge between the service specification in the GSM 02-series of specification and the more detailed specifications such as TS GSM of the 03, 04, 07 and 09 series. As such, it establishes a framework for the specification and understanding of the more detailed specifications. It is therefore not a specification against which detailed conformance testing can be performed. However, it shall be considered mandatory for the understanding of the more detailed specifications and used to resolve issues of conflict in these specifications.

2 Normative references

This GTS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this GTS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] GSM 01.02 (ETR 099): "European digital cellular telecommunication system (Phase 2); General description of a GSM Public Land Mobile Network (PLMN)".

[2] GSM 01.04 (ETR 100): "European digital cellular telecommunication system (Phase 2); Abbreviations and acronyms".

[3] GSM 02.01 (ETS 300 500): "European digital cellular telecommunication system (Phase 2); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".

[4] GSM 02.02 (ETS 300 501): "European digital cellular telecommunication system (Phase 2); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[5] GSM 02.03 (ETS 300 502): "European digital cellular telecommunication system (Phase 2); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[6] GSM 02.04 (ETS 300 503): "European digital cellular telecommunication system (Phase 2); General on supplementary services".

[7] GSM 02.06 (ETS 300 504): "European digital cellular telecommunication system (Phase 2); Types of Mobile Stations (MS)".

[8] GSM 02.07 (ETS 300 505): "European digital cellular telecommunication system (Phase 2); Mobile Station (MS) features".

[9] GSM 02.09 (ETS 300 506): "European digital cellular telecommunication system (Phase 2); Security aspects".

[10] GSM 02.11 (ETS 300 507): "European digital cellular telecommunication system (Phase 2); Service accessibility".

[11] GSM 02.16 (ETS 300 508): "European digital cellular telecommunication system (Phase 2); International Mobile station Equipment Identities (IMEI)".

[12] GSM 02.17 (ETS 300 509): "European digital cellular telecommunication system (Phase 2); Subscriber identity modules: Functional characteristics".

[13] GSM 02.24 (ETS 300 510): "European digital cellular telecommunication system (Phase 2); Description of Charge Advice Information (CAI)".

[14] GSM 02.30 (ETS 300 511): "European digital cellular telecommunication system (Phase 2); Man-Machine Interface (MMI) of the Mobile Station (MS)".

[15] GSM 02.40 (ETS 300 512): "European digital cellular telecommunication system (Phase 2); Procedures for call progress indications".

[16] GSM 02.41 (ETS 300 513): "European digital cellular telecommunication system (Phase 2); Operator determined barring".

[17] GSM 02.81 (ETS 300 514): "European digital cellular telecommunication system (Phase 2); Line identification supplementary services - Stage 1".

[18] GSM 02.82 (ETS 300 515): "European digital cellular telecommunication system (Phase 2); Call Forwarding (CF) supplementary services - Stage 1".

[19] GSM 02.83 (ETS 300 516): "European digital cellular telecommunication system (Phase 2); Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 1".

[20] GSM 02.84 (ETS 300 517): "European digital cellular telecommunication system (Phase 2); MultiParty (MPTY) supplementary services - Stage 1".

[21] GSM 02.85 (ETS 300 518): "European digital cellular telecommunication system (Phase 2); Closed User Group (CUG) supplementary services - Stage 1".

[22] GSM 02.86 (ETS 300 519): "European digital cellular telecommunication system (Phase 2); Advice of charge (AoC) supplementary services - Stage 1".

[23] GSM 02.88 (ETS 300 520): "European digital cellular telecommunication system (Phase 2); Call Barring (CB): supplementary services - Stage 1".

[26] GSM 03.01 (ETS 300 521): "European digital cellular telecommunication system (Phase 2); Network functions".

[27] GSM 03.02 (ETS 300 522): "European digital cellular telecommunication system (Phase 2); Network architecture".

[28] GSM 03.03 (ETS 300 523): "European digital cellular telecommunication system (Phase 2); Numbering, addressing and identification".

[29] GSM 03.04 (ETS 300 524): "European digital cellular telecommunication system (Phase 2); Signalling requirements relating to routeing of calls to mobile subscribers".

[30] GSM 03.05 (ETR 102): "European digital cellular telecommunication system (Phase 2); Technical performance objectives".

[31] GSM 03.07 (ETS 300 525): "European digital cellular telecommunication system (Phase 2); Restoration procedures".

[32] GSM 03.08 (ETS 300 526): "European digital cellular telecommunication system (Phase 2); Organisation of subscriber data".

[33] GSM 03.09 (ETS 300 527): "European digital cellular telecommunication system (Phase 2); Handover procedures".

[34] GSM 03.11 (ETS 300 529): "European digital cellular telecommunication system (Phase 2); Technical realization of supplementary services".

[35] GSM 03.12 (ETS 300 530): "European digital cellular telecommunication system (Phase 2); Location registration procedures".

[36] GSM 03.13 (ETS 300 531): "European digital cellular telecommunication system (Phase 2); Discontinuous Reception (DRX) in the GSM system".

[37] GSM 03.14 (ETS 300 532): "European digital cellular telecommunication system (Phase 2); Support of Dual Tone Multi-Frequency signalling (DTMF) via the GSM system".

[38] GSM 03.15 (ETS 300 533): "European digital cellular telecommunication system (Phase 2); Technical realization of operator determined barring".

[39] GSM 03.20 (ETS 300 534): "European digital cellular telecommunication system (Phase 2); Security related network functions".

[40] GSM 03.22 (ETS 300 535): "European digital cellular telecommunication system (Phase 2); Functions related to Mobile Station (MS) in idle mode".

[41] GSM 03.30 (ETR 103): "European digital cellular telecommunication system (Phase 2); Radio network planning aspects".

[42] GSM 03.38 (ETS 300 628): "European digital cellular telecommunication system (Phase 2); Alphabet and language specific information".

[43] GSM 03.40 (ETS 300 536): "European digital cellular telecommunication system (Phase 2); Technical realization of the Short Message Service (SMS) Point to Point (PP)".

[44] GSM 03.41 (ETS 300 537): "European digital cellular telecommunication system (Phase 2); Technical realization of Short Message Service Cell Broadcast (SMSCB)".

[45] GSM 03.43 (ETR 104): "European digital cellular telecommunication system (Phase 2); Support of Videotex".

[46] GSM 03.44 (ETR 105): "European digital cellular telecommunication system (Phase 2); Support of teletex in a GSM Public Land Mobile Network (PLMN)".

[47] GSM 03.45 (ETS 300 538): "European digital cellular telecommunication system (Phase 2); Technical realization of facsimile group 3 transparent".

[48] GSM 03.46 (ETS 300 539): "European digital cellular telecommunication system (Phase 2); Technical realization of facsimile group 3 non-transparent".

[49] GSM 03.47 (ETR 106): "European digital cellular telecommunication system (Phase 2); Example protocol stacks for interconnecting Service Centre(s) (SC) and Mobile-services Switching Centre(s) (MSC)".

[50] GSM 03.49 (ETR 107): "European digital cellular telecommunication system (Phase 2); Example protocol stacks for interconnecting Cell Broadcast Centre (CBC) and Mobile-services Switching Centre (MSC)".

[51] GSM 03.50 (ETS 300 540): "European digital cellular telecommunication system (Phase 2); Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system".

[52] GSM 03.70 (ETS 300 541): "European digital cellular telecommunication system (Phase 2); Routeing of calls to/from Public Data Networks (PDN)".

[53] GSM 03.81 (ETS 300 542): "European digital cellular telecommunication system (Phase 2); Line identification supplementary services - Stage 2".

[54] GSM 03.82 (ETS 300 543): "European digital cellular telecommunication system (Phase 2); Call Forwarding (CF) supplementary services - Stage 2".

[55] GSM 03.83 (ETS 300 544): "European digital cellular telecommunication system (Phase 2); Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 2".

[56] GSM 03.84 (ETS 300 545): "European digital cellular telecommunication system (Phase 2); MultiParty (MPTY) supplementary services - Stage 2".

[57] GSM 03.85 (ETS 300 546): "European digital cellular telecommunication system (Phase 2); Closed User Group (CUG) supplementary services - Stage 2".

[58] GSM 03.86 (ETS 300 547): "European digital cellular telecommunication system (Phase 2); Advice of Charge (AoC) supplementary services - Stage 2".

[59] GSM 03.88 (ETS 300 548): "European digital cellular telecommunication system (Phase 2); Call Barring (CB) supplementary services - Stage 2".

[60] GSM 03.90 (ETS 300 549): "European digital cellular telecommunication system (Phase 2); Unstructured supplementary services operation - Stage 2".

[61] GSM 04.01 (ETS 300 550): "European digital cellular telecommunication system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface: General aspects and principles".

[62] GSM 04.02 (ETS 300 551): "European digital cellular telecommunication system (Phase 2); GSM Public Land Mobile Network (PLMN) access reference configuration".

[63] GSM 04.03 (ETS 300 552): "European digital cellular telecommunication system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface: Channel structures and access capabilities".

[64] GSM 04.04 (ETS 300 553): "European digital cellular telecommunication system (Phase 2); Layer 1: General requirements".

[65] GSM 04.05 (ETS 300 554): "European digital cellular telecommunication system (Phase 2); Data Link (DL) layer: General aspects".

[66] GSM 04.06 (ETS 300 555): "European digital cellular telecommunication system (Phase 2); Mobile Station - Base Station System (MS - BSS) interface: Data Link (DL) layer specification".

[67] GSM 04.07 (ETS 300 556): "European digital cellular telecommunication system (Phase 2); Mobile radio interface signalling layer 3:General aspects".

[68] GSM 04.08 (ETS 300 557): "European digital cellular telecommunication system (Phase 2); Mobile radio interface layer 3 specification".

[69] GSM 04.10 (ETS 300 558): "European digital cellular telecommunication system (Phase 2); Mobile radio interface layer 3:Supplementary services specification: General aspects".

[70] GSM 04.11 (ETS 300 559): "European digital cellular telecommunication system (Phase 2); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[71] GSM 04.12 (ETS 300 560): "European digital cellular telecommunication system (Phase 2); Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".

[72] GSM 04.21 (ETS 300 562): "European digital cellular telecommunication system (Phase 2); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[73] GSM 04.22 (ETS 300 563): "European digital cellular telecommunication system (Phase 2); Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS - BSS) interface and the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[74] GSM 04.80 (ETS 300 564): "European digital cellular telecommunication system (Phase 2); Mobile radio interface layer 3 supplementary services specification: Formats and coding".

[75] GSM 04.81 (ETS 300 565): "European digital cellular telecommunication system (Phase 2); Line identification supplementary services - Stage 3".

[76] GSM 04.82 (ETS 300 566): "European digital cellular telecommunication system (Phase 2); Call Forwarding (CF) supplementary services - Stage 3".

[77] GSM 04.83 (ETS 300 567): "European digital cellular telecommunication system (Phase 2); Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 3".

[78] GSM 04.84 (ETS 300 568): "European digital cellular telecommunication system (Phase 2); MultiParty (MPTY) supplementary services - Stage 3".

[79] GSM 04.85 (ETS 300 569): "European digital cellular telecommunication system (Phase 2); Closed User Group (CUG) supplementary services - Stage 3".

[80] GSM 04.86 (ETS 300 570): "European digital cellular telecommunication system (Phase 2); Advice of Charge (AoC) supplementary services - Stage 3".

[81] GSM 04.88 (ETS 300 571): "European digital cellular telecommunication system (Phase 2); Call Barring (CB) supplementary services - Stage 3".

[82] GSM 04.90 (ETS 300 572): "European digital cellular telecommunication system (Phase 2); Unstructured supplementary services operation - Stage 3".

[83] GSM 05.01 (ETS 300 573): "European digital cellular telecommunication system (Phase 2); Physical layer on the radio path: General description".

[84] GSM 05.02 (ETS 300 574): "European digital cellular telecommunication system (Phase 2); Multiplexing and multiple access on the radio path".

[85] GSM 05.03 (ETS 300 575): "European digital cellular telecommunication system (Phase 2); Channel coding".

[86] GSM 05.04 (ETS 300 576): "European digital cellular telecommunication system (Phase 2); Modulation".

[87] GSM 05.05 (ETS 300 577): "European digital cellular telecommunication system (Phase 2); Radio transmission and reception".

[88] GSM 05.08 (ETS 300 578): "European digital cellular telecommunication system (Phase 2); Radio subsystem link control".

[89] GSM 05.10 (ETS 300 579): "European digital cellular telecommunication system (Phase 2); Radio subsystem synchronisation".

[90] GSM 05.90 (ETR 108): "European digital cellular telecommunication system (Phase 2); GSM Electro Magnetic Compatibility (EMC) considerations".

[91] GSM 06.01 (ETS 300 580-1): "European digital cellular telecommunication system (Phase 2); Full rate speech processing functions".

[92] GSM 06.10 (ETS 300 580-2): "European digital cellular telecommunication system (Phase 2); Full rate speech transcoding".

[93] GSM 06.11 (ETS 300 580-3): "European digital cellular telecommunication system (Phase 2); Substitution and muting of lost frames for full rate speech channels".

[94] GSM 06.12 (ETS 300 580-4): "European digital cellular telecommunication system (Phase 2); Comfort noise aspect for full rate speech traffic channels".

[95] GSM 06.31 (ETS 300 580-5): "European digital cellular telecommunication system (Phase 2); Discontinuous Transmission (DTX) for full rate speech traffic channel".

[96] GSM 06.32 (ETS 300 580-6): "European digital cellular telecommunication system (Phase 2); Voice Activity Detection (VAD)".

[97] GSM 06.02 (ETS 300 581-1): "European digital cellular telecommunication system (Phase 2); Half rate speech processing functions".

[98] GSM 06.20 (ETS 300 581-2): "European digital cellular telecommunication system (Phase 2); Half rate speech transcoding".

[99] GSM 06.21 (ETS 300 581-3): "European digital cellular telecommunication system (Phase 2); Substitution and muting of lost frames for half rate speech traffic channels".

[100] GSM 06.22 (ETS 300 581-4): "European digital cellular telecommunication system (Phase 2); Comfort noise aspects for half rate speech traffic channels".

[101] GSM 06.41 (ETS 300 581-5): "European digital cellular telecommunication system (Phase 2); Discontinuous Transmission (DTX) for half rate speech traffic channels".

[102] GSM 06.42 (ETS 300 581-6): "European digital cellular telecommunication system (Phase 2); Voice Activity Detection (VAD) for half rate speech traffic channels".

[103] GSM 07.01 (ETS 300 582): "European digital cellular telecommunication system (Phase 2); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[104] GSM 07.02 (ETS 300 583): "European digital cellular telecommunication system (Phase 2); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[105] GSM 07.03 (ETS 300 584): "European digital cellular telecommunication system (Phase 2); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[106] GSM 08.04 (ETS 300 588): "European digital cellular telecommunication system (Phase 1); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface: Layer 1 specification".

[107] GSM 08.06 (ETS 300 589): "European digital cellular telecommunication system (Phase 2); Signalling transport mechanism specification for the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[108] GSM 08.08 (ETS 300 590): "European digital cellular telecommunication system (Phase 2); Mobile Switching Centre - Base Station System (MSC - BSS) interface: Layer 3 specification".

[109] GSM 08.20 (ETS 300 591): "European digital cellular telecommunication system (Phase 2); Rate adaption on the Base Station System -:Mobile-services Switching Centre (BSS - MSC) interface".

[110] GSM 09.04 (ETS 300 601): "European digital cellular telecommunication system (Phase 2); Interworking between the Public Land Mobile Network (PLMN) and the Circuit Switched Public Data Network (CSPDN)".

[111] GSM 09.05 (ETS 300 602): "European digital cellular telecommunication system (Phase 2); Interworking between the Public Land Mobile Network (PLMN) and the Packet Switched Public Data Network (PSPDN) for Packet Assembly/Disassembly facility (PAD) access".

[112] GSM 09.06 (ETS 300 603): "European digital cellular telecommunication system (Phase 2); Interworking between a Public Land Mobile Network (PLMN) and a Packet Switched Public Data Network/Integrated Services Digital Network (PSPDN/ISDN) for the support of packet switched data transmission services".

[113] GSM 09.07 (ETS 300 604): "European digital cellular telecommunication system (Phase 2); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[114] CCITT Recommendation I.460: "Multiplexing, rate adaption and support of existing interfaces".

[115] CCITT Recommendation V.110: "Support of data terminal equipments (DTEs) with V-Series interfaces by an integrated services digital network".

[116] CCITT Recommendation V.21: "300 bits per second duplex modem standardised for use in the general switched telephone network".

[117] CCITT Recommendation V.22: "1200 bits per second duplex modem standardised for use in the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[118] CCITT Recommendation V.22bis: "2400 bits per second duplex modem using the frequency division technique standardised for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[119] CCITT Recommendation V.23: "600/1200-band modem standardised for use in the general switched telephone network".

[120] CCITT Recommendation V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[121] CCITT Recommendation V.25: "Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls".

[122] CCITT Recommendation V.25bis: "Automatic calling and/or answering equipment on the general switched telephone network (GSTN) using the 100-series interchange circuits".

[123] CCITT Recommendation V.26bis: "2400/1200 bits per second modem standardised for use in the general switched telephone network".

[124] CCITT Recommendation V.26ter: "2400 bits per second duplex modem using the echo cancellation technique standardised for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[125] CCITT Recommendation V.27ter: "4800/2400 bits per second modem standardised for use in the general switched telephone network".

[126] CCITT Recommendation V.28: "Electrical characteristics for unbalanced double-current interchange circuits".

[127] CCITT Recommendation V.29: "9600 bits per second modem standardised for use on point-to-point 4-wire leased telephone-type circuits".

[128] CCITT Recommendation V.32: "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".

[129] CCITT Recommendation V.32bis: "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".

[130] CCITT Recommendation V.42bis: “Data Compression for Data Circuit Terminating Equipment (DCE) using Error Correction Procedures”.

[131] CCITT Recommendation X.21: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for synchronous operation on public data networks".

[132] CCITT Recommendation X.21bis: "Use on public data networks of data terminal equipment (DTE) which is designed for interfacing to synchronous V-series modems".

[133] CCITT Recommendation X.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) on public data networks".

[134] CCITT Recommendation X.25: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[135] CCITT Recommendation X.26: "Electrical characteristics for unbalanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications".

[136] CCITT Recommendation X.27: "Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications".

[137] CCITT Recommendation X.28: "DTE/DCE interface for a start-stop mode data terminal equipment accessing the packet assembly/disassembly facility (PAD) in a public data network situated in the same country".

[138] CCITT Recommendation X.29: "Procedures for the exchange of control information and user data between a packet assembly/disassembly (PAD) facility and a packet mode DTE or another PAD".

[139] CCITT Recommendation X.30: "Support of X.21, X.21 bis and X.20 bis based data terminal equipments (DTEs) by an integrated services digital network (ISDN)".

[140] CCITT Recommendation X.31: "Support of packet mode terminal equipment by an ISDN".

[141] CCITT Recommendation X.32: "Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and accessing a packet switched public data network through a public switched telephone network or an integrated services digital network or a circuit switched public data network".

[142] CCITT Recommendation X.75: "Packet-switched signalling system between public networks providing data transmission services".

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of this specification, the following definitions apply.

(DIGITAL) connection: A concatenation of (digital) transmission channels or (digital) telecommunication circuits, switching and other functional units set up to provide for the transfer of (digital) signals between two or more points in a telecommunication network to support a single communication.

GSM PLMN connection: A connection that is established through a GSM PLMN between specified GSM PLMN reference points.

GSM PLMN connection type: A description of a set of GSM PLMN connections which have the same characteristics.

3.2 Abbreviations

Abbreviations used in this specification are listed in GSM 01.04.

4 General considerations

Low layer capabilities are defined in TS GSM 02.01 and characterized in TS GSM 02.02 for Bearer Services and TS GSM 02.03 for Teleservices. Apart from the short message service, all Bearer Services and Teleservices are provided using low layer capabilities in the connection mode. Network capabilities to support the short message services are defined in TS GSM 03.40 and 04.11 for the point to point service, and in TS GSM 03.41 and 04.12 for the cell broadcast service.

4.1 Relationship between lower layer capabilities and radio traffic channels

The realization of low layer capabilities for the provision of telecommunication services will make use of a physical medium consisting of a traffic channel TCH (refer to TS GSM 04.03) except for the short message point to point which uses a dedicated control channel DCCH (see TS GSM 04.11) or the cell broadcast service which uses the CBCH (see TS GSM 04.12). Per connection one TCH will be used and no multiplexing of low data rate connections on one TCH is allowed.

Either a full rate or a half rate channel may be used depending on the requirements of the individual service. User data rates below or equal to 4800 bit/s may be supported either on a full rate channel or on a half rate channel. User data rate of 9600 bit/s is always supported on a full rate channel.

Technically every MS, regardless of whether it uses a half or a full rate TCH for speech transmission, should be able to use both half and full rate TCHs for data transmission and telematic services. However, particular designs of MS may only provide access to a limited set of services and therefore only use limited options.

For the alternate speech and data bearer service and the alternate speech and group 3 facsimile teleservice, when a full rate traffic channel is required for the speech or data portion of the service, a full rate traffic channel will be used for the duration of the call, see TS GSM 02.02.

For the speech followed by data Bearer services, when a full rate traffic channel is required for speech and a half-rate traffic channel is required for the data service, a full-rate traffic channel will be used for the speech phase of the call. When the data phase is entered, a half-rate channel may be used instead. See TS GSM 02.02.

Within a GSM PLMN, the transport of user data and access interface status information (if present) will use a rate adaptation method based on CCITT Recommendation V.110. For the access interface, the rate adaptation schemes used are referenced in the TS GSM 07-series. On the radio path, the rate adaptation leads to rates of 12.0, 6.0 and 3.6 kbit/s (seeTS GSM 04.21). At the BSS to MSC interface, the rate adaptation scheme used is described in TS GSM 08.20.

Protection of information from errors on the radio path (i.e. between MS and BSS) will be implemented by use of FEC techniques (see TS GSM 05.03).

4.2 Transparent and non-transparent lower layer capabilities

Two classes of low layer capabilities have been identified (see TS GSM 02.02 and TS GSM 02.03):

- a transparent class which is characterized by constant throughput, constant transit delay and variable error rate.

- a non-transparent class for which an ARQ technique is used (see TS GSM 04.22) on the radio path and extended to an appropriate interworking function. This class is characterized by improved error rate with variable transit delay and throughput. Data compression can optionally be used in combination of non-transparent lower layer capability, to increase the data rate on the DTE/DCE interface (or the equivalent interface depending on the TE type).

The considerations described above provide the basis for the definition of a limited set of connection types to be implemented by a GSM PLMN.

4.3 The GSM environment

4.3.1 The hand-over procedure

The GSM connection is heterogeneous and merges PCM links and radio path as a unit for the user.

One of the most specific characteristics of the mobile networks is the hand-over procedure (see TS GSM 03.09, 04.08, 05.08, 08.08) which result in a temporary break of the TCH, and consequently in a loss of information.

The GSM makes it possible to use one TCH slot for signalling (frame stealing for FACCH) in one TDMA frame resulting in a loss of information.

For the transparent data calls, this will result in a period of highly errored stream. For the non-transparent services, the use of the ARQ procedure (TS GSM 04.22) will overcome this problem.

After a hand-over, in case of loss of synchronization, the process to recover synchronization, as described in TS GSM 09.07 and 04.21 should apply. If data compression is used, V.42bis procedure should apply.

4.3.2 DTX procedure

For the full rate speech traffic channel, DTX function goes along with other procedures such as voice activity detection, generation of comfort noise,... and is described in TS GSM 06.31.

For the non-transparent traffic channels, DTX apply according to TS GSM 08.20.

5 Framework for the description of connection types

5.1 Introduction

A GSM PLMN provides a set of network capabilities which enable telecommunication services to be offered to a user.

A GSM PLMN connection is a connection established between GSM PLMN reference points. A GSM PLMN connection type is a way of referring to and describing a GSM PLMN connection. Thus a GSM PLMN connection is a physical or a logical realization of a GSM PLMN connection type. Each GSM PLMN connection can be characterized as belonging to a connection type.

Figure 1 illustrates the concepts (see also Figure 1 of TS GSM 02.01).

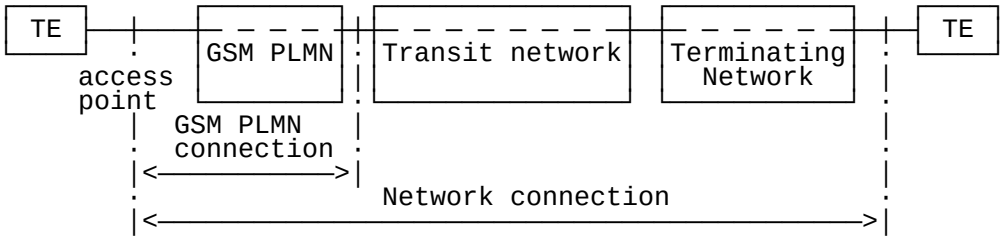


Figure 1: Framework for the description of GSM PLMN connections

5.2 Purpose of GSM PLMN connection types

The definition of a set of GSM PLMN connection types provides the necessary input to identify the network capabilities of a GSM PLMN. Other key requirements of a GSM PLMN are contained in other GSM specifications, in particular TS GSM 03.01, 04.01 and 04.02. In addition to describing network capabilities of a GSM PLMN, the identification of connection types facilitates the specification of network-to-network interfaces. It may also assist in the allocation of network performance parameters.

NOTE: The user specifies only the telecommunication service required while the GSM PLMN allocates the resources to set up a connection of the specific type as necessary to support the requested service. It is further noted that, for certain service offerings, additional network functions, e.g. additional lower layer functions and/or higher layer functions, may be required (see Figure 2).

NOTE: The user specifies only the telecommunication service required while the GSM PLMN allocates the resources to set up a connection of the specific type as necessary to support the requested service. It is further noted that, for certain service offerings, additional network functions, e.g. additional lower layer functions and/or higher layer functions, may be required (see Figure 2).

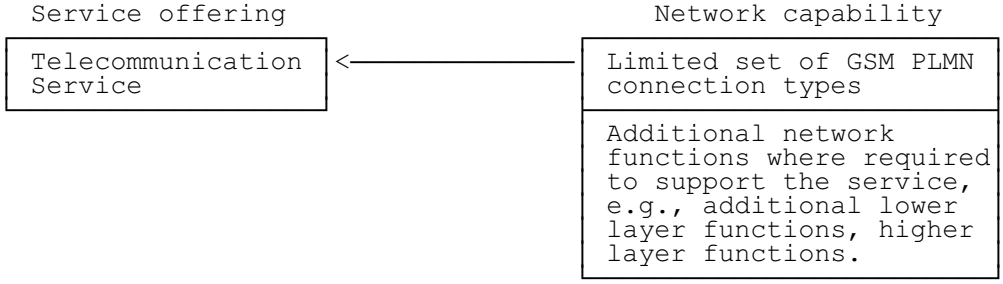


Figure 2: The role of network capabilities in supporting service offerings

5.3 Functions associated with a GSM PLMN connection

Any GSM PLMN connection involves an association of functions to support telecommunication services as shown in Figure 3. Three sets of functions are required.

i) Connection means - including transmission and switching.

ii) Control functions and protocols - including signalling, flow/congestion control and routing functions.

iii) Operations and management functions - including network management and maintenance functions.

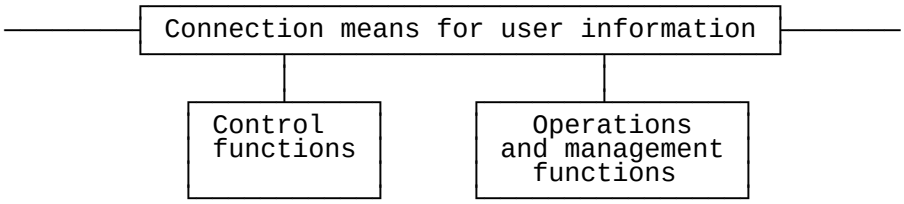


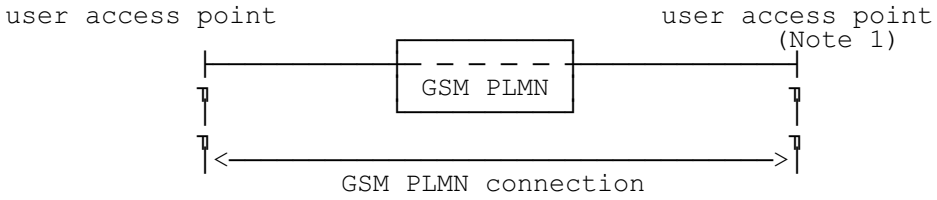
Figure 3: Functional description

5.4 Applications of GSM PLMN connection types

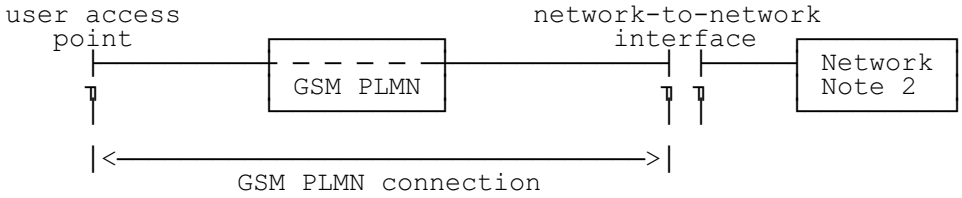
The following situations to which GSM PLMN connection types apply (see Figure 4) may arise:

- Between two GSM PLMN user access points (refer to TS GSM 02.01 and 04.02): see figure 4a.
- Between a GSM PLMN user access point and a network-to-network interface: see figure 4b.
- Between a GSM PLMN user access point and an interface to a specialized resource within the GSM PLMN: see figure 4c.
- Between a GSM PLMN user access point and an interface to a specialized resource outside the GSM PLMN: see figure 4d.

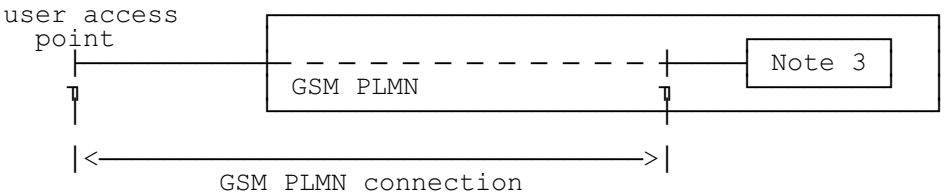
a)



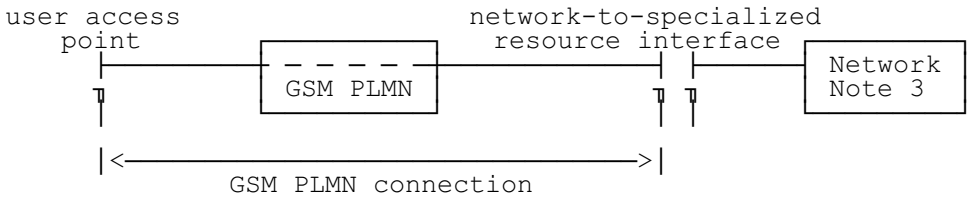
b)



c)



d)



NOTE 1: See TS GSM 02.01.

NOTE 2: Network means here any fixed network as described in TS GSM 02.01.

NOTE 3: The box represents a specialized resource. Its use originates from a service request. Further study is required to give some examples.

Figure 4: Applications of GSM PLMN connection types

5.5 GSM PLMN connection involving several networks

A GSM PLMN connection may comprise a number of tandem network connections. Figure 5 shows an example in which each end network is a GSM PLMN. The intermediate network(s) must offer the appropriate network capabilities for the service provided by the (overall) GSM PLMN connection. In (overall) GSM PLMN connections involving several networks, each network provides a part of the connection and may be categorized by different attribute values.

The IWF/MSC can interwork with different type of networks, e.g.:

- analogue (A),
- digital circuit (D) with V.110/X.31 in band protocol,
- packet (P) with X.25 in band protocol.

Examples of such networks are:

- GSM (D),
- PSPDN (P),
- ISDN (A, D, P),
- PSTN (A).

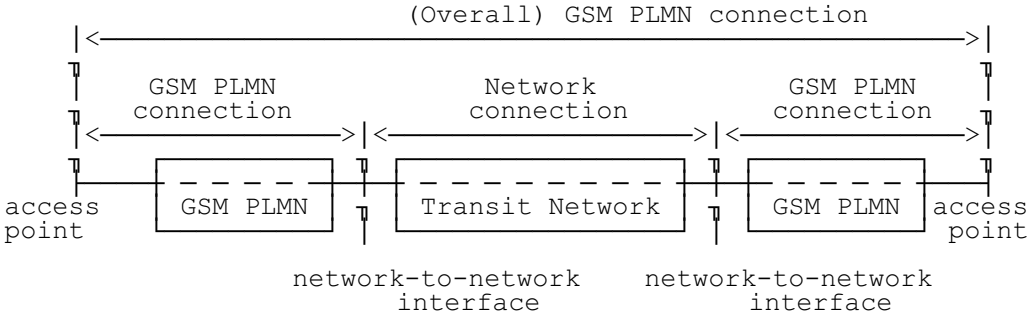


Figure 5: Example of a GSM PLMN connection involving several networks

6 GSM PLMN connection types

6.1 Description of GSM PLMN connection types

The characterization of GSM PLMN connection types is done by using a set of attributes. A GSM PLMN connection type attribute is a specific characteristic of a GSM PLMN connection type whose values distinguish it from another GSM PLMN connection type. Particular values are assigned to each attribute when a given GSM PLMN connection type is described and specified.

A list of definitions of attributes and values is contained in the annex A to this specification.

A GSM PLMN connection type is partitioned into connection elements. This partitioning is based on the two most critical transitions of a connection, firstly, the change of signalling system, secondly, the type of transmission system. In a GSM PLMN, the change in signalling and transmission between the radio interface and the A interface leads to two connection elements, the radio interface connection element and the A interface connection element. Section 4.3 describes the relationship between the attributes values of connection elements and connection types.

To complete the description of GSM PLMN connection types, the definition of functions within the different entities of a GSM PLMN which are involved in the realization of a GSM PLMN Connection is needed. These functions will be used in section 4.4 to describe the limited set of GSM PLMN connection types.

The following functions have been identified:

- Rate adaptation functions,
- The radio link protocol function,
- The forward error correction function,
- The Layer 2 relay function.

6.1.1 Rate adaptation

The RA0 rate adaptation is only used with asynchronous interfaces. Incoming asynchronous data is padded by the addition of stop elements to fit the nearest channel defined by (2 to the power n) times 600 bit/s. Thus both 75 and 300 bit/s user data signalling rate shall be adapted to a synchronous 600 bit/s stream. This function is described in GSM 04.21.

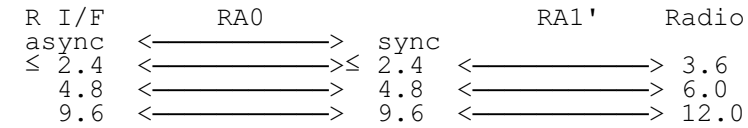
The adaptation to intermediate rate function (RA1) is a rate adaptation function which takes either the output of an RA0 function or synchronous user data, and produces an output stream at 8 or 16 kbit/s by bit repetition and frame addition. This function is described in GSM 04.21.

The adaptation of intermediate rates to 64 kbit/s (RA2) performs the final conversion from the intermediate rates generated by an RA1 function to 64 kbit/s.

The radio interface intermediate rate adaptation function (RA1') is in the case of transparent data transmission a variant of the RA1 function which adapts the user data rate or the output of the RA0 function to one of the following data rates: 3.6, 6.0 or 12.0 kbit/s over the radio path. For the non-transparent case, the RA1' function provides direct access to the 12.0 or 6.0 kbit/s data rates by allowing the V.110 frame status bits to be used as additional data bits. This function is described in GSM 04.21 and 08.20.

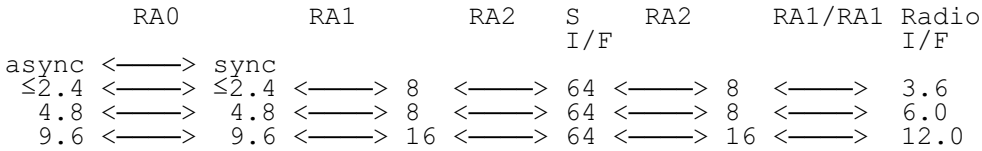
The rate adaptation functions for the various user data rates are summarized in Tables 1 to 3.

Table 1: Rate adaptation functions for the support of TE2 in the transparent case.



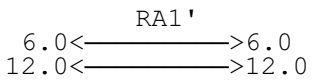
NOTE: In the case of synchronous data transmission, the RA0 is not present.

Table 2: Rate adaptation functions for the support of TE1/TA in the transparent case.



NOTE: In the case of synchronous data transmission, the RA0 is not present.

Table 3: RA1' function in the non-transparent case.



6.1.2 Radio Link Protocol

The Radio Link Protocol (RLP) is a layer 2 LAPB based protocol which performs grouping of user data for the purpose of implementing error control and retransmission mechanisms in the case of non-transparent low layer capabilities. The RLP layer is in charge of the transmission of the data compression parameters to the peer RLP entity and to the L2R layer, when those parameters have to be negotiated. The function that realizes the implementation of the protocol (described in GSM 04.22) takes place at both ends of the GSM connection in the MT and the IWF/MSC.

6.1.3 Layer 2 Relay function

The Layer 2 Relay function (L2R) performs protocol conversion between the user data structure (e.g. characters or X.25 Layer 2 frames) and a structure more adapted to the radio link protocol. This function is described in the relevant GSM 07-series specifications.

The L2R function includes the data compression function.

6.1.4 Resources allocated by the GSM network

Part of the GSM connection concerns the resources allocated by the GSM network on the basis of the attribute values of the connection elements.

For the speech calls, the GSM codec is allocated.

For data calls, resources are provided at the IWF/MSC such as:

- V.110 based rate adaptation (GSM 04.21, 08.20),
- filtering of status bits (GSM 07.01),
- RLP for non-transparent services (GSM 04.22).
- Data compression (GSM 04.22, 07.02).

These are sufficient for data services such as:

- asynchronous circuit (bearer service series 20), used with unrestricted digital information transfer capability,
- synchronous circuit (bearer service series 30), used with unrestricted digital information transfer capability when interworking with circuit switched digital networks.

In addition to the above listed resources, further resources are allocated in the other cases:

- modems for asynchronous circuit (bearer service series 20) or synchronous circuit (bearer service series 30) used with 3.1 kHz information transfer capability,
- fax adaptor for the fax group 3 (teleservice series 60),
- PAD for asynchronous PAD (bearer service series 40), Packet handler and flag stuffing for synchronous packet (bearer service series 50) used with unrestricted digital information transfer capability,
- flag stuffing for synchronous packet using bearer service series 30 with unrestricted digital information transfer capability when interworking with packet switched networks.

6.2 GSM PLMN connection elements

The radio interface connection element is the portion of the connection spanning from the Mobile Termination to an appropriate internal reference point within the Base Station System.

The A interface connection element is the portion of the connection from the above internal reference point within the base station to an appropriate internal reference point within the interworking function (IWF) of the MSC.

By using connection elements and attributes which have a layered nature the construction of a connection type is more easily viewed. The use of different values for the same attribute allows a greater degree of description and flexibility.

6.3 Rules of association for the attribute values of connection elements and connection types

This section describes the relationship between the attribute values of connection elements and connection types. For each attribute the various possible values recommended are listed. The definitions of the attributes and attribute values are contained in the annex A. In addition to the (possible) attribute values applicable to the connection elements, an association law is given (where appropriate) for each attribute to show how the value of the attribute for the overall connection type is obtained from the values of the attribute applicable to the connection elements.

6.3.1 Information transfer mode

Attribute values for connection elements:

Circuit

Attribute values for overall connection type:

Circuit

Association Law:

Circuit

6.3.2 Information transfer rate (kbit/s)

Attribute values for connection elements:

3.6 or 6.0 or 12.0 or 13.0 or 64

Attribute values for overall connection type:

3.6 or 6.0 or 12.0 or 13.0 or 64

Association Law:

The value for the overall connection type will be equal to the lowest value of any of its connection elements.

6.3.3 Information transfer susceptance

Attribute values for connection elements:

Speech processing functions (e.g. GSM Speech Coding/A Law conversion, Discontinuous Transmission) and/or Echo suppression functions and/or Multiple satellite hops or null.

Attribute values for overall connection types:

Unrestricted Digital Information or Speech

Association Law:

For an overall connection type to have the value Unrestricted digital no connection element may contain speech processing functions or echo suppression functions. Connection elements containing speech processing devices having the flexibility to change operation between speech and unrestricted digital would on the other hand be allowed to be part of a number of different connection types.

For an overall connection type to have the value speech it must contain GSM Speech Coding/A Law conversion equipment and echo suppression functions when appropriate.

6.3.4 Establishment of connection

Attribute values for connection elements:

Demand

Attribute values for overall connection type:

Demand

Association Law:

If any of the connection elements are Demand, then the overall connection type is Demand.

6.3.5 Symmetry

Attribute values for connection elements:

Bidirectional Symmetric

Attribute values for overall connection type:

Bidirectional Symmetric

Association Law:

The overall symmetry can only be generated from the connection elements by analysis of the connection element values in the context of the architecture of the connection.

6.3.6 Connection configuration Topology

Attribute values for connection elements:

Point to point

Attribute values for the overall connection type:

Not applicable

Association Law:

Not applicable

6.3.7 Structure

Attribute values for connection elements:

Unstructured or Service Data Unit Integrity

Attribute values for the overall connection type:

As per values for connection elements.

Association Law:

Unspecified.

6.3.8 Channels

6.3.8.1 Information channel (rate)

Attribute values for connection elements:

Radio interface connection element: Full-rate TCH or Half-rate TCH

A interface connection element: 64 kbit/s

Attribute values for the overall connection type:

Not applicable

6.3.8.2 Signalling channel (rate)

Attribute values for connection elements:

Radio interface connection element: Dm

A interface connection element: Common channel signalling system (64 kbit/s)

Attribute values for the overall connection type:

Not applicable

6.3.9 Connection control protocol

Attribute values for connection elements:

Radio interface connection element:
- Layer 1: GSM 04.03 and GSM 05-series
- Layer 2: GSM 04.05 and 04.06
- Layer 3: GSM 04.07 and 04.08, 04.11

A interface connection element:
- Layer 1: GSM 08.04
- Layer 2: GSM 08.06
- Layer 3: GSM 04.07, 04.08 and 08.08

Attribute values for the overall connection type:

Not applicable

6.3.10 Information transfer coding/protocol

Attribute values for connection elements:

Radio interface connection elements:
- Layer 1: GSM 04.21, GSM 05-series and 06-series
- Layer 2: GSM 04.06, 04.22 and GSM 07.02 or GSM 04.22 and GSM 07.03 or transparent
- Layer 3: Transparent, GSM 04.11

A interface connection element:
- Layer 1: GSM 08.04 and GSM 08.20
- Layer 2: GSM 04.22 and GSM 07.02 or GSM 04.22 and GSM 07.03 or transparent
- Layer 3: Transparent

Attribute values for the overall connection type:

Not applicable

6.3.11 Further attributes and attribute values

This section has outlined the relationships between those attributes values presently existing, the possibility for new values being added remains.

Table 4 summarizes the attributes values for GSM PLMN connection elements.

Table 4: Values for attributes for GSM PLMN connection elements

	Attributes	Values for attributes	
		Radio interface connection element	A interface connection element
1	Information Transfer Mode	Circuit	Circuit
2	Information Transfer Rate Layer 1	 3.6 or 6.0 or 12.0 or 13	 64
3	Information Transfer Susceptance	Speech processing equipment, Echo suppression equipment, Null	Speech processing equipment, Echo suppression equipment, Null
4	Establishment of Connection	Demand	Demand
5	Symmetry	Bidirectional symmetric Bidirectional asymmetric	Bidirectional symmetric Bidirectional asymmetric
6	Connection Configuration Topology	 Point to point	 Point to point
7	Structure	Unstructured SDU integrity	Unstructured SDU integrity
8	Channel Rate Information Channel Signalling Channel	 Tch fullrate or halfrate Dm	 64 kbit/s Common channel signalling system
9	Connection Control Protocol Layer 1 Layer 2 Layer 3	 GSM 04.03 and 05 series GSM 04.05 and 04.06 GSM 04.07, 04.08, 04.11	 GSM 08.04 GSM 08.06 GSM 04.07, 04.08, 08.08
10	Information Transfer Coding/Protocol Layer 1 Layer 2 Layer 3	 GSM 04.21 05 and 06 series GSM 04.22 and 07.02 or 04.22 and 07.03 04.06 or transparent Transparent, 04.11	 GSM 08.04 and 08.20 GSM 04.22 and 07.02 .. or 04.22 and 07.03 or transparent Transparent

6.4 Limited set of GSM PLMN connection types

From the two connection elements defined in section 4.2, the list of attributes and their possible values given in section 4.3, and from the service requirements defined in TS GSM 02.02 and 02.03, a limited set of GSM PLMN connection types have been identified (see also Table 5 and Table 6 for the relationship between connection elements and telecommunication services).

Figure 6 gives the information transfer protocol models for the identified set of GSM PLMN connection types. The S bits correspond to status bits and the D bits to data bits (TS GSM 04.21); S* indicates that S bits are used only when 3.1 kHz audio ex PLMN. D' bits corresponds to user bits passed in the place of status bits in the non transparent case Moreover, it should be noted that the RLP rate of 6 and 12 kbit/s correspond to the 8 and 16 Kbit/s intermediate rate in the transparent case.

Protocol Model 1 is the model for asynchronous data transmission in the transparent mode.

Protocol Model 2 is the model for synchronous data transmission in the transparent mode.

Protocol Model 3 is the model for character 'asynchronous' mode data transmission in the non-transparent mode. In this case, L2RCOP represents the protocol used between the Layer 2 Relay functions (L2R) to convey characters between the MS and the IWF (see GSM 07.02). The data compression function is located in the L2R COP function

Protocol Model 4 is the model for synchronous data transmission using the CCITT Recommendation X.25 PSPDN access protocol in the non-transparent mode. In this case, L2RBOP represents the protocol used between the Layer 2 Relay functions (L2R) to convey the LAP B information between the MS and the IWF (see GSM 07.03).

In all the above models, the a and b variants indicate alternative access arrangements at the MS, i.e. access at the S interface or at the R interface. The c variant indicates a further alternative access arrangement where rate adaptation at the S interface is performed by flag stuffing as defined in CCITT Recommendation X.31.

Protocol Model 5 is the model for the transparent support of group 3 facsimile transmission.

Protocol Model 6 is the model for speech transmission. As in models 1-4, the a and b variants indicate alternative access arrangements at the MS, i.e. access at the S interface or direct access of the telephony teleservice.

Protocol model 7 is the model for the non-transparent support of group 3 facsimile transmission.

For all the models, only the minimum functionality of the IWF is shown. Additional functions will be required for various interworking situations. These additional functions are described in specifications GSM 09.04, GSM 09.05, GSM 09.06 and GSM 09.07.

It should be noted that, in Figure 6, the representation of the transcoding and rate adaptation from the intermediate rate on the radio interface to the 64 kbit/s rate required by the MSC is not intended to indicate a particular implementation. The annex B to GSM 03.10 identifies alternative arrangements.

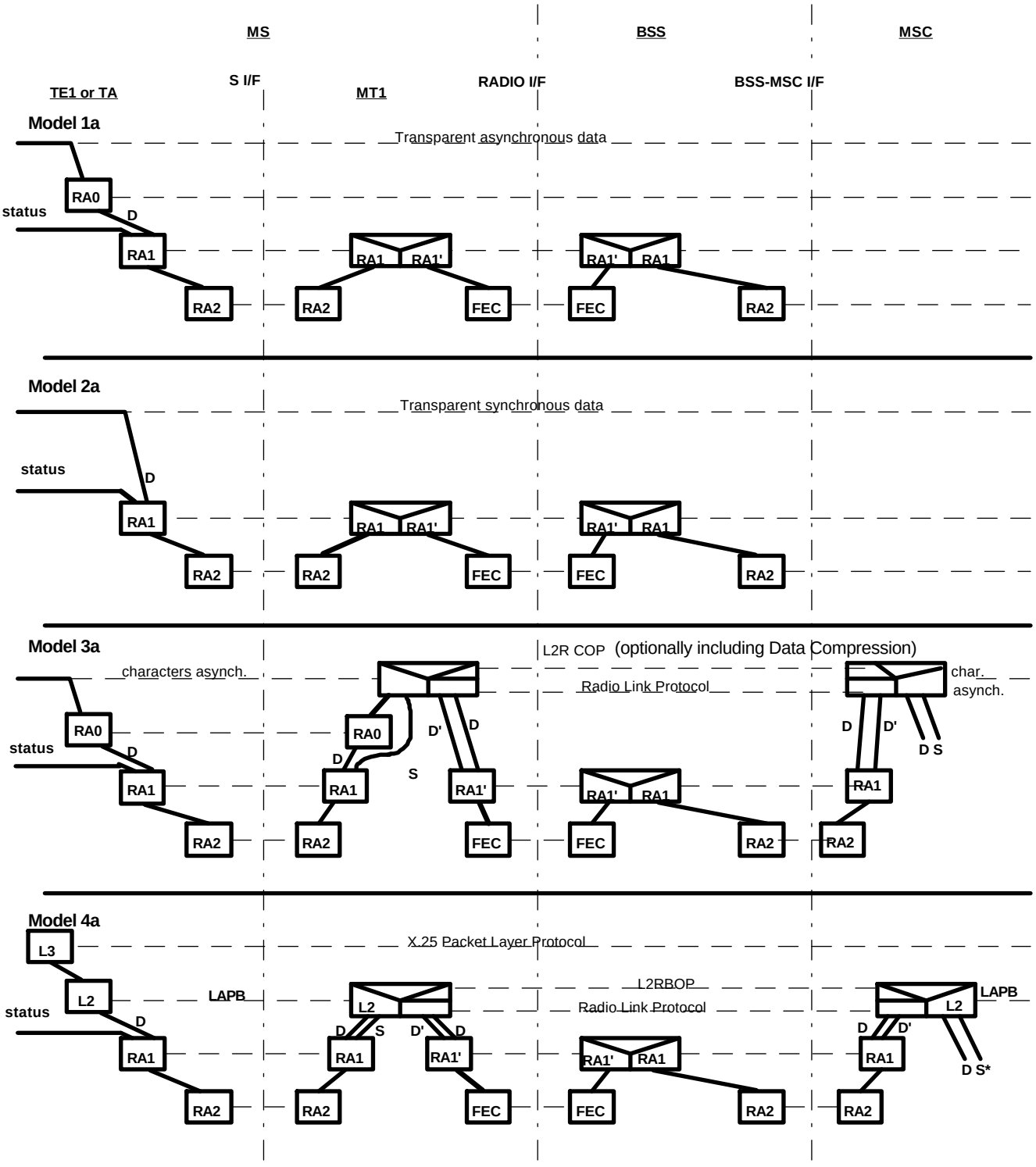


Figure 6 : Information transfer protocol models for GSM PLMN connections

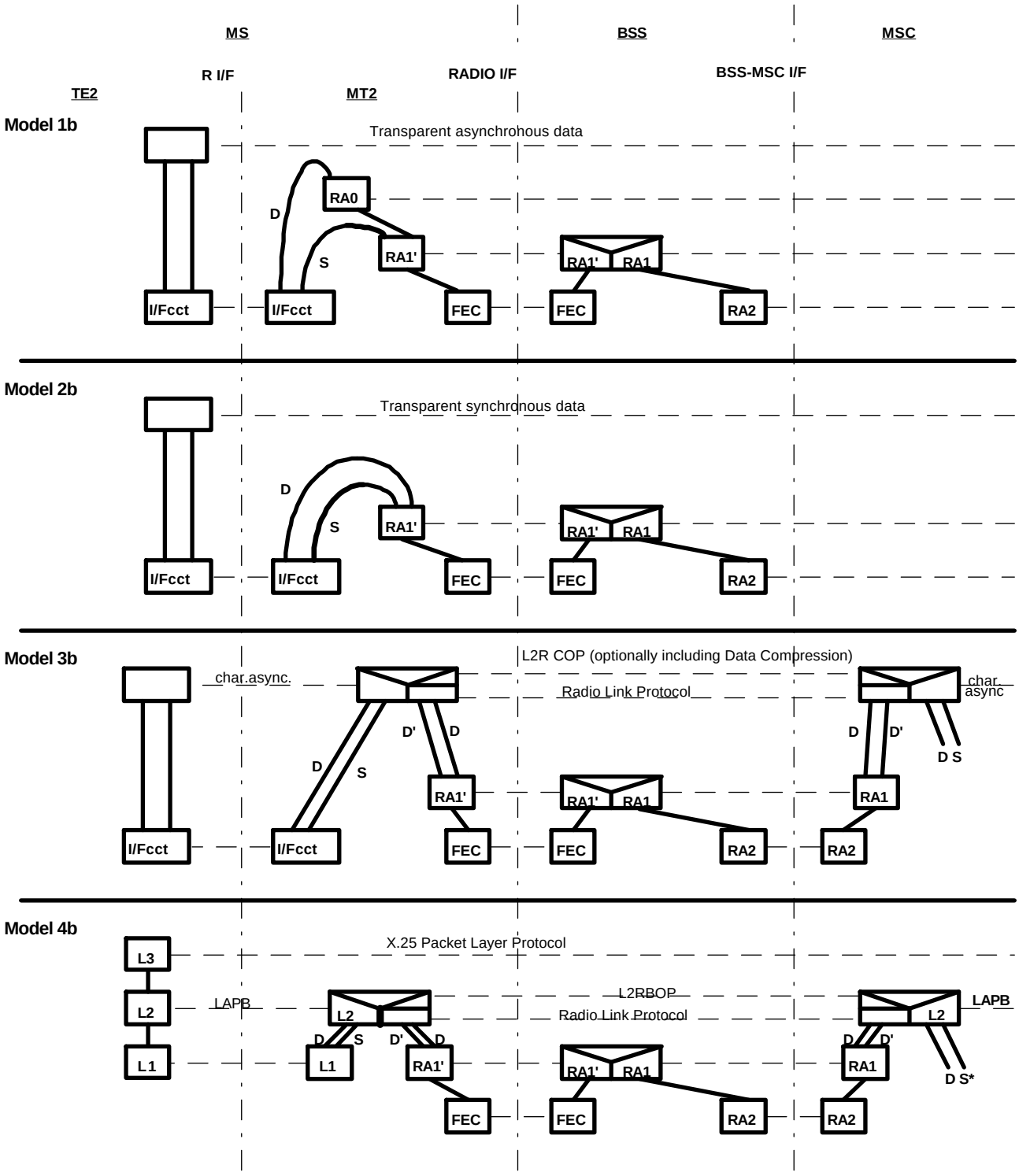
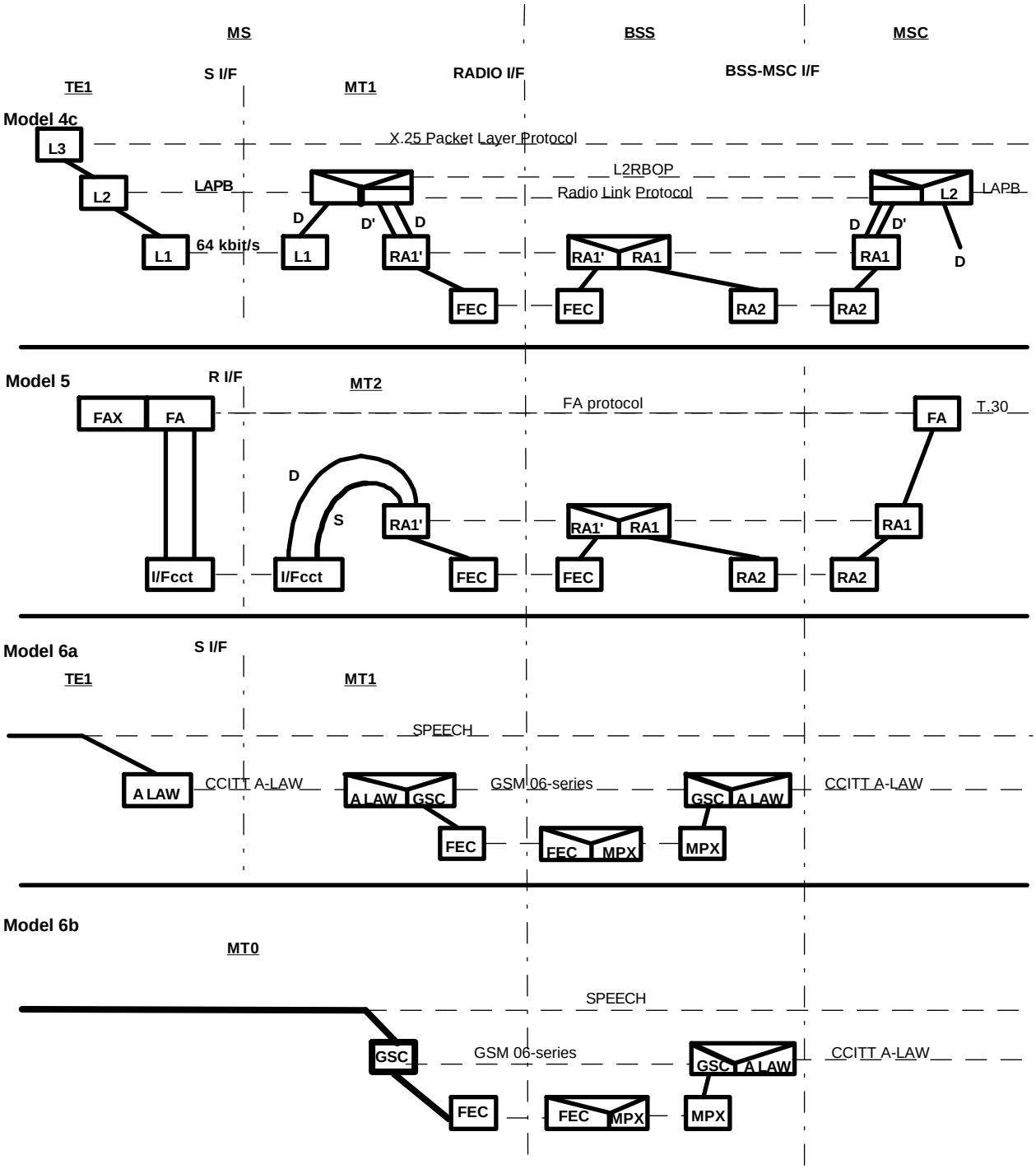


Figure 6 cont'd



Legend:

FA = Fax Adaptor

GSC = GSM speech codec

FEC = Forward Error Correction

MPX = Multiplex/Demultiplex

Figure 6 cont'd

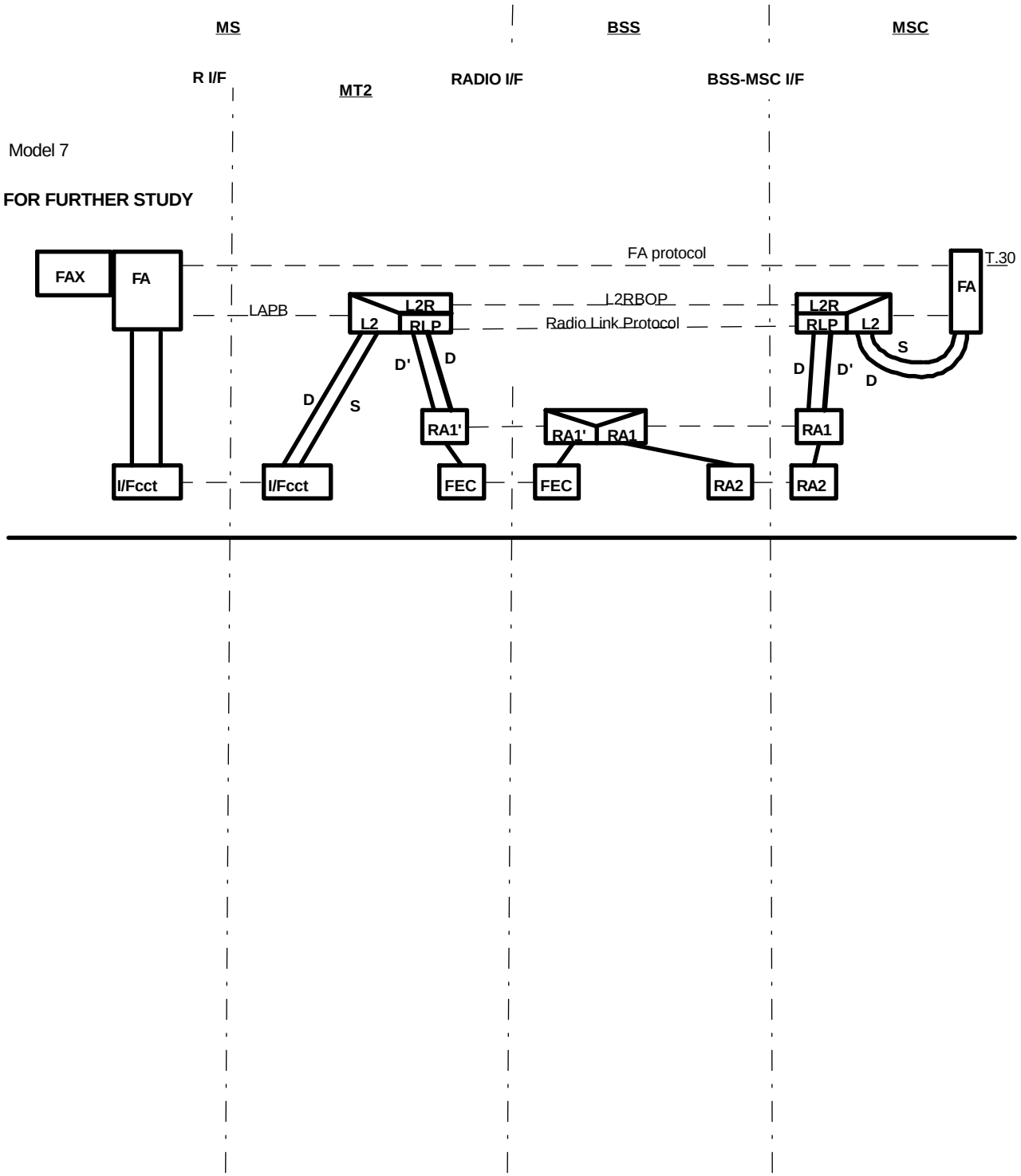


Figure 6 cont'd

7 Relationship between Telecommunication services and connection types

7.1 General

Given a request for a telecommunication service at the initiation of a call, the GSM PLMN must establish a connection of a connection type that supports the attributes of the service requested. This establishment of a connection is effected at the time of call set up.

It should be noted that GSM PLMN connection types represent the technical capabilities of a GSM PLMN and provide a basis for the definition of performance and interworking with other networks. Telecommunication services supported by a GSM PLMN are the packages offered to customers and the definition of their attributes is the means to standardize the service offerings in all GSM PLMNs.

Quality of service and commercial attributes are relevant to telecommunication services whereas connection types are characterized by network performance, network operations and maintenance attributes.

7.2 Relationship between Bearer services and connection types

Table 5 shows the relationship between Bearer services and GSM PLMN connection types. In table 5, the connection elements for each connection type related to a Bearer service are shown.

Dominant attributes of the connection elements, such as information transfer mode, information transfer rate, information transfer capability and structure are indicated. The type of radio traffic channel used is also shown (half rate and full rate).

7.3 Relationship between Teleservices and connection types

Table 6 shows the relationship between teleservices and connection type elements, for those teleservices having a GSM PLMN connection type which does not correspond to the GSM PLMN connection type of a bearer service. As in Table 5 / GSM 03.10, dominant attributes of the connection elements and the type of radio traffic channel are shown.

7.4 Network capability to support in-call modification

Specifications GSM 02.02 and 02.03 identify a particular need for a GSM PLMN to support the Alternate speech/data (3.1kHz audio ex PLMN), Alternate speech and group 3 facsimile, and Speech followed by data (3.1 kHz audio).

These services allow the use of in-call modification to change the mode of service. The network capability to support in-call modification is described in GSM 04.08. An in-call modification of the service mode is not possible for other services.

7.5 Network capability to support channel mode modification

Specification GSM 03.45 (Technical Realization of the Group 3 Facsimile Teleservice) identifies a need for a GSM PLMN to support channel mode modification within the facsimile phase of the alternate speech and facsimile group 3 service. The network capability to support channel modification is described in GSM 04.08. Channel mode modification is not possible for other services. A channel mode modification results in a change of connection element over the radio interface with resultant change in access at the mobile station.

Table 5: Relationship between Bearer services and GSM PLMN Connection elements

Connection description	**Bearer service user data rate**	**Radio interface connection element**	**Intermediate rate RA1 to RA2 at the BSS-MSC interface**	**BSS-MSC connection element**	**Protocol model in fig. 6**
Circuit mode unstructured with unrestricted digital capability transparent	Data circuit duplex async 9600 bit/s Data circuit duplex sync 9600 bit/s	cct mode unstructured unrestricted 12 kbit/s on full rate channel	16 kbit/s	cct mode unstructured unrestricted 64 kbits/s	1 2
	Data circuit duplex async 4800 bit/s Data circuit duplex sync 4800 bit/s	cct mode unstructured unrestricted 6 kbit/s on full rate channel and half rate channel	8 kbit/s	cct mode unstructured unrestricted 64 kbits/s	1 2
	Data circuit duplex async 300 Data circuit duplex async 1200 Data circuit duplex async 1200/75 Data circuit duplex async 2400 Data circuit duplex sync 1200 Data circuit duplex sync 2400	cct mode unstructured unrestricted 3.6 kbit/s on full rate channel and half rate channel	8 kbit/s	cct mode unstructured unrestricted 64 kbits/s	1 1 1 1 2 2
Circuit mode unstructured with unrestricted digital capability non transparent	Data circuit duplex async 9600 bit/s	cct mode SDU unrestricted 12 kbit/s on full rate channel	16 kbit/s	cct mode unstructured unrestricted 64 kbits/s	3
	Data circuit duplex async 4800 bit/s	cct mode SDU unrestricted full rate channel, 12 kbit/s or half rate channel, 6 kbit/s	16 kbit/s FR 8 kbit/s HR	cct mode unstructured unrestricted 64 kbits/s	3
	Data circuit duplex async 300 Data circuit duplex async 1200 Data circuit duplex async 1200/75 Data circuit duplex async 2400	cct mode SDU unrestricted full rate channel, 12 kbit/s or half rate channel, 6 kbit/s	16 kbit/s FR 8 kbit/s HR	cct mode unstructured unrestricted 64 kbits/s	3 3 3 3

NA: Not Applicable

Table 5 (cont'd)

Connection description	**Bearer service user data rate**	**Radio interface connection element**	**Intermetiate rate RA1 to RA2 at the BSS-MSC interface**	**BSS-MSC connection element**	**Protocol model in fig. 6**
Circuit mode unstructured with 3.1 kHz audio ex PLMN transparent	Data circuit duplex async 9.6 kbit/s sync 9.6 kbit/s	cct mode unstructured unrestricted 12 kbit/s full rate channel	16 kbit/s		
	Data circuit duplex async 4.8 kbit/s sync 4.8 kbit/s	cct mode unstructured unrestricted 6 kbit/s full and half rate channel	8 kbit/s	cct mode unstructured unrestricted 64 kbit/s	1 for asynch. 2 for synch.
	Data circuit duplex async ≤ 2400 sync ≤ 2400	cct mode unstructured unrestricted 3.6 kbit/s full and half rate channel	16 kbit/s		
Circuit mode unstructured with 3.1 kHz audio ex PLMN non transparent	Data circuit duplex async 9.6 kbit/s sync 9.6 kbit/s	cct mode SDU unrestricted 12 kbit/s full rate channel	16 kbit/s		
	Data circuit duplex async 4.8 kbit/s sync 4.8 kbit/s	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s	16 kbit/s FR 8 kbit/s HR	cct mode unstructured unrestricted 64 kbit/s	3 for asynch. 4 for synch
	Data circuit duplex async ≤ 2400 sync ≤ 2400	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s			

Table 5 (cont'd)

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate RA1 to RA2 at the BSS-MSC interface	BSS-MSC connection element	Protocol model in fig. 6
Pad access transparent	PAD access circuit async 300 PAD access circuit async 1200 PAD access circuit async 1200/75 PAD access circuit async 2400	cct mode unstructured unrestricted 3.6 kbit/s on full rate channel and half rate channel	8 kbit/s	cct mode unstructured unrestricted 64 kbit/s	1 1 1 1
	PAD access circuit async 4800	cct mode unstructured unrestricted 6 kbit/s on half rate channel and full rate channel			1
	PAD access circuit async 9600	cct mode unstructured unrestricted 12 kbit/s on full rate channel	16 kbit/s		1
Pad access non transparent	PAD access circuit async 300 PAD access circuit async 1200 PAD access circuit async 1200/75 PAD access circuit async 2400	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s	16 kbit/s FR 8 kbit/s HR	cct mode unstructured unrestricted 64 kbit/s	3 3 3 3
	PAD access circuit async 4800	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s			3
	PAD access circuit async 9600	cct mode SDU unrestricted 12 kbit/s on full rate channel	16 kbit/s		3

Table 5 (cont'd)

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate RA1 to RA2 at the BSS-MSC interface	BSS-MSC connection element	Protocol model in fig. 6
Packet services, dedicated access, non transparent	Data packet duplex sync 2400	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s	16 kbit/s FR 8 kbit/s HR	cct mode unstructured unrestricted 64 kbit/s	4
	Data packet duplex sync 4800	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s			4
	Data packet duplex sync 9600	cct mode SDU unrestricted 12 kbit/s on full rate channel	16 kbit/s		4

Table 5 (cont'd)

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate RA1 to RA2 at the BSS-MSC interface	BSS-MSC connection element	Protocol model in fig. 6
packet services basic access transparent	Data circuit duplex sync 9600 bit/s	cct mode unstructured unrestricted 12 kbit/s on full rate channel	16 kbit/s	cct mode unstructured unrestricted 64 kbit/s	2
	Data circuit duplex sync 4800 bit/s	cct mode unstructured unrestricted 6 kbit/s on full rate channel and half rate channel	8 kbit/s	cct mode unstructured unrestricted 64 kbit/s	2
	Data circuit duplex sync 2400 bit/s	cct mode unstructured unrestricted 3.6 kbit/s on full rate Channel and half rate channel	8 kbit/s	cct mode unstructured unrestricted 64 kbit/s	2
packet services basic access non transparent	Data circuit duplex sync 9600 bit/s	cct mode SDU unrestricted 12 kbit/s on full rate channel	16 kbit/s	cct mode unstructured unrestricted 64 kbit/s	4
	Data circuit duplex sync 4800 bit/s	cct mode SDU unrestricted full rate channel, 12 kbit/s or half rate channel, 6 kbit/s	16 kbit/s FR 8 kbit/s HR	cct mode unstructured unrestricted 64 kbit/s	4
	Data circuit duplex sync 2400 bit/s	cct mode SDU unrestricted full rate channel, 12 kbit/s or half rate channel, 6 kbit/s	16 kbit/s FR 8 kbit/s HR	cct mode unstructured unrestricted 64 kbit/s	4

Table 5 (cont'd)

Connection description	**Bearer service user data rate**	**Radio interface connection element**	**Intermediate rate RA1 to RA2 at the BSS-MSC interface**	**BSS-MSC connection element**	**Protocol model in fig. 6**
Circuit mode unstructured with alternate speech and 3.1 Khz audio ex PLMN transparent	Alternate speech and data duplex async 9600	cct mode speech alternating with cct mode unstructured unrestricted 12 kbit/s on full rate channel	Speech NA 16 kbit/s	cct mode alternate speech and unstructured unrestricted 64 kbit/s	6 and 1
	Alternate speech and data duplex sync 9600				6 and 2
	Alternate speech and data duplex async 4800	cct mode speech alternating with cct mode unstructured unrestricted 6 kbit/s	Speech NA 8 kbit/s	cct mode alternate speech and unstructured unrestricted 64 kbit/s	6 and 1
	Alternate speech and data duplex sync 4800	on full rate channel or half rate channel			6 and 2
	Alternate speech and data duplex async ≤ 2400	cct mode speech alternating with cct mode unstructured unrestricted 3.6 kbit/s	Speech NA 8 kbit/s	cct mode alternate speech and unstructured unrestricted 64 kbit/s	6 and 3
	Alternate speech and data duplex sync ≤ 2400	on full rate channel or half rate channel			6 and 4
Circuit mode unstructured with alternate speech and 3.1 Khz audio ex PLMN non transparent	Alternate speech and data duplex async 9600	cct mode speech alternating with cct mode SDU unrestricted 12 kbit/s on full rate channel	Speech NA 16 kbit/s	cct mode alternate speech and unstructured unrestricted 64 kbit/s	6 and 3
	Alternate speech and data duplex async 4800	cct mode speech alternating with cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s	Speech NA 16 kbit/s FR 8 kbit/s HR	cct mode alternate speech and unstructured unrestricted 64 kbit/s	6 and 3
	Alternate speech and data duplex async ≤ 2400	cct mode speech alternating with cct mode SDU unrestricted full rate channel, 12 kbit/s or half rate channel, 6 kbit/s	Speech NA 16 kbit/s FR 8 kbit/s HR	cct mode alternate speech and unstructured unrestricted 64 kbit/s	6 and 3

Table 5 (cont'd)

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate RA1 to RA2 at the BSS-MSC interface	BSS-MSC connection element	Protocol model in fig. 6
Circuit mode unstructured with speech followed by 3.1 Khz audio ex PLMN transparent	Speech followed by 9.6 kbit/s data duplex async	cct mode speech followed by cct mode unstructured unrestricted 12 kbit/s on full rate channel	Speech NA 16 kbit/s	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s	6b then 1b
	Speech followed by 9.6 kbit/s data duplex sync				6b then 2b
	Speech followed by 4.8 kbit/s data duplex async	cct mode speech followed by cct mode unstructured unrestricted 6 kbit/s on full rate and half rate channel	Speech NA 8 kbit/s	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s	6b then 1b
	Speech followed by 4.8 kbit/s data duplex sync				6b then 2b
	Speech followed by ≤ 2.4 kbit/s data duplex async	cct mode speech followed by cct mode unstructured unrestricted 3.6 kbit/s on full rate and half rate channel	Speech NA 8 kbit/s	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s	6b then 1b
	Speech followed by ≤ 2.4 kbit/s data duplex sync				6b then 2b
Circuit mode unstructured with speech followed by 3.1 Khz audio ex PLMN non transparent	Speech followed by 9.6 kbit/s data duplex async	cct mode speech followed by cct mode SDU unrestricted 6 kbit/s on full rate and half rate channel	Speech NA 16 kbit/s	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s	6b then 3b
	Speech followed by 4.8 kbit/s data duplex async	cct mode speech followed by cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s	Speech NA 8 kbit/s HR 16 kbit/s FR	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s	6b then 3b
	Speech followed by ≤ 2.4 kbit/s data duplex async	cct mode speech followed by cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s	Speech NA 8 kbit/s 16 kbit/s FR	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s	6b then 3b

Table 6: Relationship between Teleservices and GSM PLMN connection types

Teleservice in GSM PLMN	**Access at mobile station**	**Radio interface connection element**	**Intermediate rate RA1 to RA2 at the BSS-MSC interface**	**BSS-MSC connection element**	**Protocol model in fig.6**
Telephony		cct mode speech	NA	cct mode structured 64 kbit/s speech	6
Emergency calls		cct mode speech	NA	cct mode structured 64 kbit/s speech	6
Alternate Speech/ Facsimile Group 3	Data cct duplex synchronous access alternate speech/ group 3 fax	cct mode speech alternating with unstructured unrestricted 3.6 or 6 or 12 kbit/s on FR transparent	speech NA 8 kbit/s 16 kbit/s	cct mode structured 64 kbit/s alternate speech / unrestricted	5 and 6
Automatic Facsimile Group 3	Data cct duplex synchronous access group 3 fax	cct mode unstructured unrestricted 3.6 or 6 or 12 kbit/s on FR transparent	8 kbit/s 16 kbit/s	cct mode structured 64 kbit/s unrestricted	5 and 6
Alternate speech/ Facsimile Group 3	Data cct duplex synchronous access alternate speech/ group 3 fax	cct mode speech alternating with unstructured unrestricted 6 or 12 kbit/s on FR non transparent	speech NA 16 kbit/s FR	cct mode structured 64 kbit/s alternate speech / unrestricted	6 and 7
Automatic Facsimile Group 3	Data cct duplex synchronous access group 3 fax	cct mode unstructured unrestricted 6 or 12 kbit/s on FR non transparent	16 kbit/s	cct mode structured 64 kbit/s unrestricted	6 and 7

NA: Not Applicable

Annex A (Informative): List of definitions of GSM PLMN connection type attributes and values

A.1 Attribute definition and their values

Information transfer mode:

This attribute describes the operational mode for transferring (transportation and switching) user information through a GSM PLMN connection in the network.

Values: - Circuit

Information transfer capability:

This attribute describes the capability associated with the transfer of different types of information through a GSM PLMN connection.

Values:
- Unrestricted digital information
- Speech
- Group 3 facsimile
- 3.1 kHz audio ex PLMN

Information transfer rate:

This attribute describes either the bit rate (circuit mode) or the throughput (packet mode, for further study). It refers to the transfer of digital information on a GSM PLMN connection.

Values:
- Appropriate bit rate
- Throughput rate

Establishment of connection:

This attribute describes the mode of establishment used to establish and release GSM PLMN connections.

Values: - Demand

Symmetry:

This attribute describes the relationship of information flow between two (or more) access points or reference points involved in a GSM PLMN connection.

Values: - Bidirectional symmetric

Connection configuration:

This attribute describes the spatial arrangement for transferring information on a given GSM PLMN connection.

Values: - Point-to-point

Structure:

This attribute refers to the capability of a GSM PLMN connection to deliver information to the destination access point or reference point in a structure that was presented in a corresponding signal structured at the origin (access point or reference point).

Values: - Service data unit integrity (see note 1)
- Unstructured (see note 2)

NOTE 1: applicable for connection element "non transparent"

NOTE 2: applicable for connection element "transparent"

Channel rate:

This attribute describes the channels and their bit rate used to transfer the user information and/or signalling information.

Values: - Name of channel (designation) and/or the corresponding bit rate

NOTE: This attribute can be used several times for connection characterization.

Connection control protocol, information transfer coding/protocol (layer 1 to 3):

These attributes characterize the protocols on the connection control and/or user information transfer channel.

Value: - Appropriate protocol for each layer

NOTE: This attribute can be used several times for connection characterization.

Synchronous/Asynchronous:

This attribute describes the type of transmission between the reference access points.

Values: - synchronous
- asynchronous

Negotiation:

This attribute describes the possibility of inband parameter exchange (according to V.110) between reference access points.

Value:- In band negotiation not possible

User Rate:

This attribute defines the user information rate at the mobile reference access point.

Values:
- 0.3 kbit/s
- 1.2 kbit/s
- 1200/75 bit/s
- 2.4 kbit/s
- 4.8 kbit/s
- 9.6 kbit/s

Intermediate rate:

This attribute defines the intermediate rate (according to TS 08.20 and CCITT V.110) at the A interface connection element part.

Values:
- 8 kbit/s
- 16 kbit/s

Network independent clocking on Tx:

This attribute defines the usage of NIC at the reference access point in the transmit direction.

Values:
- Not required
- Required

Network independent clocking on Rx:

This attribute defines the usage of NIC at the reference access point in the receive direction.

Values:
- Not accepted
- Accepted

Number of stop bits:

This attribute describes the number of stop bits for the asynchronous type of transmission between reference access points.

Values:
- 1 bit
- 2 bit

Number of data bits excluding parity if present:

This attribute describes the number of data bits for a character oriented mode of transmission between reference access points.

Values:
- 7 bit
- 8 bit

Parity information:

This attribute describes the type of parity information for a character oriented mode of transmission between the reference access points.

Values:
- odd
- even
- none
- forced to 0
- forced to 1

Duplex mode:

This attribute describes the kind of transmission of the GSM PLMN between reference access points.

Value: - full duplex

Modem type:

This attribute describes the modem allocated by the IWF/MSC in the case of a 3.1 kHz audio used outside the GSM PLMN information transfer capability.

Values:
- V.21
- V.22
- V.22 bis
- V.23
- V.26 ter
- V.32
- autobauding type 1
- none

Compression

This attribute describes the possible usage of data compression between the reference access points. In the network to MS direction, it indicates the possibility of using data compression. In the MS to network direction, it indicates the allowance of data compression.

Values:
- data compression not possible/not allowed
- data compression possible/allowed (see note 3)

NOTE 3: only applicable for the asynchronous transmission between the reference access points, if connection element is not “transparent”.

Radio channel requirement:

This attribute describes the available channels for the transfer of the user information between the reference access points.

Values:
- full rate channel (Bm)
- half rate channel (Lm)
- dual rate/full rate preferred
- dual rate/half rate preferred

Negotiation of Intermediate Rate Requested (NIRR)

This attribute indicates if 6 kbit/s radio interface rate is requested.

Values: - NIRR not requested/not accepted
- NIRR requested/accepted

Connection element:

This attribute describes the possible usage of GSM layer 2 protocol between the reference access points.

Values: - transparent
- non-transparent (RLP)
- both, transparent preferred
- both, non transparent preferred

User information layer 2 protocol:

This attribute describes the layer 2 relay protocol used between the reference access points in non-transparent transmissions.

Values: - ISO 6429, code set 0
- X.25
- character oriented protocol with no flow control

Signalling access protocol:

This attribute characterizes the protocol on the signalling or user information transfer channel at the mobile reference access point.

Value:- I.440/450
- X.21
- X.28, dedicated PAD, individual NUI
- X.28, dedicated PAD, universal NUI
- X.28, non dedicated PAD
- X.32

Rate adaptation:

This attribute describes the rate adaptation used at the fixed reference access point.

Values: - V.110/X.30
- X.31 flagstuffing
- no rate adaptation

Coding standard:

This attribute refers to the structure of the BC-IE defined in the TS 04.08.

Value:- GSM

User information layer 1 protocol:

This attribute characterizes the layer 1 protocol to be used at the Um interface according to the TS GSM 05.01.

Value:- default

A.2 Definition of values

Unrestricted digital data information:

Transfer of information sequence of bits at its specified bit rate without alteration.

This implies:- bit sequence independence
- digit sequence integrity
- bit integrity.

Speech:

Digital representation of speech coded according to a specified encoding rule (e.g. A Law, GSM 06-series)

Demand connection:

A GSM PLMN connection is set up at any time on demand via a digital channel in response to signalling information received from subscriber, other MSCs or other networks, i.e. on a per call basis.

Bidirectional symmetric:

This value applies when the information flow characteristics provided by the GSM PLMN connection are the same between two (or more) access points or reference points in the forward and backward directions.

Point-to-point connection:

This value applies when only two end points are provided by the connection.

Service data unit integrity:

This value applies when:

i) at each user-network interface, protocols provide a mechanism for identifying the boundaries of service data units (e.g. X.25 complete packet sequence) and
ii) all bits submitted within a single service data unit are delivered in a corresponding service data unit.

Unstructured:

This value is applicable when the GSM PLMN connection neither provides structural boundaries nor preserves structural integrity.

Annex B (Informative): Location of the transcoding and RA2 functions

The location of the transcoding and data rate adaptation functions used to convert from the data rate used on the radio interface to the 64 kbits/s required by the MSC, is considered in this annex B. There are three alternatives which are equally valid from a connection type point of view. The selection of which alternative to use is not considered in TS GSM 03.10. The alternatives are shown in Figure 7.

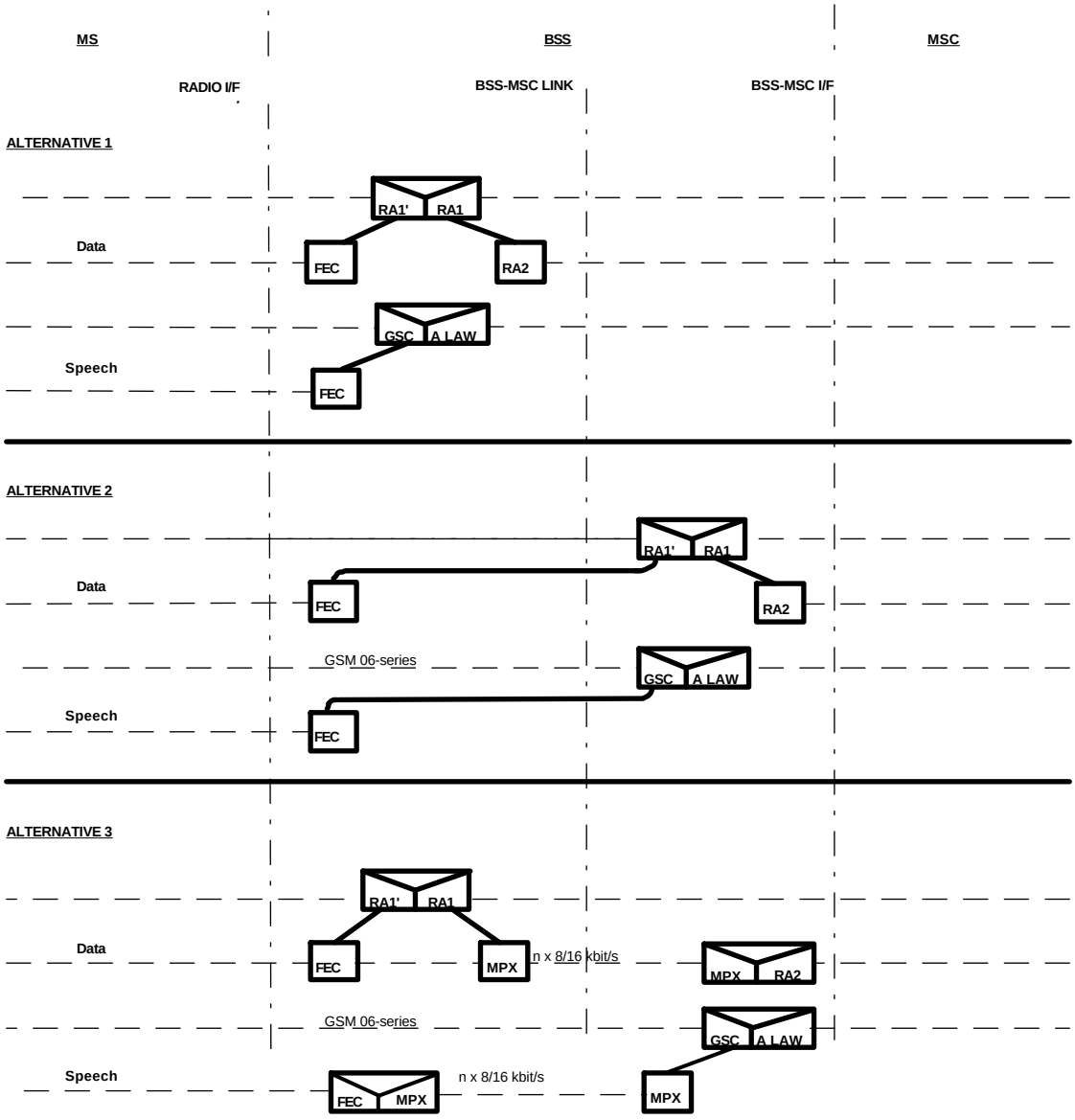
Alternative 1 assumes that all the transcoding and data rate adaptation is located at the BSS end of the A interface.

Alternative 2 assumes that all the transcoding and data rate adaptation is located at the MSC end of the A interface and gives no indication how the information is carried on the link.

Alternative 3 assumes that the information is transferred on the A interface in 8 or 16 kbit/s channels using one of the sub-multiplexing schemes described in CCITT Recommendation I.460. The same sub-multiplexing scheme is used for both speech and data.

It should be noted that in all of the alternatives the transcoding and data rate adaptation are performed on the BSS side of the A interface and is therefore considered to be a function of the BSS.

In all three alternatives, the interface at the MSC is always based on 64 k bit/s without sub-multiplexing.



Legend:

GSC = GSM speech codec
FEC = Forward Error Correction
MPX = Multiplex/demultiplex

Figure 7 : Location of transcoding and rate adaptation

History

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