3GPP TSG_CN#6 **NP-99436**
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Agenda item: **5.3.3**

Source: **TSG_N WG3**

Title: **CRs to 3G Work Item Service clean up**

Introduction:

This document contains **"5"** CRs **on Work Item Service clean up** agreed by **TSG_N WG3** and forwarded to **TSG_N Plenary** meeting #6 for approval.

The CR to 03.10 v8.0.0 is a to GSM only specification, hence agreement is sought from TSG_N and approval from SMG3.

Tdoc	Spec	CR	Rev	CAT	Rel.	Old Ver	New Ver	Subject
N3-99351	03.10	A011		C	R99	8.0.0	8.1.0	Service clean-up for Release 99
N3-99352	27.001	008		C	R99	3.2.0	3.3.0	Service clean-up for Release 99
N3-99353	27.002	002		C	R99	3.1.0	3.2.0	Service clean-up for Release 99
N3-99354	27.003	003		C	R99	3.1.0	3.2.0	Service clean-up for Release 99
N3-99355	29.007	006		C	R99	3.2.0	3.3.0	Service clean-up for Release 99

ETSI SMG3
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CHANGE REQUEST

Please see embedded help file at the bottom of this

03.10	CR	A011	Current Version:	8.0.0

↑ *CR number as allocated by MCC support team*

For submission to: SMG3 *list expected approval meeting # here ↑*	for approval	X	strategic		*(for SMG use only)*
	for information		non-strategic	X	

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] M [ ] UTRAN / Radio [ ] Core Network [X]

Source: SMG3 WPD **Date:** 11.11.1999

Subject: R99 service clean up

Work item: Service Clean up R99

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature	X		Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Due to the deletion of services in GSM R99 (dual services, dedicated services) this specification has to be updated.

Additionally it provides the updates required for 3GPP (e.g. changes of references)

Clauses affected:

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other

1 Scope

A GSM PLMN may be described by a limited set of access interfaces (refer to 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 GSMTS 01.02, 02.01, 022.002, 02.03, 03.01, 023.002, 04.02 and 04.03.

This specification provides a bridge between the service specification in the GSMTS 02 and 22-series of specifications and the more detailed specifications such as the GSMTS 03, 04, 23, 24, 027 and 029 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.

From GSM R99 onwards the following services are no more required to be provided by a GSM PLMN:

- the dual Bearer Services “alternate speech/data” and “speech followed by data”
- the dedicated services for PAD and Packet access
- the single asynchronous and synchronous Bearer Services (BS 21..26, BS 31..34)

If a PLMN network still provides these services it has to fulfil the specification of GSM R98.

2 Normative 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.02: "Digital cellular telecommunications system (Phase 2+); General description of a GSM Public Land Mobile Network (PLMN)".

[2] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[3] GSM 02.01: "Digital cellular telecommunications system (Phase 2+); Principles of telecommunications services supported by a GSM Public Land Mobile Network (PLMN)".

[4] GSM 3G TS 022.002: "Digital cellular telecommunications system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[5] GSM 02.03: "Digital cellular telecommunications system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[6] GSM 03.01: "Digital cellular telecommunications system (Phase 2+); Network functions".

[7] GSM3G TS 023.002: "Digital cellular telecommunications system (Phase 2+); Network architecture".

[8] GSM 3G TS 023.009: "Digital cellular telecommunications system (Phase 2+); Handover procedures".

[9] GSM 3G TS 023.034: "Digital cellular telecommunications system (Phase 2+); High Speed Circuit Switched Data (HSCSD) - Stage 2 Service Description".

[10] GSM 3G TS 023.040: "Digital cellular telecommunications system (Phase 2+); Technical realization of the Short Message Service (SMS) Point-to-Point (PP)".

[11] GSM3G TS 023.041: "Digital cellular telecommunications system (Phase 2+); Technical realization of Short Message Service Cell Broadcast (SMSCB)".

[12] GSM 03.45: "Digital cellular telecommunications system (Phase 2+); Technical realization of facsimile group 3 transparent".

[13] GSM 04.01: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface General aspects and principles".

[14] GSM 04.02: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".

[15] GSM 04.03: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities".

[16] GSM 04.05: "Digital cellular telecommunications system (Phase 2+); Data Link (DL) layer; General aspects".

[17] GSM 04.06: "Digital cellular telecommunications system (Phase 2+); Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[18] 3G TSGSM 024.007: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface signalling layer 3; General aspects".

[19] GSM 3G TS 024.008: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[20] GSM 3G TS 024.011: "Digital cellular telecommunications system (Phase 2+); Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[21] GSM 3G TS 024.012: "Digital cellular telecommunications system (Phase 2+); Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".

[22] GSM 04.21: "Digital cellular telecommunications system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[23] GSM 3G TS 024.022: "Digital cellular telecommunications 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".

[24] GSM 05.01: "Digital cellular telecommunications system (Phase 2+); Physical layer on the radio path General description".

[25] GSM 05.03: "Digital cellular telecommunications system (Phase 2+); Channel coding".

[26] GSM 05.08: "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".

[27] GSM 06.31: "Digital cellular telecommunications system; Full rate speech; Discontinuous Transmission (DTX) for full rate speech traffic channels".

[28] GSM 3G TS 027.001: "Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[29] GSM 3G TS 027.002: "Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[30] GSM 3G TS 027.003: "Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[31] GSM 08.04: "Digital cellular telecommunications system (Phase 2+); Base Station System - Mobile-services Switching Centre (BSS - MSC) interface Layer 1 specification".

[32] GSM 08.06: "Digital cellular telecommunications system (Phase 2+); Signalling transport mechanism specification for the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[33] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface Layer 3 specification".

[34] GSM 08.20: "Digital cellular telecommunications system (Phase 2+); Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[35] ~~GSM 09.04: "Digital cellular telecommunications system (Phase 2+); Interworking between the Public Land Mobile Network (PLMN) and the Circuit Switched Public Data Network (CSPDN)".~~

[36] ~~GSM 09.05: "Digital cellular telecommunications 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".~~

[37] ~~GSM~~ 3G TS 0~~2~~9.0~~0~~6: "~~Digital cellular telecommunications 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".

[38] ~~GSM~~ 3G TS 0~~2~~9.0~~0~~7: "~~Digital cellular telecommunications 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)".

[39] ~~CCITT~~ITU-T Recommendation I.460: "Multiplexing, rate adaption and support of existing interfaces".

[40] ~~CCITT~~ITU-T Recommendation V.110: "Support of Data Terminal Equipments (DTEs) with V-Series interfaces by an integrated services digital network".

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

[42] ~~CCITT~~ITU-T Recommendation V.22: "1 200 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".

[43] ~~CCITT~~ITU-T Recommendation V.22bis: "2 400 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".

[44] ~~CCITTITU-T Recommendation V.23: "600/1 200-band modem standardised for use in the general switched telephone network".~~

[45] ~~CCITT~~ITU-T Recommendation V.24: "List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE)".

[46] ~~CCITTITU-T 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".~~

[47] ~~CCITTITU-T Recommendation V.25bis: "Automatic calling and/or answering equipment on the General Switched Telephone Network (GSTN) using the 100-series interchange circuits".~~

[48] ~~CCITTITU-T Recommendation V.26bis: "2 400/1 200 bits per second modem standardised for use in the general switched telephone network".~~

[49] ~~CCITT~~ITU-T Recommendation V.26ter: "2 400 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".

[50] ~~CCITTITU-T Recommendation V.27ter: "4 800/2 400 bits per second modem standardised for use in the general switched telephone network".~~

[51] CCITTITU-T Recommendation V.28: "Electrical characteristics for unbalanced double-current interchange circuits".

[52] CCITTITU-T Recommendation V.29: "9 600 bits per second modem standardised for use on point-to-point 4-wire leased telephone-type circuits".

[53] CCITTITU-T Recommendation V.32: "A family of 2-wire, duplex modems operating at data signalling rates of up to 9 600 bit/s for use on the general switched telephone network and on leased telephone-type circuits".

[54] CCITTITU-T 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".

[55] CCITTITU-T Recommendation V.42bis: "Data Compression for Data Circuit terminating Equipment (DCE) using Error Correction Procedures".

[56] CCITTITU-T Recommendation V.120: "Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing".

[57] CCITTITU-T Recommendation X.21: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for synchronous operation on public data networks".

[58] CCITTITU-T Recommendation X.21bis: "Use on public data networks of Data Terminal Equipment (DTE) which is designed for interfacing to synchronous V-series modems".

[59] CCITTITU-T Recommendation X.24: "List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) on public data networks".

[60] CCITTITU-T 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".

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

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

[63] CCITTITU-T 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".

[64] CCITTITU-T 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".

[65] CCITTITU-T Recommendation X.30: "Support of X.21, X.21bis and X.20bis based Data Terminal Equipments (DTEs) by an Integrated Services Digital Network (ISDN)".

[66] CCITTITU-T Recommendation X.31: "Support of packet mode terminal equipment by an ISDN".

[67] CCITTITU-T 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".

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

[69] ITU-T Recommendation V.34 (1994): "A modem operating at data signalling rates of up to 28 800 bits for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits".

[70] CCITTITU-T Recommendation I.440 (1989): "ISDN user-network interface data link layer - General aspects".

[71] CCITTITU-T Recommendation I.450 (1989): "ISDN user-network interface layer 3 General aspects".

[72] ISO/IEC 6429 (1992): "Information technology - Control functions for coded character sets".

[73] 3G TS 23.060: " General Packet Radio Service (GPRS)".

[74] ITU-T Recommendation V.90 - 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

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.

EDGE channels: A general term referring to channels based on 8PSK modulation; i.e. TCH/F28.8, TCH/F32.0, and TCH/F43.2.

3.2 Abbreviations

Abbreviations used in this specification are listed in GSM 01.04.

4 General considerations

Low layer capabilities are defined in GSM 02.01 and characterized in GSMTS 022.002 for Bearer Services and GSM 02.03 for Teleservices. Apart from the short message service and GPRS, 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 TSGSM 023.040 and GSM 204.011 for the point-to-point service, and in GSM 023.041 and GSMTS 024.012 for the cell broadcast service. Network capabilities to support GPRS are described in 23.060.

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 GSM 04.03) or a combination of several full rate traffic channels (Multislot configuration for data) except for the short message point-to-point which uses a dedicated control channel DCCH (see GSMTS 024.011) or the cell broadcast service which uses the CBCH (see GSMTS 024.012). No multiplexing of data 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 4 800 bit/s may be supported either on a full rate channel or on a half rate channel. Single slot configurations of 9.6Kbit/s and above are always supported on a full rate channel. Multislot configurations for data use combinations of 4.8 kbit/s or 9.6 kbit/s or 14.4 kbit/s full rate traffic channels only.

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 GSMTS 02.002.

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 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 CCITTITU-T Recommendation V.110 except on TCH/F14.4 or EDGE channels for which GSM specific rate adaption is used between the mobile station and the interworking function. For the access interface, the rate adaptation schemes used are referenced in the GSMTS 0727-series.

On the radio path, rate adaptation leads to rates of 43.5, 32.0, 29.0, 14.5, 12.0, 6.0 and 3.6 kbit/s per TCH (see GSM 04.21). However, in multislot configurations for data the 3.6 kbit/s per TCH/F rate is excluded. At the BSS to MSC interface, the rate adaptation scheme used is described in 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 GSM 05.03).

4.2 Transparent and non-transparent lower layer capabilities

Two classes of low layer capabilities have been identified (see GSMTS 0022.002 and 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 GSMTS 0024.022) 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 an unit for the user.

One of the most specific characteristics of the mobile networks is the hand-over procedure (see GSMTS 0023.009, 0024.008, 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 (GSMTS 0024.022) will overcome this problem.

After a hand-over, in case of loss of synchronization, the process to recover synchronization, as described in TSGSM 0029.007 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 GSM 06.31.

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

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. Subclause 6.3 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 subclauses 6.4 and 6.5 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 same or nearest higher synchronous rate defined by 2 to the power n (where n≤ 6) times 600 bit/s, 14.4 kbit/s or 28.8 kbit/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 RA0 used in GSM is not identical to that described in ITU-T Recommendation V.110 which converts the 14,4 and 28,8 kbit/s user rates to 19,2 and 38,4 kbit/s, respectively.

The intermediate rate adaptation function (RA1) is a rate adaptation function which turns either the output of the RA0 function or a synchronous user data stream into a data stream at 8, 16, or 32 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 the 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 and it adapts synchronous user data stream or the output of the RA0 function to one of the following data rates: 3.6, 6.0 or 12.0 or 14.5 kbit/s over the radio path. In case of a TCH/F28.8 channel two 14.5 kbit/s substreams produced by the RA1' function are multiplexed into a 29.0 kbit/s air interface channel by an EDGE multiplexing function. For the non-transparent case, the RA1' function provides direct access to the 12.0 or 6.0 kbit/s data rates. This

is achieved by allowing the V.110 frame status bits to be used as additional data bits. This function is described in GSM 04.21 and GSM 08.20. RA1' is not applied in TCH/F14.4 or EDGE non-transparent operation.

For TCH/F14.4 channel coding three GSM-specific adaptation functions are used: namely, RA1'/RAA', RAA', and RAA'' (GSM 08.20). On the network side of the air interface, the 14.5 kbit/s substreams multiplexed into a 29.0 or 43.5 kbit/s air interface channel are transferred just as in a multislot connection of TCH/F14.4 substreams. RA1'/RAA' adapts between the 14.5 air-interface rate and the 16 kbit/s rate used across the Abis-interface. RAA' adapts between the 16 kbit/s Abis Interface-rate and 16.0 kbit/s A-interface substream. (Up to four such A-interface substreams may be multiplexed into the 64kbit/s A-interface stream).) RAA'' converts between the A-interface data substream(s) and the overall synchronous stream. In non-transparent operation the RAA'' converts between the A-interface stream and the 290-bit blocks containing bits M1, M2, and 288 data bits as described in GSM 04.21.

In multislot data configurations the intermediate rates 16, 32, and 64 kbit/s are supported on those sections of the network where the overall data stream is not split into multiple channels (GSM 04.21 and 08.20). RA1-adaptation is not applied to rates higher than 38.4 kbit/s. Instead, a GSM-specific rate adaptation function RA1'' to user rates 48 and 56 kbit/s is applied; this function adapts between these rates and the 64 kbit/s "intermediate" rate. The RA2 function passes rate 64 kbit/s on as such.

In multislot data connections, the rate adaptation functions are performed per TCH/F between the Split/Combine-functions. On the A-interface up to four TCH/Fs are multiplexed into one 64 kbit/s channel according to the procedures defined in GSM 08.20. However, multiplexing is not applied to those user rates which make use of more than four TCH/Fs; for such rates the Split/Combine-function is located at the BSS.

The splitting and recombining of the data flow into/from TCH/Fs takes place at the RA1-function or RAA" function (transparent service) at the MSC/IWF and at the MS's RA1/RA1'- or RA1'-function, or between the RLP and RA1' (RA1' not applied to TCH/F14.4) (non-transparent service) at the MS and between RA1 or RAA"and RLP at MSC/IWF (figures 6 and 7). The TCH/Fs are treated as independent channels between the Split/Combine-functions.

For user rates requiring more than four TCH/Fs (transparent only) the Split/Combine-function is located at the RA1/RA1'-or RA1'-function at the MS and at the RA1'/RA1-function at the BSS (figures 6 and 7). The rate adaptation functions for the various user data rates are summarized in tables 1 to 3. It should be noted that in the case of synchronous data transmission, the RA0 is not present.

For 56 and 64 kbit/s connections using a 2×TCH/F32.0 channel configuration across the radio interface, no rate adaptation is applied as the PLMN offers a '64 kbit/s pipe' between TE and an external network.

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

R I/F	RA0		RA1'	Radio I/F
async	**<------>**	**sync**		
≤ 2.4	<------>	≤ 2.4	<---------->	3.6
4.8	<------>	4.8	<---------->	6.0
9.6	<------>	9.6	<---------->	12.0 or 2 × 6.0
14.4	<------>	14.4	<---------->	14.5 or 2 × 12.0 or 3 × 6.0
19.2	<------>	19.2	<---------->	2 × 12.0 or 4 × 6.0
28.8	<------>	28.8	<---------->	1 x 29.0 or 2 x 14.5 or 3 × 12.0
38.4	<------>	38.4	<---------->	3 x 14.5 or 4 × 12.0
		48.0	<---------->	4 x 14.5 or 5 × 12.0
		56.0	<---------->	2 x 32.0 or 4 x 14.5 or 5 × 12.0 note 1
		64.0	<---------->	2 x 32.0 or 5 x 14.5 or 6 × 12.0 note 1

NOTE 1: AIUR of 11.2 kbit/s per 12.0 kbit/s air interface channel (GSM 04.21).

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

RA0			RA1		RA2	S I/F	RA2		RA1/RA1'	Radio I/F
async		sync								
≤ 2.4	<------>	≤ 2.4	<------>	8	<------>	64	<------>	8	<------>	3.6
4.8	<------>	4.8	<------>	8	<------>	64	<------>	8	<------>	6.0
9.6	<------>	9.6	<------>	16	<------>	64	<------>	16	<------>	12.0 or 2 × 6.0
14.4	<------>	14.4	<------>	32	<------>	64	<------>	32	<------>	14.5 or 2 × 12.0 or 3 × 6.0
19.2	<------>	19.2	<------>	32	<------>	64	<------>	32	<------>	2 × 12.0 or 4 × 6.0
28.8	<------>	28.8	<------>	64	<------>	64	<------>	64	<------>	1 x 29.0 or 2 x 14.5 or 3 × 12.0
38.4	<------>	38.4	<------>	64	<------>	64	<------>	64	<------>	3 x 14.5 or 4 × 12.0

	RA1''		RA2	S I/F	RA2		RA1/RA1'	Radio I/F
	48.0	<------>	64	<------>	64	<------>	64	<------>	4 x 14.5 or 5 × 12.0 note 1
	56.0	<------>	64	<------>	64	<------>	64	<------>	2 x 32.0 or 4 x 14.5 or 5 × 12.0 notes 1, 2
			64	<------>	64	<------>	64	<------>	2 x 32.0 or 5 x 14.5 or 6 × 12.0 notes 1, 2

NOTE 1: RA2 not applicable.

NOTE 2: AIUR of 11.2 kbit/s per 12.0 kbit/s air interface channel (GSM 04.21).

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

RA1'		
6.0	<------>	6.0
12.0	<------>	12.0

NOTE: RA1' not applicable to TCH/F14.4, TCH/F28.8, or TCH/F43.2

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~~TS ~~0~~2~~4~~.0~~2~~2) 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~~TS ~~0~~2~~7~~-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 for such channel codings as TCH/F 4,8 and TCH/F9,6 and GSM specific rate adaption for channel codings TCH/F14.4, TCH/F28.8, TCH/F43.2 (GSM 04.21, 08.20);

- filtering of status bits (GSMTS 02.001);
- RLP for non-transparent services (GSMTS 024.022);
- Data compression (GSMTS 024.022, 027.002).

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 subclause 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 14.5 or 29.0 or 43.5 or 64.0

or n × 6.0 (1 ≤ n ≤ 4) or n × 12.0 (1 ≤ n ≤ 6) or n x 14.5 (1 ≤ n ≤ 5) or 2 x 29.0 or 2 x 32.0

Attribute values for overall connection type:

3.6 or 6.0 or 12.0 or 13.0 or 14.5 29.0 or 43.5 or 64.0;

or n × 6.0 (1 ≤ n ≤ 4) or n × 12.0 (1 ≤ n ≤ 6) or n x 14.5 (1 ≤ n ≤ 5) or 2 x 29.0 or 2 x 32.0..

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.

Bidirectional Asymmetric (Multislot connections for data).

Attribute values for overall connection type:

Bidirectional Symmetric.

Bidirectional Asymmetric (Multislot connections for data).

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 Full rate TCHs or Half rate TCH.

A interface connection element: 64.0 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 (64.0 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: GSMTS 024.007 and 024.0008, 024.011.

A interface connection element:

Layer 1: GSM 08.04.

Layer 2: GSM 08.06.

Layer 3: GSMTS 024.007, 024.008 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: TSGSM 04.06, 024.022 and TSGSM 027.002 or TSGSM 024.022 and TSGSM 027.003 or transparent.

Layer 3: Transparent, TSGSM 024.011.

A interface connection element:

Layer 1: GSM 08.04 and GSM 08.20.

Layer 2: TSGSM 024.022 and TSGSM 027.002 or TSGSM 024.022 and TSGSM 027.003 or transparent.

Layer 3: Transparent.

Attribute values for the overall connection type:

Not applicable.

6.3.11 Further attributes and attribute values

This subclause 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 13.0 or 14.5 or 29.0 or 43.5 or n × 6.0 (1 ≤ n ≤ 4) or n × 12.0 (1 ≤ n ≤ 6) or n x 14.5 (1 ≤ n ≤ 5) or 2 x 29.0 or 2 x 32.0 kbit/s	 64.0 kbit/s
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/F(s) or TCH/H Dm	 64.0 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 ~~0~~24.007, ~~0~~24.008, ~~0~~24.011	 GSM 08.04 GSM 08.06 GSM ~~0~~24.007, ~~0~~24.008, 08.08
10 Information Transfer Coding/Protocol Layer 1 Layer 2 Layer 3	 GSM 04.21 05 and 06 series GSM ~~0~~24.022 and ~~0~~27.002 or ~~0~~24.022 and ~~0~~27.003 04.06 or transparent Transparent, ~~0~~24.011	 GSM 08.04 and 08.20 GSM ~~0~~24.022 and ~~07~~27.002 or ~~0~~24.022 and ~~0~~27.003 or transparent Transparent

6.4 Limited set of GSM PLMN connection types **(all channel codings excluding TCH/F14.4)**

From the two connection elements defined in subclause 6.2, the list of attributes and their possible values given in subclause 6.3, and from the service requirements defined in ~~GSM~~TS ~~0~~22.002 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 (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 Models 1 a and b are the models for asynchronous data transmission in the transparent mode. Models 1d and 1e are for multislot transparent asynchronous data configurations.

Protocol Models 2 a and b are the models for synchronous data transmission in the transparent mode. Models 2d and 2e are for multislot transparent synchronous data.

Protocol Models 3 a and b are the models 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 GSMTS 027.002). The data compression function is located in the L2R COP function. Models 3d and 3e are for multislot character "asynchronous" data transmission in the non-transparent mode.

Protocol Models 4 a, b, and c are the models for synchronous data transmission using the CCITTITU-T 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 GSMTS 027.003).

Models 4d, 4e, and 4f are for multislot synchronous data transmission using the CCITTITU-T Recommendation X.25 PSPDN access protocol in the non-transparent mode.

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

Protocol Model 5a is the model for the transparent support of group 3 facsimile transmission. Model 5b is for transparent support of group 3 facsimile transmission in multislot data configurations.

Protocol Models 6 a and b are the models 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 a is the model for the non-transparent support of group 3 facsimile transmission. Model 7b is for non-transparent support of group 3 facsimile transmission in multislot data configurations.

In the multislot-data models the data is split into parallel substreams between the Split/Combine-functions (S/C). These substreams are transmitted through parallel TCH/Fs which are treated as independent channels. Between the S/C-functions parallel RA- and FEC-functions are used.

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, TSGSM 029.006 and TSGSM 029.007.

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.

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). In the multislot cases the minimum number of timeslots per connection (n) is 1.

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. In the multislot cases the minimum number of timeslots per connection (n) is 1.

7.4 Network capability to support in-call modification

Specifications TS~~GSM 0~~2.02 and 02.03 identify a particular need for a GSM PLMN to support the ~~Alternate speech/data (3.1 kHz audio ex PLMN),~~ Alternate speech and group 3 facsimile~~, and Speech followed by data (3.1 kHz audio)~~.

This~~ese~~ service~~s~~ allow the use of in-call modification to change the mode of service. The network capability to support in-call modification is described in TS~~GSM 0~~24.008. 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 TS~~GSM 0~~24.008. 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 at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6, 7 or 8
Circuit mode unstructured with unrestricted digital capability transparent.	Data circuit duplex async n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 4). Data circuit duplex sync n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 5) or n × 1 1200 bit/s (n = 5 or 6).	cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 6) on n full rate channels.	8 or 16 kbit/s per TCH/F. For data connections using 5 or 6 TCH/Fs no intermediate rate(s) .	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 :1 d, 1 e, 2 d, 2 e
	Data circuit duplex async n × 14 400 bit/s (n ≤ 3). Data circuit duplex sync n × 14 400 bit/s (n ≤ 5)	cct mode unstructured unrestricted n x 14.5 kbit/s (n ≤ 5) on n full rate channels	16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 1 d, 1 e, 2 d, 2 e
	Data circuit duplex async 28 800 bit/s. Data circuit duplex sync 28 800 bit/s Data circuit duplex sync 64 000 bit/s	cct mode unstructured unrestricted 29.0 kbit/s on full rate channel cct mode unstructured unrestricted 2 x 32.0 kbit/s on full rate channels	16 kbit/s per TCH/F. No intermediate rate for the 64 000 bit/s rate	cct mode unstructured unrestricted 64 kbit/s.	Fig 8 : 1 a, 1 b, 2 a, 2 b None
	Data circuit duplex async 14 400 bit/s Data circuit duplex sync 14 400 bit/s	cct mode unstructured unrestricted 14.5 kbit/s on full rate Channel	16 kbit/s	cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 1 a, 1 b 2 a, 2 b
	Data circuit duplex async 9 600 bit/s. Data circuit duplex sync 9 600 bit/s.	cct mode unstructured unrestricted 12 kbit/s on full rate channel.	16 kbit/s.	cct mode unstructured unrestricted 64 kbits/s.	Fig 6 :1 a, 1 b Fig 6 2 a, 2 b
	Data circuit duplex async 4 800 bit/s. Data circuit duplex sync 4 800 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.	Fig 6 1 a, 1 b Fig 6 2 a, 2 b
	Data circuit duplex async 300. Data circuit duplex async 1 200. ~~Data circuit duplex async 1 200/75.~~ Data circuit duplex async 2 400. Data circuit duplex sync 1 200. Data circuit duplex sync 2 400.	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.	Fig 6 : 1 a, 1 b Fig 6 1 a, 1 b ~~Fig 6 1 a, 1 b~~ Fig 6 1 a, 1 b Fig 6 2 a, 2 b Fig 6 2 a, 2 b

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6, 7 or 8
Circuit mode unstructured with unrestricted digital capability non transparent.	Data circuit duplex async n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on full rate channels.	8 or 16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 3 d, 3 e
	Data circuit duplex async n × 14 400 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 14.5 kbit/s (n ≤ 4) on full rate channels.	16 kbit/s	cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 3 d, 3e
	Data circuit duplex async n x 28 800 bit/s (n ≤ 2). Data circuit duplex async 43 200 bit/s	cct mode SDU unrestricted n × 29.0 kbit/s (n ≤ 2) on full rate channels. cct mode SDU unrestricted 43.5 kbit/s on a full rate channel.	16 kbit/s per TCH/F. 16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbit/s.	Fig 8 : 3a, 3 b
	Data circuit duplex async 14 400 bit/s	cct mode SDUunrestricted 14.5 kbit/s on full rate channel	16 kbit/s	cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 3 a, 3 b
	Data circuit duplex async 9 600 bit/s.	cct mode SDU unrestricted 12 kbit/s on full rate channel.	16 kbit/s.	cct mode unstructured unrestricted 64 kbits/s.	Fig 6 : 3 a, 3 b
	Data circuit duplex async 4 800 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.	Fig 6 : 3 a, 3 b
	Data circuit duplex async 300. Data circuit duplex async 1 200. ~~Data circuit duplex async 1 200/75.~~ Data circuit duplex async 2 400.	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.	Fig 6: 3 a, 3 b Fig 6 : 3 a, 3 b ~~Fig 6 3 a, 3 b~~ Fig 6 3 a, 3 b

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6, 7 or 8
Circuit mode unstructured with 3.1 kHz audio ex PLMN transparent.	Data circuit duplex async n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3). Data circuit duplex sync n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3).	cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 3) on n full rate channels.	8 or 16 kbit/s TCH/F.	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 : 1 d, 1 e, 2 d, 2 e
	Data circuit duplex async n × 14 400 bit/s (n ≤ 2). Data circuit duplex sync n × 14 400 bit/s (n ≤ 2)	cct mode unstructured unrestricted x 14.5 kbit/s (n ≤ 2) on n full rate channels	16 kbit/s per TCH/F	cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 1 d, 1 e, 2 d, 2e
	Data circuit duplex async 28 800 bit/s. Data circuit duplex sync 28 800 bit/s	cct mode unstructured unrestricted 29.0 kbit/s on a full rate channel	16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbit/s.	Fig 8 : 1 a, 1 b, 2 a, 2 b
	Data circuit duplex asynch 14 400 bit/s synch 14 400 bit/s	cct mode unstructured unrestricted 14.5 kbit/s on full rate channels	16 kbit/s	cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 1 a, 1 b for async Fig 7 2 a 2 b for synch
	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.	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 : 1 a, 1 b for asynch. Fig 6 : 2 a, 2 b for synch.
	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.		
	Data circuit duplex async ≤ 2 400 sync ≤ 2 400.	cct mode unstructured unrestricted 3.6 kbit/s full and half rate channel.	8~~16~~ kbit/s.		

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6, 7 or 8
Circuit mode unstructured with 3.1 kHz audio ex PLMN non transparent.	Data circuit duplex async n × 4 800 (n ≤ 4) or n × 9 600 (n ≤ 4) bit/s. Data circuit duplex sync n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on full rate channels.	8 or 16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbits/s.	Fig 6 : 3 d, 3 e for async. Fig 6 : 4 d, 4 e, 4 f for sync.
	Data circuit duplex async n × 14 400 bit/s (n ≤ 4). Data circuit duplex sync n × 14 400 bit/s (n ≤ 4)	cct mode SDU unrestricted n x 14.5 kbit/s (n ≤ 4) on n full rate channels	16 kbit/s per TCH/F	cct mode unstructured unrestricted 64 kbits/s.	Fig 7 : 3 d, 3 e for asynch Fig 7 : 4 d, 4 e 4 f for synch
	Data circuit duplex async 28 800 bit/s. Data circuit duplex async 43 200 bit/s	cct mode SDU unrestricted 29.0 kbit/s on a full rate channel. cct mode SDU unrestricted 43.5 kbit/s on a full rate channel.	16 kbit/s per TCH/F. 16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbits/s.	Fig 8 : 3a, 3 b
	Data circuit duplex sync 28 800 bit/s	cct mode SDU unrestricted 29.0 kbit/s on a full rate channel.	16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbits/s.	Fig 8 : 4a, 4 b, 4c
	Data circuit duplex asynch 14 400 bit/s synch 14 400 bit/s	cct mode SDU unrestricted 14.5 kbit/s full rate channel	16 kbit/s	cct mode unstructured unrestricted 64 kbits/s.	Fig 7 : 3a, 3b for asynch Fig 7 : 4 a, 4 b, 4 c for synch
	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.	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 : 3 a, 3 b for asynch. Fig 6 : 4 a, 4 b, 4 c for synch.
	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.		
	Data circuit duplex async ≤ 2 400 sync ≤ 2 400.	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s.			

Pad access transparent.	PAD access circuit async 300. PAD access circuit async 1 200. PAD access circuit async 1 200/75. PAD access circuit async 2 400.	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.	Fig 6 : 1 a, 1 b Fig 6 : 1 a, 1 b Fig 6 : 1 a, 1 b Fig 6 : 1 a, 1 b
	PAD access circuit async 4 800.	cct mode unstructured unrestricted 6 kbit/s on half rate channel and full rate channel.			Fig 6 : 1 a, 1 b
	PAD access circuit async 9 600.	cct mode unstructured unrestricted 12 kbit/s on full rate channel.	16 kbit/s.		Fig 6 :1 a, 1 b
	PAD access circuit asynch 14 400 bit/s	cct mode unstructured unrestricted 14.5 kbit/s on full rate channel	16 kbit/s		Fig 7 : 1 a, 1 b
	PAD access circuit async n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤-4).	cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on n full rate channels.	8 or 16 kbit/s per TCH/F.		Fig 6 : 1 d, 1 e
	PAD access circuit async n × 14 400 bit/s (n ≤-3).	cct mode unstructured unrestricted n × 14.5 kbit/s (n ≤ 3) on n full rate channels.	16 kbit/s per TCH		Fig 7 : 1 d, 1 e
Pad access non transparent.	PAD access circuit async 300. PAD access circuit async 1 200. PAD access circuit async 1 200/75. PAD access circuit async 2 400.	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.	Fig 6 : 3 a, 3 b Fig 6 : 3 a, 3 b Fig 6 : 3 a, 3 b Fig 6: 3 a, 3 b
	PAD access circuit async 4 800.	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s.			Fig 6 : 3 a, 3 b
	PAD access circuit async 14 400 bit/s	cct mode SDU unrestricted 14.5 kbit/s on full rate channel	16 kbit/s		Fig 7 : 3 a, 3 b
	PAD access circuit async 9 600.	cct mode SDU unrestricted 12 kbit/s on full rate channel.	16 kbit/s.		Fig 6 : 3 a, 3 b
	PAD access circuit async n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on full rate channels.	8 or 16 kbit/s per TCH/F.		Fig 6 : 3 d, 3 e

(continued)

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

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6 or 7
	PAD access circuit async n × 14 400 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 14.5 kbit/s (n ≤ 4) on full rate channels.	16 kbit/s per TCH/F.		Fig 7 : 3 d, 3 e
Packet services, dedicated access, non transparent.	Data packet duplex sync 2 400.	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.	Fig 6 : 4 a, 4 b, 4 c
	Data packet duplex sync 4 800.	cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s.			Fig 6 : 4 a, 4 b, 4 c
	Data packet duplex sync 9 600.	cct mode SDU unrestricted 12 kbit/s on full rate channel.	16 kbit/s.		Fig 6 : 4 a, 4 b, 4 c
	Data packet duplex synch 14 400 bit/s	cct mode SDU unrestricted 14.5 kbit/s on full rate channel	16 kbit/s.		Fig 7 : 4 a, 4 b, 4 c
	Data packet duplex sync n × 4 800 (n ≤ 4)	cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or	8 or 16 kbit/s per TCH/F.		Fig 6 : 4 d, 4 e, 4 f

	or n × 9 600 bit/s (n ≤ 4).	n × 12 kbit/s (n ≤ 4) on full rate channels.			
	Data packet duplex sync n × 14 400 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 14.5 kbit/s (n ≤ 4) on full rate channels.	16 kbit/s per TCH/F		Fig 7 : 4 d, 4 e, 4 f

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6, 7 or 8
Packet services basic access transparent.	Data circuit duplex sync n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 5) or n × 11200 bit/s (n = 5 or 6).	cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 6) on n full rate channels.	8 or 16 kbit/s per TCH/F. For data connections using 5 or 6 TCH/Fs no intermediate rate(s).	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 : 2 d, 2 e
	Data circuit duplex sync n × 14 400 bit/s (n ≤ 5)	cct mode unstructured unrestricted n × 14.5 kbit/s (n ≤ 5) on n full rate channels.	16 kbit/s per TCH/F	cct mode unstructured unrestricted 64 kbits/s.	Fig 7 : 2 d, 2 e
	Data circuit duplex synch 14 400 bit/s	cct mode unstructured unrestricted 14.5 kbit/s on full rate channel.	16 kbit/s.	cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 2 a, 2 b
	Data circuit duplex sync 9 600 bit/s.	cct mode unstructured unrestricted 12 kbit/s on full rate channel.	16 kbit/s.	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 : 2 a, 2 b
	Data circuit duplex sync 4 800 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.	Fig 6 : 2 a, 2 b
	Data circuit duplex sync 2 400 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.	Fig 6 : 2 a, 2 b

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6, 7 or 8
Packet services basic access non transparent.	Data circuit duplex sync n × 4 800 (n ≤4) or n × 9 600 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on full rate channels.	8 or 16 kbit/s per TCH/F.	cct mode unstructured unrestricted 64 kbits/s.	Fig 6 : 4 d, 4 e, 4 f
	Data circuit duplex sync n × 14 400 bit/s (n ≤ 4).	cct mode SDU unrestricted n × 14.5 kbit/s (n ≤ 4) on full rate channels	16 kbit/s per TCH/F	cct mode unstructured unrestricted 64 kbits/s.	Fig 7 : 4 d, 4 e, 4 f
	Data circuit duplex sync n × 28 800 bit/s (n ≤ 2).	cct mode SDU unrestricted n × 29.0 kbit/s (n ≤ 2) on full rate channels	16 kbit/s per TCH/F	cct mode unstructured unrestricted 64 kbits/s.	Fig 8 : 4 a, 4 b, 4 c
	Data circuit duplex sync 43 200 bit/s.	cct mode SDU unrestricted 43.5 kbit/s on a full rate channel	16 kbit/s per TCH/F		Fig 8 : 4 a, 4 b, 4 c
	Data circuit duplex synch 14 400 bit/s	cct mode SDU unrestricted 14.5 kbit/s on full rate channel	16 kbit/s	cct mode unstructured unrestricted 64 kbits/s.	Fig 7 : 4 a, 4 b, 4 c
	Data circuit duplex sync 9 600 bit/s.	cct mode SDU unrestricted 12 kbit/s on full rate channel.	16 kbit/s.	cct mode unstructured unrestricted 64 kbit/s.	Fig 6 : 4 a, 4 b, 4 c
	Data circuit duplex sync 4 800 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 a,b,c
	Data circuit duplex sync 2 400 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 a,b,c

Circuit mode unstructured with alternate speech and 3.1 Khz audio ex PLMN transparent.	Alternate speech and data duplex async n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3). Alternate speech and data duplex sync n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3).	cct mode speech alternating with cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 3) on n full rate channels.	Speech NA 8 or 16 kbit/s per TCH/F.	cct mode alternate speech and unstructured unrestricted 64 kbit/s.	Fig 6 :, 6 b, 1 d, 1 e, 2 d, 2 e
	Alternate speech and data duplex async n × 14 400 bit/s (n ≤ 2). Alternate speech and data duplex sync n × 14 400 bit/s (n ≤ 2).	cct mode speech alternating with cct mode unstructured unrestricted n × 14.5 kbit/s (n ≤ 2) on n full rate channels.	Speech NA 16 kbit/s per TCH/F.	cct mode alternate speech and unstructured unrestricted 64 kbit/s	Fig 7 : 6 b and 1d, 1e, 2d, 2e
	Alternate speech and data duplex async 14 400	cct mode speech alternating with cct mode unstructured unrestricted 14.5 kbit/s on full rate channel.	Speech NA 16 kbit/s	cct mode alternate speech and unstructured unrestricted 64 kbit/s	Fig 7 : 6 b and 1 a, 1 b
	Alternate speech and data duplex sync 14 400	cct mode speech alternating with cct mode unstructured unrestricted 14.5 kbit/s on full rate channel.	Speech NA 16 kbit/s.	cct mode alternate speech and unstructured unrestricted 64 kbit/s.	Fig 7 : 6 b and 2 a, 2 b
	Alternate speech and data duplex async 9 600.	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.	Fig 6 : 6b and 1 a, 1 b
	Alternate speech and data duplex sync 9 600.				Fig 6 : 6b and 2 a, 2 b
	Alternate speech and data duplex async 4 800.	cct mode speech alternating with cct mode unstructured unrestricted 6 kbit/s on full rate channel or half rate channel.	Speech NA 8 kbit/s.	cct mode alternate speech and unstructured unrestricted 64 kbit/s.	Fig 6 : 6 b and 1 a, 1 b
	Alternate speech and data duplex sync 4 800.				Fig 6 : 6 b and 2 a, 2 b
	Alternate speech and data duplex async ≤ 2 400.	cct mode speech alternating with cct mode unstructured unrestricted 3.6 kbit/s. on full rate channel or half rate channel.	Speech NA 8 kbit/s.	cct mode alternate speech and unstructured unrestricted 64 kbit/s.	Fig 6 : 6b and 3 a, 3 b
	Alternate speech and data duplex sync ≤ 2 400.				Fig 6 : 6 b and 4 a, 4 b, 4 c
Circuit mode unstructured with alternate speech and 3.1 Khz audio ex PLMN non transparent.	Alternate speech and data duplex async n × 4 800 (n ≤ 4) or n × 9 600 (n ≤ 4) bit/s.	cct mode speech alternating with cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on full rate channels.	Speech NA 8 or 16 kbit/s per TCH/F.	cct mode alternate speech and unstructured unrestricted 64 kbit/s.	Fig 6 : 6b and 3d, 3e

(continued)

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

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6 or 7
	Alternate speech and data duplex async n × 14 400 (n ≤ 4) bit/s.	cct mode speech alternating with cct mode SDU unrestricted n × 14.5 kbit/s (n ≤ 4) on full rate channels	Speech NA 16 kbit/s per TCH/F	cct mode alternate speech and unstructured unrestricted 64 kbit/s.	Fig 7 : 6 b and 3 d, 3 e
	Alternate speech and data duplex async 14 400.	cct mode speech alternating with cct mode SDU unrestricted 14.5 kbit/s on full	Speech NA	cct mode alternate speech and unstructured	Fig 7 : 6 b and 3a, 3b

		rate channel	16 kbit/s.	unrestricted 64 kbit/s.	
	Alternate speech and data duplex async 9 600.	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.	Fig 6 6 b and 3 a, 3 b
	Alternate speech and data duplex async 4 800.	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.	Fig 6 : 6 b and 3 a, 3 b
	Alternate speech and data duplex async ≤ 2 400.	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.	Fig 6 : 6 b and 3 a, 3 b
Circuit mode unstructured with speech followed by 3.1 Khz audio ex PLMN transparent.	Speech followed by data duplex async n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3). Speech followed by data duplex sync n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3).	cct mode speech followed by cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 3) on n full rate channels.	Speech NA 8 or 16 kbit/s per TCH/F.	cct mode speech followed by unstructured unrestricted 64 kbit/s.	Fig 6 : 6 a 6 b then1 e or 2 e
	Speech followed by data duplex async n × 14 400 bit/s (n ≤ 2). Speech followed by data duplex sync n × 14 400 bit/s (n ≤ 2).	cct mode speech followed by cct mode unstructured unrestricted n × 14.5 kbit/s (n ≤ 2) on n full rate channels.	Speech NA 16 kbit/s per TCH/F.		Fig 7 : 6 a or 6 b then 1 e or 2 e
	Speech followed by 14 400 bit/s data duplex async	cct mode speech followed by cct mode unstructured unrestricted 14.5 kbit/s on full rate channel	Speech NA 16 kbit/s.	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 6 a or 6 b then 1 b
	Speech followed by 14 400 bit/s data duplex sync	cct mode speech followed by cct mode unstructured unrestricted 14.5 kbit/s on full rate channel	Speech NA 16 kbit/s.	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 6 a or 6 b then 2 b
	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.	Fig 6 : 6a or 6b then 1 b
	Speech followed by 9.6 kbit/s data duplex sync.				Fig 6: 6a or 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.	Fig 6 : 6a or 6b then 1b

(continued)

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

Connection description	Bearer service user data rate	Radio interface connection element	Intermediate rate at the BSS-MSC interface	BSS-MSC connection element	Protocol model in figure 6 or 7
	Speech followed by 4.8 kbit/s data duplex sync.				Fig 6 : 6a or 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.	Fig 6 : 6a or 6b then 1b
	Speech followed by ≤ 2.4 kbit/s data duplex sync.				Fig 6 : 6a or 6b then 2b

Circuit mode unstructured with speech followed by 3.1 Khz audio ex PLMN non transparent.	Speech followed by data duplex async $n \times 4\,800$ ($n \leq 4$) or $n \times 9\,600$ ($n \leq 4$) bit/s.	cct mode speech followed by cct mode SDU unrestricted $n \times 6$ kbit/s ($n \leq 4$) or $n \times 12$ kbit/s ($n \leq 4$) on full rate channels.	Speech NA 8 or 16 kbit/s per TCH/F.	cct mode speech followed by unstructured unrestricted 64 kbit/s.	Fig 6 : 6a or 6b then3e
	Speech followed by data duplex async $n \times 14\,400$ bit/s ($n \leq 4$).	cct mode speech followed by cct mode SDU unrestricted $n \times 14.5$ kbit/s ($n \leq 4$) on n full rate channels.	Speech NA 16 kbit/s per TCH/F.		Fig 7 : 6 a or 6 b then 3 e
	Speech followed by 9.6 kbit/s data duplex async.	cct mode speech followed by cct mode SDU unrestricted 12 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.	Fig 6 : 6a or 6b then 3b
	Speech followed by 14.4 kbit/s data duplex async.	cct mode speech followed by cct mode SDU unrestricted 14.5 kbit/s on full rate channel.	Speech NA 16 kbit/s.	cct mode speech followed by cct mode unstructured unrestricted 64 kbit/s.	Fig 7 : 6a or 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.	Fig 6 : 6a or 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.	Fig 6 : 6a or 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 at the BSS-MSC interface**	**BSS-MSC connection element**	**Protocol model in figure 6 or 7**
Telephony.		cct mode speech.	NA.	cct mode structured 64 kbit/s speech.	Fig 6 : 6 a or 6 b
Emergency calls.		cct mode speech.	NA.	cct mode structured 64 kbit/s speech.	Fig 6 : 6 a or 6 b
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 or n × 6 kbit/s (n ≤ 3) or n × 12 kbit/s (n ≤ 2) on FR transparent.	Speech NA 8 or 16 kbit/s per TCH/F.	cct mode structured 64 kbit/s alternate speech/unrestricted.	Fig 6 : 5, 5b and 6 a or 6 b
		cct mode speech alternating with unstructured unrestricted 14.5 kbit/s or n × 14.5 kbit/s (n ≤ 2) on FR transparent	Speech NA 16 kbit/s per TCH/F.		Fig 7 : 5 and 5 b and 6 a or 6 b
Automatic Facsimile Group 3.	Data cct duplex synchronous access group 3 fax.	cct mode unstructured unrestricted 3.6 or 6 or 12 kbit/s or n × 6 kbit/s (n ≤ 3) or n × 12 kbit/s (n ≤ 2) on FR transparent.	8 or 16 kbit/s per TCH/F.	cct mode structured 64 kbit/s unrestricted.	Fig 6 : 5, 5b
		cct mode unstructured unrestricted 14.5 kbit/s or n × 14.5 kbit/s (n ≤ 2) on FR transparent	16 kbit/s per TCH/F.		
Alternate speech/ Facsimile Group 3.	Data cct duplex synchronous access alternate speech/ group 3 fax.	cct mode speech alternating with SDU unrestricted 6 or 12 kbit/s or n × 6 kbit/s (n ≤ 3) or n × 12 kbit/s (n ≤ 2) on FR non transparent.	Speech NA 8 or 16 kbit/s per TCH/F.	cct mode structured 64 kbit/s alternate speech/unrestricted.	Fig 6 : 6 a or 6 b, 7 a and 7 b
		cct mode speech alternating with SDU unrestricted 14.5 kbit/s or n × 14.5 kbit/s (n ≤ 2) on FR non transparent.	16 kbit/s per TCH/F.		Fig 7 : 6 a or 6 b and 7 a and 7 b
Automatic Facsimile Group 3.	Data cct duplex synchronous access group 3 fax.	cct mode SDUunrestricted 6 or 12 kbit/s or n × 6 kbit/s (n ≤ 3) or n × 12 kbit/s (n ≤ 2) on FR non transparent.	8 or 16 kbit/s per TCH/F.	cct mode structured 64 kbit/s unrestricted.	Fig 6 : 7 a and 7 b
		cct mode SDU unrestricted 14.5 kbit/s or n × 14.5 kbit/s (n ≤ 2) on FR non transparent.	16 kbit/s per TCH/F.		Fig 7 : 7 a and 7 b

NA: Not Applicable

NOTE: The multislot data connections and the connections using TCH/F14.4 coding belong to the General Bearer Services (Classes 20 and~~,~~ 30~~, 40, and 50~~ in TS~~GSM~~ ~~0~~22.0~~0~~2).

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.

Value: - 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

- Restricted digital information (Note: this value is signalled in the "Other ITC" element, due to a lack of further code points in the "ITC" element.)

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.

Value: - 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

- Bidirectional asymmetric (Multislot configurations for data)

Connection configuration:

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

Value: - 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.

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

NOTE 3: 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 4: 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 element is relevant between the IWF and the fixed network.

Values: - 0.3 kbit/s

- 1.2 kbit/s

~~- 1.200/75 bit/s~~

- 2.4 kbit/s

- 4.8 kbit/s

- 9.6 kbit/s

Intermediate rate:

This attribute defines the intermediate rate (according to GSM 08.20 and ~~CCITT~~ITU-T V.110) at the A interface connection element part.

Values: - 8 kbit/s

- 16 kbit/s

Fixed network user rate FNUR (Multislot configurations for data):

This element is relevant between the IWF and the fixed network.

Values: - 9.6 kbit/s

- 14.4 kbit/s

- 19.2 kbit/s

- 28.8 kbit/s

- 38.4 kbit/s

- 48.0 kbit/s

- 56.0 kbit/s

- 64.0 kbit/s

Acceptable channel coding(s) ACC:

This attribute indicates the channel codings acceptable to the MS. This parameter is given at call set-up and it is non negotiable.

Values: 4.8 kbit/s

and/or 9.6 kbit/s

and/or 14.4 kbit/s

and/or 28.8 kbit/s

and/or 32.0 kbit/s

and/or 43.2 kbit/s

Maximum number of TCH/Fs (Multislot configurations for data):

This attribute is given at call set-up and it enables the mobile user to limit the number of TCH/Fs used during the call.

Values: 1

2

3

4

5

6

7 (note 5)

8 (note 5)

NOTE 5: Not used by the currently specified services.

Wanted air interface user rate (AIUR) (Multislot configurations for data):

This attribute is applicable to non-transparent services only, and it gives the AIUR that the mobile user wants and which the network tries to achieve but which it is not allowed to exceed.

Values: Not applicable

9.6 kbit/s

14.4 kbit/s

19.2 kbit/s

28.8 kbit/s

38.4 kbit/s

43.2 kbit/s

57.6 kbit/s

User initiated modification indication (Multislot configurations for data):

This element is relevant between the MT and the IWF.

Values: - User initiated modification not requested

- User initiated modification up to 1 TCH/F requested

- User initiated modification up to 2 TCH/F requested

- User initiated modification up to 3 TCH/F requested

- User initiated modification up to 4 TCH/F requested

The parameters where it is indicated that they are related to Multislot configurations for data are optional.

For multislot configuration, the following applies to the parameters contained in the BC-IE:

- Half rate channels are not supported. The MS shall code the radio channel requirement as "Full rate support only MS" or "Dual rate support MS, full rate preferred". In the second case, the network shall assign full rate channel(s) only.
- The "fixed network user rate" and "other modem type" take precedence over the "user rate" and "modem type", except for modem types “autobauding”, “modem for undefined interface” or “none”.
- The "intermediate rate" parameter is overridden. The intermediate rate used per each TCH/F is derived from the chosen channel type:

  channel type IR per TCH/F

  TCH/F4.8 8 kbit/s

  TCH/F9.6 16 kbit/s

  TCH/F14.4 16 kbit/s (on the A interface but 32 kbit/s inside the MS)

- The user rate per TCH is derived from the chosen channel type:

  channel type user rate per TCH

  TCH/F4.8 4.8 kbit/s

  TCH/F9.6 9.6 kbit/s

  TCH/F14.4 14.4 kbit/s

For CE: T, the padding procedure described in GSM 04.213.34 can be applied.

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.22bis

- V.23

- V.26ter

- V.32

- Autobauding type 1

- None

Other Modem Type (OMT):

This element is relevant between the MS and IWF.

Values: - No other modem type

- V.32bis

- V.34

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 6)

NOTE 6: Only applicable for the asynchronous transmission between the reference access points, if connection element is "non 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.

Values: - I.440/450

- X.21

- X.28, dedicated PAD, individual NUI (note 7)

- X.28, dedicated PAD, universal NUI (note 7)

- X.28, non dedicated PAD

- X.32

NOTE 7: This value was used by services defined for former GSM releases and does not need to be supported.

Rate adaptation:

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

Values: - V.110/X.30

- X.31 flag stuffing

- No rate adaptation

- V.120 (Note: This value is signalled in the "Other Rate Adaption" element, due to a lack of further code points in the "Rate Adaptation" element.)

Coding standard:

This attribute refers to the structure of the BC-IE defined in the TS~~GSM 0~~24.008.

Value: - GSM

User information layer 1 protocol:

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

Value: - Default

Rate adaption header/no header:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Rate adaption header not included

- Rate adaption header included

Multiple frame establishment support in data link:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Multiple frame establishment not supported. Only UI frames allowed

- Multiple frame establishment supported

Mode of operation:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Bit transparent mode of operation

- Protocol sensitive mode of operation

Logical link identifier negotiation:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Default, LLI=256 only

- Full protocol negotiation (note ~~7~~8)

NOTE 8~~7~~: A connection over which protocol negotiation will be executed is indicated in the "In-band/out-band negotiation" parameter.

Assignor/assignee:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Message originator is "default assignee"

- Message originator is "assignor only"

In-band/out-band negotiation:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Negotiation is done with USER INFORMATION messages on a temporary signalling connection

- Negotiation is done in-band using logical link zero.

3GPP-N3/SMG3 WPD Meeting #7
Sophia Antipolis, France, 29 Nov-03 Dec 1999

***Document* N3-99352**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

27.001	CR	008	Current Version:	3.2.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG_N#6	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑	for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [X]

Source: TSG_N3 **Date:** 21-11-1999

Subject: Service clean-up for Release 99

Work item: Service clean-up for Release 99

Category: *(only one category shall be marked with an X)*

F	Correction	
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	X
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Due to the deletion of services in GSM R99 (dual services, dedicated services) this specification has to be updated.

Clauses affected:

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:


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<--------- double-click here for help and instructions on how to create a CR.

3G TS 27.001 V3.2.0 (1999-10)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS) (3G TS 27.001 version 3.2.0)

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Contents

Foreword

This Technical Specification has been produced by the 3GPP.

This TS specifies the functions needed for terminal adaptation 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 this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 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 specification;

1 Scope

This TS based on the principles of terminal adaptor functions presented in the CCITT I-series of recommendations (I.460 - I.463).

The GSM PLMN supports a wide range of voice and non-voice services in the same network. In order to enable non-voice traffic in the GSM PLMN there is a need to connect various kinds of terminal equipments to the Mobile Termination (MT). The target of this ETS is to outline the functions needed for the terminal adaptation.

In the GSM 02.02 (ETS 300 904) the bearer services are described. The general network configuration is described in GSM 03.02 and the GSM PLMN access reference configuration is defined in GSM 04.02. The various connection types used in the GSM PLMN are presented in GSM 03.10. Terminology used in this ETS is presented in GSM 01.04 (ETR 350). For support of data services between GSM PLMN and other networks see GSM 09-series of Specifications.

Note: From GSM R99 onwards the following services are no more required to be provided by a GSM PLMN:

- the dual Bearer Services “alternate speech/data” and “speech followed by data”
- the dedicated services for PAD and Packet access
- BS 21 ... 26 and BS 31 ... 34

The support of these services is still optional. The specification of these services is not within the scope of this TS. For that, the reader is referred to GSM Release 98.

2 Normative 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.02: "Digital cellular telecommunication system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[3] GSM 02.03: "Digital cellular telecommunication system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[4] GSM 03.02: "Digital cellular telecommunication system (Phase 2+); Network architecture".

[5] GSM 03.10: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) connection types".

[6] GSM 04.02: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".

[7] GSM 04.08: "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification".

[8] GSM 04.21: "Digital cellular telecommunication system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[9] GSM 04.22: "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".

[10] GSM 05.05: "Digital cellular telecommunication system (Phase 2+); Radio transmission and reception".

[11] GSM 07.02: "Digital cellular telecommunication system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[12] GSM 07.03: "Digital cellular telecommunication system (Phase 2+); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[13] GSM 07.05: "Digital cellular telecommunication system (Phase 2+); Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)".

[14] GSM 07.07: "Digital cellular telecommunication system (Phase 2+); AT command set for GSM Mobile Equipment (ME)

[15] GSM 09.01 (ETR 359): "Digital cellular telecommunication system (Phase 2); General network interworking scenarios".

[16] GSM 09.02: "Digital cellular telecommunication system (Phase 2+); Mobile Application Part (MAP) specification".

[17] GSM 09.03: "Digital cellular telecommunication system (Phase 2+); Signalling requirements on interworking between the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) and the Public Land Mobile Network (PLMN)".

~~[18] GSM 09.04: "Digital cellular telecommunication system (Phase 2+); Interworking between the Public Land Mobile Network (PLMN) and the Circuit Switched Public Data Network (CSPDN)".~~

~~[19] GSM 09.05: "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 (PAD) facility access".~~

[20] GSM 09.06: "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".

[21] GSM 09.07: "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)".

[22] GSM 09.08: "Digital cellular telecommunication system (Phase 2+); Application of the Base Station System management Application Part (BSSMAP) on the E-interface".

[23] GSM 09.10: "Digital cellular telecommunication system (Phase 2+); Information element mapping between Mobile Station - Base Station System and BSS - Mobile-services Switching Centre (MS - BSS - MSC) Signalling procedures and the Mobile Application Part (MAP)".

[24] GSM 09.11: "Digital cellular telecommunication system (Phase 2+); Signalling interworking for supplementary services".

[25] GSM 09.90: "Digital cellular telecommunication system (Phase 2+); Interworking between Phase 1 infrastructure and Phase 2+ Mobile Stations (MS)".

[26] CCITT Series V Recommendations: "Data communication over the Telephone network".

[27] CCITT Series V.42bis: "Data Compression for Data Circuit Terminating Equipment (DCE) using Error Correction Procedures".

[28] CCITT Series X Recommendations: "Data Communication networks”.

[29] 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".

[30] CCITT Recommendation X.150: "Data Communication Networks: Transmission, Signalling and Switching, Network Aspects, Maintenance and Administrative Arrangements".

[31] CCITT Recommendation V.25bis: "Automatic Calling and/or Answering Equipment on the General Switched Telephone Network (GSTN) using the 100-Series Interchange Circuits".

[32] ITU-T Recommendation V.25ter: "Serial asynchronous automatic dialing and control".

[33] CCITT Recommendation V.54: "Loop Test Devices for Modems".

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

[35] CCITT Recommendation I.460-I.464: "ISDN Overall Network Aspects and Functions, User Network Interfaces".

[36] ETS 300 102-1: "Integrated Services Digital Network (ISDN); User-network interface layer 3 specifications for basic call control".

[37] ETR 018: "Integrated Services Digital Network (ISDN), Application of the BC-, HLC-, LLC-Information elements by terminals supporting ISDN services".

[38] ISO/IEC 6429: "Information technology - Control functions for coded character sets".

[39] Personal Computer Memory Card Association: "PCMCIA 2.1 or PC-Card 3.0 electrical specification or later revisions".

[40] IrDA "IrPHY Physical signalling standard".

[41] TIA-617: "Data Transmission Systems and Equipment - In-Band DCE Control".

[42] CCITT Recommendation V.120: "Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing".

[43] GSM 03.34:”Digital cellular telecommunication system (Phase 2+); High Speed Circuit Switched Data (HSCSD); Stage 2 Service description”.

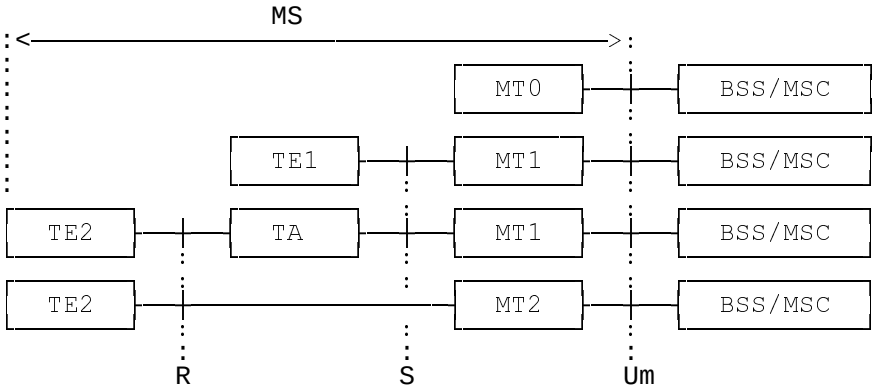
3 Abbreviations and Definitions

In addition to those below, abbreviations used in this TS are listed in GSM 01.04.

CALL PROC	CALL PROCEEDING
CALL CONF	CALL CONFIRMED
CONNACK	CONNECT ACKNOWLEDGEMENT
EDGE channel	A general term referring to channels based on 8PSK modulation; i.e. TCH/F28.8, TCH/F32.0, and TCH/F43.2.

4 Access reference configuration

Figure 1 presents the reference configuration for access to a GSM PLMN (see GSM 04.02).



┼ = reference point

TE1 = ISDN terminal

TE2 = V- or X-type terminal

TA = Terminal Adaptor

BSS = Base Station System

MSC = Mobile Switching Centre

Figure 1: GSM PLMN Access Reference Configuration

Within the scope of this ETS the Mobile Termination MT0 means a fully integrated MS including data terminal and its adaptation functions. MT1 includes ISDN terminal adaptation functions and MT2 includes CCITT V- or X-series terminal adaptation functions among other MT functions.

5 Functions to support data services

The main functions of the MT to support data services are:

- functions to ensure conformity of terminal service requests to network capability;
- physical connection of the reference points R and S;
- flow control of signalling and mapping of user signalling to/from GSM PLMN access signalling;
- rate adaptation of user data (see GSM 04.21);
- flow control of non-transparent user data and mapping of flow control for asynchronous data services;
- support of data integrity between the MS and the interworking function in the GSM PLMN;
- end-to-end synchronization between terminals;
- filtering of status information;
- functions to support non-transparent bearer services e.g. termination of the Radio Link Protocol (RLP) and the Layer 2 Relay function (L2R) including optional data compression function (where applicable);
- terminal compatibility checking;
- optional support of local test loops.

In addition, functions to support autocalling and autoanswering are optionally specified in accordance with CCITT Rec. V.25 bis or with ITU-T Reccomendation. V.25 ter (although the use of other autocalling/auto-answering procedures are not prohibited provided that mapping in a functionally equivalent way to GSM 04.08 call control is also provided).

Other functional entities can be envisaged apart from the TAF. One of the physical interface to all these functions is the DTE/DCE interface to the MT. Normally, this DTE/DCE interface is associated with the TAF, if available. Therefore the access to any of these other functional entities, if implemented, via the DCE/DTE interface must be triggered by appropriate command sequences which are described in the applicable specifications (although the use of other procedures is not prohibited provided that mapping in a functionally equivalent way is also provided). These command sequences can be issued by the DTE only when the MT is in the appropriate command status and there is no data connection pending. They are interpreted by an MT internal control function and result in an association of the DTE/DCE interface with the addressed function, if available.

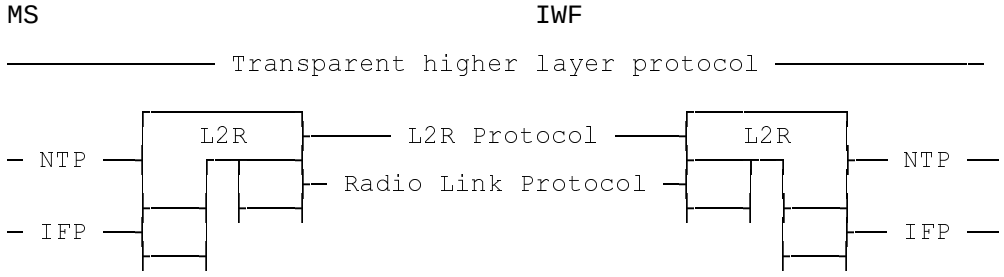
6 Support of non transparent Bearer Services

In order to support non transparent bearer services a Layer 2 Relay (L2R) function is included in the mobile termination. The details of the particular L2R function for the different non transparent bearer services are contained in the appropriate GSM 07-series Specification. This section describes the general aspects of the L2R function.

The Layer 2 Relay (L2R) function provides for the reliable transportation of known, i.e. non transparent, user protocols across the radio interface of a GSM PLMN. The L2R functions are located in the Mobile Termination (MT) and the Interworking Function (IWF) associated with a Mobile Switching Centre (MSC). The L2R uses the services provided by the Radio Link Protocol (RLP) to transport the non transparent protocol information between the MS and the IWF.

6.1 Functions of the Layer 2 Relay

The complete protocol reference models for data and telematic services are described in GSM 03.10. The subset of those protocol reference models relating to the L2R function is reproduced in figure 2.



NTP Non Transparent Protocol
IFP Interface Protocol

Figure 2

The Non Transparent Protocol (NTP) will normally be a layer 2 protocol for OSI conformant protocols or an equivalent in the case of non OSI protocols. The Interface Protocol (IFP) will normally be a layer 1 protocol for OSI conformant systems or equivalent for non OSI systems.

The L2R can be considered to consist of 3 sub-functions, see figure 3.

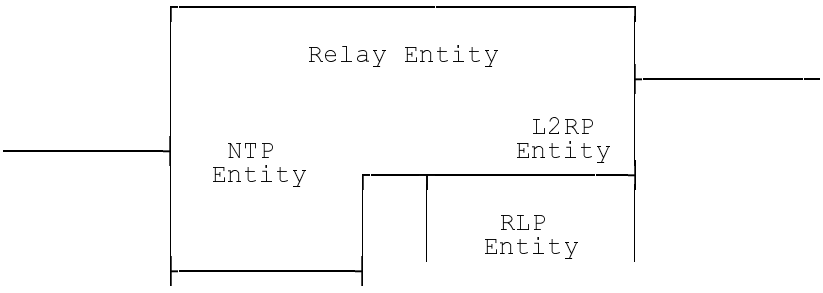


Figure 3

The 3 sub-functions are:

- A Non Transparent Protocol Entity
- A L2R Protocol Entity
- A Relay Entity

The NTP-entity interfaces the L2R to the IFP-entity and provides an interface to the particular NTP.

The L2RP-entity interfaces the L2R to the RLP-entity and provides an interface to the appropriate L2R protocol.

The Relay-entity provides the mapping between the NTP-entity and the L2R-entity. If applicable, it contains the data compression function. The negotiable parameters are exchanged with the remote Relay-entity by means of the RLP XID frame.

It should be noted that the inter-layer interfaces within the MS and the IWF and within the L2R will not be specified by GSM, any description given is for explanatory purposes only and is not intended to indicate a method of implementation. Therefore, the specification of the L2R is in terms of the peer-peer protocols. Generally, the non transparent and interface protocols will be specified elsewhere, e.g. CCITT Recommendation X.25 Layer 2 and 1. Thus the main specification for the L2R will consist of the L2R peer-peer protocols.

6.2 Radio Link Services Used

The L2R function uses services defined in GSM Specification 04.22 (Radio Link Protocol).

6.3 Flow Control - General Description

A flow control active condition can take place under a number of circumstances:

- End to end flow control (DTE to DTE matter);
- Backpressure (buffers filling);
- Receive not ready (RLP condition).

It is possible that there will be an interaction between flow control active and inactive conditions in each circumstance.

6.3.1 End to End Flow Control

A DTE may wish to send a flow control active condition to another DTE.

Provisions exists in the L2R entity to transfer a flow control active condition (sent by its associated DTE) to the other L2R entity as soon as possible. This mechanism in the L2R entities allows such a flow control condition to be put ahead of any queuing which exists in the L2R entities.

Such a mechanism avoids build up of data in buffers which can be undesirable.

The L2R entity, receiving a flow control active condition from its associated DTE, stops sending data to that associated DTE immediately.

6.3.2 Back Pressure

The L2R and RLP entities have buffers which may become full to a predetermined threshold for a number of reasons, e.g. severe radio fading, failure or slowness of DTE to react to end to end flow control, certain RNR conditions. When this predetermined threshold is reached, a flow control active condition is sent to the associated DTE which is then prevented from sending any data, subsequently, the flow control inactive condition is sent to the associated DTE when the L2R or RLP entities have indicated that there is sufficient free capacity in their buffers for data flow from the associated DTE to proceed.

The corresponding peer-layer procedure to assess the respective buffer conditions are a layer management matter and are not dealt with here. It is also considered an implementation matter to ensure that such procedure do not result in loss of data or considerable reduction in throughput.

6.3.3 Receive not Ready

When the RNR condition arises, an RLP indication is sent to the other RLP entity which in turn shall send a flow control active condition to its associated L2R entity. That L2R entity shall then send a flow control active condition to its associated DTE.
An RNR condition may result in the Execution of "back pressure" as mentioned under 6.3.2.

6.4 User initiated service level up and down grading

When the value of the negotiated UIMI parameter is greater than 0, the MS may at any time during the call, control, to some extent, the number of traffic channels to be used. This is done by signalling a higher or lower value for the wanted air interface user rate (WAIUR) and maximum number of traffic channels (mTCH). The network will assign an AIUR matching the WAIUR using up to mTCH traffic channels, provided that the resources are available (GSM TS 02.34, 03.34, 04.08).

If the value of the RLP optional feature ‘Up signalling’ is negotiated to 1, the MS may receive a suggestion from the network to initiate an upgrading. This occurs when the following condition holds:

The IWF

1) is receiving user data from the fixed network side at a higher rate than the current AIUR, or,

2) in symmetrical calls only, can send user data towards the fixed network side at a higher rate than the current AIUR.

The MS can detect the condition stated in 1) and 2) above by examining the value of the UP bit in the received RLP S and I+S frames. When the condition does not hold, the value of the UP bit is continuously 0. If the condition does hold, the number of 1s between two consecutive 0s indicates the number of traffic channels to upgrade by. There is no need to repeat this indication since the FCS protects it. For instance, if the UP bit sequence is ...01100... and the current number of assigned traffic channels is 2, then an upgrading 4 traffic channels is suggested. .NOTE: From MSC/IWF's perspective a TCH/F28.8 or TCH/F43.2 EDGE configuration is identical to a multislot 2×TCH/F14.4 or 3×TCH/F14.4 configuration. Therefor, a factor of 1/2 or 1/3 has to be applied to the suggested increase when the assigned up link channel is TCH/F28.8 or TCH/F43.2 respectively.

The MS may use the information signalled in the UP bit to find out when a service level upgrading may increase the data throughput. In order to initiate a service level upgrading, the value of UIMI must be greater than the number of currently assigned channels.

In order to determine when to downgrade, the MS may compare the rate of received and sent information in the RLP frames to the AIUR. If the rate of received and sent information is less than the current AIUR the MS may initiate a downgrading.

User initiated service level up and down grading mechanism may also be used to modify the asymmetry preference, see Section 6.5. This is achieved by sending a new value of the asymmetry preference in the BC-IE.

6.5 Asymmetry preference indication

The MS's classmark may restrict the possible number of channels or modulation that may be assigned by the network in one of the directions. This may result in an asymmetric transmission, i.e., different numbers of channels or modulations are assigned in each direction.

Asymmetric transmission may also result from a preference indication. At call set up, the MS may send an asymmetry preference indication in the BC-IE (see GSM TS 04.08). There are three options:

1) no preference

2) up link biased asymmetry preferred

3) down link biased asymmetry preferred

If down or up link asymmetry preference is indicated, the network shall not assign EDGE channels on the unbiased link. If the network assigns EDGE channels on the biased link, it shall assign TCH/F14.4 on the unbiased link. The WAIUR shall then apply to the biased link.

7 Structure of the GSM 07-series of Specifications

The structure of the Specifications is as follows:

07.01 General on Terminal Adaptation Functions for Mobile Stations

07.02 Terminal Adaptation Functions for Services using Asynchronous Bearer Capabilities

This Specification defines the interfaces and terminal adaption functions integral to a MT which enable the attachment of Asynchronous Terminals to a MT.

07.03 Terminal Adaptation Functions for Services using Synchronous Bearer Capabilities

This Specification defines the interfaces and terminal adaptation functions integral to a MT which enable the attachment of Synchronous Terminals to a MT.

8 Functions common to all interfaces

8.1 Synchronization of the Traffic Channel

As long as there is no connection between the traffic channel and the interface to the TE this interface must be terminated in the appropriate way.

Prior to exposing the traffic channel of a GSM PLMN connection to transmission of user data, the controlling entities of the connection have to assure of the availability of the traffic channel(s). This is done by the so called synchronization process:

- starting on the indication of "physical connection established" resulting from the PLMN inherent outband signalling procedure. This indication is given on reception of the message CONNECT in case of MOC, on reception of the message CONNACK in case of MTC and on reception of the message MODIFY COMPLETE in case of in-call modification;

- ending by indicating the successful execution of this process to the controlling entity, which then takes care of the further use of the inband information (data, status).

It should be noted that during the call control phases (set-up and clear), the procedures at the V.-series and X.-series DTE interfaces can be mapped completely to the out-of-band signalling procedure. The state of the S-bits and X-bits during the call control phases are irrelevant to the DTE interface procedures. However, the "ready for data" condition (i.e. CTs 106 and 109, in the case of V.-series interface, and I-circuit, in the case of X.-series interface) is derived from the status bits received by the TAF once synchronization is complete. Since half duplex operation is not supported by a GSM PLMN, status bit SB is not needed to signal the turn around of the connection.

8.1.1 Transparent services

8.1.1.1 Initial procedure for traffic channel types TCH/F4.8 and TCH/F9.6

With respect to the TAF for the transparent bearer capability support the synchronization procedure with the channel codings 2.4, 4.8 and 9.6 kbit/s is as follows:

- sending of synchronization pattern 1/OFF (all data bits "1" / all status bits "OFF", all E-bits "1") to the IWF. In multislot transparent operation, the synchronisation pattern sent is 1/OFF with the exception of the bit positions S1, first X, S3, and S4 which contain the substream number and multiframe alignment pattern (Ref. GSM TS 04.21);

- searching for detection of the synchronization pattern received from the IWF, and in multislot operation, also searching for the multiframe alignment pattern “0000 1001 0110 0111 1100 0110 1110 101” (Ref. to GSM 04.21) in bit position S4 and substream numbers in bit positions S1, first X, and S3. The value of the bits E4-E7 shall not be checked;

8.1.1.2 Initial procedure for traffic channel types TCH/F14.4 and TCH/F28.8

With respect to the TAF for the transparent bearer capability support the procedure with the TCH/F14.4 or TCH/F28.8 is as follows:

- sending of synchronization pattern 1/OFF (all data bits "1" / status bits in M2 "OFF") to the network in the multiframe structure with the multiframe alignment pattern “0000 1001 0110 0111 1100 0110 1110 101” in the M1 (Ref. to GSM TS 4.21) and, in a multislot or TCH/F28.8 case, sending substream numbers in the bit M2

- searching for the detection of the multiframe alignment pattern “0000 1001 0110 0111 1100 0110 1110 101” (Ref. to GSM 04.21) in the bit M1 originating from the network, and, in a multislot or TCH/F28.8 case, searching for substream numbers in the bit M2. (Any 5 bit sequence in the multiframe alignment pattern is unique, i.e. the multiframe alignment can take place by the recognition of five successive S1 bits.)

8.1.1.3 Subsequent procedures for traffic channel types TCH/F4.8, TCH/F9.6, TCH/F14.4, and TCH/F28.8

When the synchronisation pattern and, in case of multislot, TCH/F14.4 or TCH/F28.8 operation the multiframe alignment pattern from the IWF have been recognized as a steady state (see note) the TAF continues sending the synchronization patterns to the IWF until a timer T (=500ms) expires.

NOTE: - An idle frame sent by the BSS and received by the MS has the same pattern as the synchronization pattern 1/OFF.

- At the moment when the message CONNECT (MOC) or CONNACK (MTC) is received at the MS, it is guaranteed that this pattern is received from the MSC/IWF with the exception of a loss of frame synchronization on the Abis interface.

- The handling of frame stealing in case of 2400 bit/s full rate data channels is implementation dependent.

8.1.1.3.1 V.-series interface

During the synchronization process described above, i.e. while the synchronization pattern is being sent by the MT, CT106, 107 and 109 remain in the OFF condition.

After the expiration of the timer T of each allocated traffic channel for the call, the X and SB bits received from the IWF are mapped on to CT 106 and CT 109, respectively, at the MT/DTE interface according to the filtering process described in section 8.2. The received SA bit, if available, is ignored. The condition on CT107 is changed from "OFF" to "ON", the data bits received from the IWF are mapped to CT104, and CT103 is mapped to the data bits sent towards the IWF. The transmitted SA (if available), SB and X bits shall be set to "ON".

8.1.1.3.2 X.-series interface

The procedure is described in GSM 07.03, "X.21 procedures mapping".

8.1.1.3.3 S interface (I.420)

During the synchronization process described above, i.e. while the synchronization pattern is being sent by the MT, the MT will not send the V.110 frame structure to the S interface. Once the timer T of each traffic channel(s) allocated for the call expires the synchronization pattern will continue to be transmitted from the MT to the IWF, however, the MT will start sending the frames received from the IWF to the S interface. The MT will start looking for the V.110 frame alignment to be received from the S interface. On recognizing frame alignment the MT will cease sending its

synchronization pattern to the IWF and connect the S interface through to the IWF. In case of multislot, TCH/14.4, or TCH/F28.8 operation the MT shall adapt the data stream as defined in GSM TS 04.21.

8.1.2 Non-transparent services

With respect to the TAF for non-transparent bearer capability support the synchronization procedure is as follows:

- firstly, receiving frames on all allocated traffic channels for the call
- secondly, initiating the RLP link establishment by sending a RLP-SABM across the radio interface.

8.1.2.1 V.-series interface

During the synchronization process described above, i.e. while the synchronization pattern is being sent by the MT, CT106, 107 and 109 remain in the OFF condition.

When the RLP link has been established, CT107 will be changed from "OFF" to "ON". From this time the information from/to the RLP, including status changes, will be mapped by the L2R entity applicable to the particular bearer capability (GSM 07.02, 07.03 "L2R functionality").

8.1.2.2 X.-series interface

The procedure is described in GSM 07.03, "X.21 procedures mapping".

8.1.2.3 S interface (I.420)

The MT will not send V.110 frame structure to the S interface and will not start looking for V.110 frame alignment to be received from the S interface unless the RLP link has been established. On recognizing V.110 frame alignment the information from/to the RLP will be mapped by the L2R entity.

8.1.3 Action on loss of synchronization

8.1.3.1 Loss at the TAF-radio interface

If the TAF detects a loss of synchronisation on one or more channels, it initiates the re-synchronisation process. The TAF searches for the data frame structure in those channels in which the synchronisation has been lost according to the initial procedures described in sections 8.1.1 and 8.1.2. The information received from the channels shall continue to be processed as if the synchronisation had not been lost, i.e. corrupted data is forwarded towards RLP entity or TE during the re-synchronisation process. No action shall be taken on the frames being transmitted towards the MSC, other than to continue sending them normally.

8.1.3.2 Loss at the TAF-terminal interface

This section is applicable only to terminals attached by means of an S interface (I.420).
If the TAF detects a loss of frame synchronisation on the TAF-TE interface, the TAF initiates a re-synchronisation on that link in line with the procedures specified in CCITT V.110. No further action shall be taken by the TAF on the TAF-radio interface or on the V.110 frames being transmitted towards the TE.

8.2 Filtering of Channel Control Information (transparent mode only)

8.2.1 General

The DTEs used at the MS side of the PLMN conform to CCITT's DTE/DCE interface specifications, which assume basically an error-free environment, i.e.

- limited distance, point-to-point local interconnection of the interface circuits for data and status;
- steady state signalling.

The envisaged use of these DTEs in the PLMN environment leads to the exposure of these "interconnections" to the PLMN radio channel. To assure proper operation even under these conditions appropriate measures have to be taken. In the non transparent case the RLP satisfies the requirement for both data and status lines.

In the transparent case the

- data line aspects have to be dealt with end-to-end by the users, while
- status line aspects are of concern to the network, and are dealt with in the following.

8.2.2 Filtering process to be applied

Filtering of channel control information is relevant only at the MS side and in the transparent mode of operation. By applying filtering measures the condition of a DTE/DCE control interchange circuit, for which the DTE constitutes the information sink, will be preserved until another condition is signalled for an "integration time" period by the channel control information (status bits) of the rate adaptation scheme.

The filtering mechanism is understood to reside between the rate adaptation function (information source) and the DTE (information sink). It receives the unfiltered condition of the respective control interchange circuit set according to the actual sequential appearance of the individual associated status bits and forwards the filtered condition to the DTE.

The filtering process starts when the traffic channel synchronization ends with the expiry of timer T.

8.2.2.1 V.-series interface

CT 106

In the transparent mode the remote inband control of this circuit is needed to support a modem retrain procedure.

OFF-ON transition at the MS will authorize the DTE to send data; if wrongly set, loss of data may occur.

ON-OFF transition at the MS will cause the DTE to cease transmitting data; set wrongly may impair the performance in connection usage.

CT 109

In the transparent mode the remote inband control of this circuit is needed to:

- trigger the interpretation of received data;
- indicate to the DTE the state of the connection.

OFF-ON transition at the MS will authorize the DTE to rely on the condition of the received data interchange circuit, set wrongly may cause receipt of wrong data, while setting late may cause loss of data.

ON-OFF transition at the MS:

- will cause the DTE to cease receiving data;
- may initiate release of the connection during a data phase by the DTE giving an ON-OFF transition on circuit 108/2.

Setting this condition wrongly may cause loss of data and potentially release the connection.

8.2.2.2 X.-series interface

I-circuit

The OFF-ON transition of this circuit in connection with the appropriate conditions of the other interchange circuit will indicate the "ready for data" status of the connection. As received data may commence immediately following this status change, the delay in conveying this condition shall be kept as short as possible.

As a clear request/indication will be directly mapped to the PLMN outband signalling the ON-OFF integration time should be rather long.

8.2.2.3 Filtering mechanism

8.2.2.3.1 Traffic channel types TCH/F4.8 and TCH/F9.6

A filtering mechanism shall be provided by an integration process on those SB and X bits carrying status information in the V.110 frame or in the multiframe structure. The integration periods applied are:

V-series	**Transition**	**Integration period**	**Status stream**
CT 106	Off-On	1 s	X
CT 106	On-Off	1 s	X
CT 109	Off-On	200 ms	SB
CT 109	On-Off	5 s	SB
X-series	**Transition**	**Integration period**	**Status stream**
I-circuit	Off-On	40 ms	SB
I-circuit	On-Off	5 s	SB

The integration process shall ensure that the interchange circuits do not change state in response to spurious transitions of the status bits during the integration period.

The integration process shall operate reliably with error characteristics as specified in GSM 05.05.

8.2.2.3.2 Traffic channel type TCH/F14.4

To change the state of CT 109 (or I-circuit) or CT 106, it is required that at least two consecutive SB-bits or X-bits, respectively, carry the same value.

8.3 Terminal Compatibility Decision

The establishment of a mobile terminated connection depends on a positive decision on the terminal compatibility. The Mobile Station (MS) contributes to this process by performing (depending on the individual call set-up condition):

- a compatibility check;
- the selection of the appropriate terminal function; and
- the indication of compatibility requirements to the PLMN;

initiated by a call set-up request from the PLMN. The aforementioned functions shall be carried out as follows.

8.3.1 Compatibility Check

Annex B of GSM 04.08 applies, particularly paragraphs B.3, B.3.1 and B.3.2. As regards the therein mentioned user-to-user compatibility checking the following applies:

When the calling user requests a service with user-to-user compatibility significance indicated by the presence of HLC and LLC information element in the call set-up request, the MS shall check that the service supported by the called user matches concerning the contents of the HLC/LLC information element. If a mismatch is detected, then the MS shall reject the offered call using the cause No.88 "Incompatible Destination".

8.3.2 Selection of Appropriate Terminal Function

The MS shall select the appropriate terminal functions following a positive result of the compatibility check and/or forwarding the indication of compatibility requirements to the PLMN.

8.3.3 Indication of Compatibility Requirements to the PLMN

8.3.3.1 Indication in case of Mobile terminating calls

In support of:

- PSTN originated calls, and
- ISDN originated calls using 3.1 kHz audio Bearer Capability (BC), as well as
- ISDN originated calls using unrestricted digital Bearer Capability but not specifying all parameters for deducing a Bearer Service.

Mobile specific requirements to be dealt with in the Bearer Capability information element the call confirmed message has been introduced in the call control protocol (GSM 04.08). This also allows for renegotiation of specific parameters at the beginning of the connection set-up process. The specific parameters are:

a) mobile specific requirements:

   - Connection element (transparent/non transparent);
   - Structure (note 1);
   - User information layer 2 protocol (note 1);
   - Intermediate rate (note 2), (note 3);
   - Modem Type (note 1), (note 3);
   - User Rate (note 3);
   - Compression ,
   - Fixed network user rate, (note 3) (note 4)
   - Other modem type, (note 3) (note 4)
   - User initiated modification indication(note 4)

   The following parameters are indicated by the MS to the network, only:

   - Acceptable channel codings (note 5)
   - Maximum number of traffic channels, (note 5)
   - Wanted air interface user rate (note 6) (note 7)
   - Asymmetry preference indication (note 7)

NOTE 1: This parameter is correlated with the value of the parameter connection element.

NOTE 2: For non-transparent services this parameter is correlated with the value of the parameter negotiation of intermediate rate requested.

NOTE 3: Modification of these parameters may be proposed by the MS. The Network may accept it or not.

NOTE 4: This parameter shall be included by the MS only in case it was received from the network.

NOTE 5: This parameter shall be included only in case the parameter ‘fixed network user rate’ is included.

NOTE 6: This parameter shall be included only for non-transparent services and in case the parameter ‘fixed network user rate’ is included.

NOTE 7: This parameter has to be included if EDGE channel coding(s) are included in Acceptable channel codings. In cases where this parameter would not otherwise be included, the value is set to 'Air interface user rate not applicable' or 'User initiated modification not requested' or “No preference’.

b) requirements with effects at the partner terminal:

- Number of data bits;
- Number of stop bits;
- Parity.

The MS indicates the radio channel requirement in the call confirmed message. If the MS indicates the support of "dual" (HR and FR channels) the final decision, which radio channel is chosen, is done by the network in an RR message.

If the network proposes optional support of both transparent and non transparent connection elements but does not indicate a user information layer 2 protocol, the MS shall set the appropriate value, if choosing non transparent in the call confirmed message and out-band flow control is not requested.

Additionally the values of the parameters structure, modem type and intermediate rate have to be set in conformance with the values of the parameters radio channel requirements, negotiation of intermediate rate requested and connection element.

Section B.1.1.2 and table B.1 in the annex B describe the negotiation procedure. Annex B table B.4 describes the selection of the modem type and the dependence on the value of the parameter connection element. Annex B table B.4 describes the selection of the intermediate rate and user rate and their dependence upon the value of the NIRR parameter and the equipment capabilities.

The following MTC cases can be deduced from the individual call set-up request conditions

a) If the set-up does not contain a BC information element, the MS in the call confirmed message shall include any BC information (single or multiple BC-IE). In case of multiple BC-IEs one BC-IE must indicate the information transfer capability "speech".

b) If the set-up message contains a single BC-IE, the MS in the call confirm message shall use either a single BC-IE, if it wants to negotiate mobile specific parameter values, or, unless otherwise specified in annex B, no BC-IE, if it agrees with the requested ones.

c) If the set-up contains a multiple BC-IE, the MS in the call confirmed message shall use either a multiple BC-IE, if it wants to negotiate mobile specific parameter values, or, unless otherwise specified in annex B, no BC-IE, if it agrees with the requested ones. Alternatively a single BC-IE containing fax group 3 only shall be used if a multiple BC-IE requesting speech alternate fax group 3 is received and the MS is not able to support the speech capability. Annex B, table B.7, describes the negotiation rules.

If the BC-IE contains 3.1 kHz ex PLMN, the MS is allowed to negotiate all mobile specific parameter values listed above. If the BC-IE contains facsimile group 3, the MS is allowed to negotiate the connection element (transparent/non transparent) only. In any case, if the set-up message requests a "single service", the MS must not answer in the call confirmed message requesting a "dual service" and vice versa.

However, for dual services with repeat indicator set to circular (alternate) the MS may change the sequence of dual BC-IEs within the call confirmed message (preceded by the same value of the repeat indicator), if it wants to start with a different Bearer Capability than proposed by the network as the initial one.

In addition, the MS may propose to the network to modify User Rate, Modem Type and Intermediate Rate in the CALL CONFIRMED message. The network may accept or release the call.

If the BC-IE received from the network contains the parameters ‘fixed network user rate’, ‘other modem type’ and possibly the ‘user initiated modification’, the MS can either:

a) discard these parameters, or

b) include the possibly modified values for the ‘fixed network user rate’ and ‘other modem type’ in the BC-IE of the call confirmed message. The network might accept or reject the modified values. In this case the MS shall also include the parameters ‘maximum number of traffic channels’ and ‘acceptable channel codings’. Additionally for non-transparent services, the MS shall also include the parameters ‘wanted air interface user rate’ and the ‘user initiated modification indication‘.

In case a),The MS shall use the fall-back bearer service indicated by the remaining parameters of the BC-IE on a single slot configuration (reference GSM 04.21).

In case b), a single slot configuration shall be used by the MS, in case the ‘maximum number of traffic channels’ is set to “1 TCH“ and the ‘user initiated modification indication’ is set either to “user initiated modification not required” or to “user initiated modification up to 1TCH may be requested”; other wise the MS shall use a multislot configuration (reference GSM 04.21).

In case the ‘acceptable channel codings’ is indicated by the MS, the decision which channel coding is used is done by the network and indicated to the mobile station with an RR message. This RR message may also assign an asymmetric channel coding. The ‘acceptable channel codings’ parameter takes precedence over the ‘negotiation of intermediate rate requested’ parameter for non-transparent services. Also the intermediate rate and user rate per traffic channel in a multislot configuration are not indicated by the ‘intermediate rate’ and ‘user rate’ parameters of the BC-IE, but depend on the chosen channel coding only.

If the parameters ‘fixed network user rate’, ‘other modem type’ were not included in the BC-IE received, or no BC-IE was received, the MS shall not include these parameters in the CALL CONFIRMED message (i.e. octets 6d, 6e, 6f, and 6g ref. to GSM 04.08).

8.3.3.2 Indication in case of Mobile originating calls

In support of mobile originating calls the values of BC-IE parameters are requested in the set-up message from the MS. If the MS indicates the support of both transparent and non transparent connection elements the network shall return its choice in the call proceeding message. The MS is not allowed to indicate support of both transparent and non transparent, if the MS also requests out-band flow control, i.e. it does not indicate a layer 2 protocol.

Additionally the value of the parameter modem type has to be set depending on the value of the parameter connection element as described in annex B, table B.4a.

The set-up message contains a single or multiple BC-IE. In case of multiple BC-IEs one BC-IE must indicate the information transfer capability "speech".

If the set-up message requests a "single service", the network must not answer in the call proceeding message requesting a "dual service" and vice versa. Alternatively the network shall answer with a single BC-IE containing fax group 3 if a multiple BC-IE requesting speech alternate fax group 3 is received but the network does not allow the use of this alternate service. Annex B, table B.7, describes the negotiation rules. If the MS requests a "dual service" the network is not allowed to change the sequence of the service.

If the set-up message is indicates that negotiation of intermediate rate is requested then the network shall behave as described in annex B, table B.4b.

Unless otherwise specified in annex B, if no BC-IE parameter needs negotiation it is up to the network if it sends a CALL PROC message (with or without a BC-IE) towards the MS or not.

For multislot, TCH/F14.4, and EDGE operations the MS shall include an appropriate set of the parameters ‘fixed network user rate’, ‘other modem type’, ‘maximum number of TCH’ and ‘acceptable channel codings’ in the BC-IE of the SETUP message. If EDGE channel coding(s) are included in ACC in case of transparent calls, the 'Wanted air interface user rate'-parameter shall be set to 'Air interface user rate not applicable' and the 'User initiated modification indication'-parameter to 'User initiated modification not requested'. In a non-transparent multislot operation, the MS shall also include the parameters ‘wanted air interface user rate’ and ‘user initiated modification indication’ in the BC-IE of the SETUP message. In a non-transparent TCH/F14.4 or EDGE operation the MS shall also include the parameter ‘wanted air interface user rate’. In non-transparent EDGE operation the MS shall also include the parameter ‘asymmetry

preference indication'. It shall also set the other parameters of the BC-IE (i.e. 'user rate') to values identifying a fall-back bearer service. The fall-back bearer service shall be within the same bearer service group as the general bearer service. Depending on the network two situations can be distinguished:

a) The network supports the requested operation:

   In this case the network must include the parameter 'fixed network user rate', 'other modem type' and possibly 'user initiated modification' in the BC-IE(s) of the CALL PROCEEDING message, irrespective whether or not they contain modified values or just a copy of the received ones.

   The 'acceptable channel codings' indicated by the MS in the SETUP message takes precedence over the 'negotiation of intermediate rate requested' parameter for non-transparent services. The intermediate rate per traffic channel and the user rate per traffic channel is dependent on the chosen channel coding only. The chosen channel coding is indicated to the mobile station by the network with an RR message.

b) The network does not support the requested operation:

   In this case the BC-IE of the CALL PROCEEDING message will not contain the parameters fixed network user rate' and 'other modem type' or no BC-IE will be included in the CALL PROCEEDING message at all. The mobile station shall then discard the parameters 'fixed network user rate', 'other modem type', 'maximum number of TCH', 'acceptable channel codings' 'wanted air interface user rate' and 'user initiated modification indication' sent with the SETUP message and apply the fall-back bearer service.

In case a), a single slot configuration shall be used by the MS, in case the 'maximum number of traffic channels' is set to "1 TCH" and the 'user initiated modification indication' is set either to "user initiated modification not requested" or to "user initiated modification up to 1TCH may be requested".

In case b), The MS shall use the fall-back bearer service indicated by the remaining parameters of the BC-IE on a single slot configuration (reference GSM 04.21).

8.4 Test Loops

In principle, both V.-series and X.-series interfaces allow for an activation of local or remote test loops by the terminal (ref. CCITT V.54/X.150). A comprehensive solution of such test loops in a GSM system has to consider the special conditions of the interface between the terminal (part of the MS) and the transmission equipment (part of the modem pool of a particular IWF within the MSC). In addition, the impact of the radiolink is to be taken into account with respect to the test objectives. Due to those special conditions a GSM system is not capable to support remote test loops. It is an implementation choice to what extent the activation of local test loops by the terminal is supported in the MT.

8.5 Alternate ~~speech/data and~~ speech/facsimile group 3

~~These~~ This alternate service~~s~~ may be initiated by either V.25 bis or manual procedures. In the former case, standard call establishment procedures will apply. In the latter case, CT106, CT107, CT108.2 and CT109 are in the OFF condition.

Selection of the data phase (from the speech phase) will be by manual intervention via the MS causing ICM by means of CT108.2 going to ON condition~~. In case of dual data services (alternate speech/data or speech followed by data) the "Reverse call setup direction" information element of the modify message (determined by MMI) together with information about the initial call setup direction may be used to control the IWF modem (working as calling or answering modem). In case of alternate speech/facsimile~~ refer to GSM 03.45. The ensuing data phase shall follow all the operational procedures as described in 07-series.

Selection of the speech phase (from the data phase) will be by manual intervention via the MS causing ICM (phone off-hook condition at the MT and data call end condition at the TE).

During the ensuing speech phases, CT107, CT106 and CT109 will be maintained in the OFF condition.

Subsequent re-selection of the data phase will be by manual intervention via the MS causing CT108.2 going to ON condition initiating ICM. At this point, re-synchronization will take place as described in section 8.1 above.

8.6 Multislot configuration split/combine function

In multislot configurations using multiple parallel channels the data flow is split into substreams between the Spit/Combine-function in the TAF and the network.

8.6.1 Non-transparent data

In non-transparent data operations the N(S)-numbering in the RLP-header is used for controlling the order of the data in the substreames (reference GSM 04.22).

8.6.2 Transparent data

In transparent multislot configurations (TCH/F9.6 or TCH/F4.8) status bits S1, S3 and the X-bit between the D12 and D13 are used for transferring substream numbering information. This S4-bit is used for frame synchronization between the parallel substreames (reference GSM 04.21).

In case of a transparent multislot configuration using TCH/F14.4 channel coding, bit M1 in the 290-bit radio interface block is used for frame synchronization between the parallel substreams, whereas bit M2 carries status information, NIC codes and substream numbering as described in GSM 04.21.

In transparent TCH/F28.8 channels, bits M1 and M2 are used as described above for transparent TCH/F14.4 channels.

8.7 EDGE multiplexing function

In EDGE configurations the number of channels across the air interface and that of substreams between BTS and MSC do not necessarily match. In such cases a multiplexing function is included at MS and BTS (GSM 04.21 and GSM 08.20). These functions distribute data between the substreams and radio channels.

Annex A (Informative): List of Bearer Capability Elements

This annex lists the GSM Bearer Capability Elements which need to be provided on the Dm channel to support Terminal adaptation function to Interworking control procedures.

Elements and their Values:

Information Transfer Capability:

This element is relevant between the IWF and the fixed network

Values:
- Speech
- Unrestricted Digital
- Group 3 Facsimile (note 1)
- 3.1 kHz Ex PLMN (note 2)
- Restricted Digital (note 3)

NOTE 1: Used for facsimile transmission, unrestricted digital between MT and IWF and 3.1 kHz audio from IWF towards the fixed network.

NOTE 2: unrestricted digital between MT and IWF and 3.1 kHz audio from IWF towards the fixed network.

NOTE 3: unrestricted digital between MT and IWF and restricted digital information from IWF towards the fixed network; this value is signalled in the "Other ITC" element, due to a lack of further code points in the "ITC" element.

Transfer Mode:

This element is relevant between MT and IWF

Values:
- Circuit
- Packet

Structure:

This element is relevant between MT and IWF.

Values:
- Service Data Unit Integrity (note 4)
- Unstructured (note 5)

NOTE 4: applicable for connection element "non transparent".

NOTE 5: applicable for connection element "transparent".

Configuration:

This element is relevant for a PLMN connection.

Values:
- Point to point

Establishment:

This element is relevant for a PLMN connection.

Values:
- Demand

Sync/Async:

This element is relevant between TE/TA and MT and between IWF and the fixed network.

Values:
- Synchronous
- Asynchronous

Negotiation:

This element is relevant between MT and IWF.

Values:
- In band negotiation not possible

User Rate:

This element is relevant between TE/TA and MT and between IWF and the fixed network, except in case the parameter FNUR is present..

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
- 19.2 kbit/s (see note 6)

NOTE 6: This value cannot be signalled between MT and IWF, but it can be used according to the rules in GSM 09.07 (Table 6A, 6B) for such connections.

Intermediate Rate:

This element is relevant between MT and BSS and BSS and IWF

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

Network Independent Clock on Tx:

This element is relevant between TE/TA and MT in the transmit direction.

Values:
- Not required
- Required

Network Independent Clock on Rx:

This element is relevant between TE/TA and MT in the receive direction.

Values:
- Not accepted
- accepted

Number of Stop Bits:

This element is relevant between the TE/TA and MT and between IWF and fixed network in case of asynchronous transmission.

Values:
- 1 bit
- 2 bit

Number of Data Bits Excluding Parity If Present:

This element is relevant between TE/TA and MT and between IWF and the fixed network in case of a character oriented mode of transmission.

Values:
- 7 bit
- 8 bit

Parity Information:

This element is relevant between TE/TA and MT and between IWF and the fixed network for a character oriented mode of transmission.

Values:
- Odd
- Even
- None
- Forced to 0
- Forced to 1

Duplex Mode:

This element is relevant between MT and IWF.

Values:
- Full Duplex

Modem Type:

This element is relevant between the IWF and the fixed network in case of 3.1 kHz audio ex-PLMN information transfer capability.

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

Radio Channel Requirement:

This element is relevant between MT and BSS

Values:
- Full Rate support only Mobile Station
- Dual Rate support Mobile Station/Half Rate preferred
- Dual Rate support Mobile Station/Full Rate preferred

Connection Element:

This element is relevant between MT and IWF

Values:
- Transparent
- Non Transparent
- both, Transparent preferred
- both, Non transparent preferred

User Information Layer 2 Protocol:

This element is relevant between TE/TA and MT and between IWF and the fixed network.

Values:
- ISO 6429
- X.25
- X.75 layer 2 modified (CAPI)

- Character oriented Protocol with no Flow Control mechanism

Signalling Access Protocol:

This element is relevant between TE/TA and MT.

Values:
- 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 element is relevant between IWF and the fixed network.

Values:
- V.110/X.30
- X.31 flagstuffing
- no rate adaptation
- V.120 (note 7)

NOTE 7: - this value is signalled in the "Other Rate Adaption" element, due to a lack of further code points in the "Rate Adaption" element.

Coding Standard:

This element refers to the structure of the BC-IE defined in GSM 04.08.

Values: - GSM

User Information Layer 1 Protocol:

This element characterize the layer 1 protocol to be used between MT and BSS (Um interface) according to GSM 05.01.

Values: - default

Negotiation of Intermediate Rate requested:

This element is relevant between MT and BSS and BSS and IWF.

Values:
- no meaning associated
- 6 kbit/s radio interface is requested for a full rate channel with a user rate up to and including 4.8 kbit/s, non transparent service

Compression:

This element is relevant between MT and IWF.

Values:
- compression possible/allowed
- compression not possible/allowed

Rate adaption header / no header:

This element is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values:
- Rate adaption header not included
- Rate adaption header included

Multiple frame establishment support in data link:

This element is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Multiple frame establishment not supported. Only UI frames allowed.
- Multiple frame establishment supported.

Mode of operation:

This element is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Bit transparent mode of operation
- Protocol sensitive mode of operation

Logical link identifier negotiation:

This element is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Default, LLI=256 only
- Full protocol negotiation (note 8)

NOTE 8: A connection over which protocol negotiation will be executed is indicated in the „In-band / out-band negotiation“ parameter.

Assignor / assignee:

This element is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Message originator is „default assignee“
- Message originator is „assignor only“

In-band / out-band negotiation:

This element is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Negotiation is done with USER INFORMATION messages on a temporary signalling connection
- Negotiation is done in-band using logical link zero.

Fixed network user rate, FNUR (Note 12)

This element is relevant between the IWF and the fixed network.

Values - Fixed network user rate not applicable (note 9)

- 9.6 kbit/s
- 14.4 kbit/s
- 19.2 kbit/s
- 28.8 kbit/s
- 38.4 kbit/s
- 48.0 kbit/s
- 56.0 kbit/s
- 64.0 kbit/s

NOTE 9: not used by currently specified services

Wanted air interface user rate, WAIUR (Note 12)

This element is relevant between the MT and the IWF

Values - Air interface user rate not applicable
- 9.6 kbit/s
- 14.4 kbit/s
- 19.2 kbit/s
- 28.8 kbit/s

- 38.4 kbit/s
- 43.2 kbit/s
- 57.6 kbit/s

- interpreted by the network as 38.4 kbit/s (note 13)

NOTE 13: Certain code points, if used, will be interpreted by the network as 38.4 kbit/s in this version of the protocol, ref TS 24.008.

Acceptable channel codings, ACC (Note 12)

This element is relevant between the MT and the IWF.

Value: - —TCH/F4.8 acceptable

- TCH/F9.6 acceptable
- TCH/F14.4 acceptable
- TCH/F28.8 acceptable
- TCH/F32.0 acceptable (Applicable to bit transparent 56 and 64 kbit/s services only)
- TCH/F43.2 acceptable (Applicable to non-transparent services only.)

Maximum number of traffic channels, MaxNumTCH (Note 12)

This element is relevant between the MT and the IWF.

Value: - —1 TCH
- 2 TCH
- 3 TCH
- 4 TCH
- 5 TCH
- 6 TCH
- 7 TCH (note11)
- 8 TCH (note11)

NOTE11: not used by currently specified services

Other modem type, OMT (Note 12)

This element is relevant between the IWF and the fixed network in case of 3.1 kHz audio ex-PLMN

Values: - no other modem type specified in this field
- V.34

User initiated modification indication, UIMI (Note 12)

This element is relevant between the MT and the IWF.

Values: —- user initiated modification not requested
- user initiated modification upto 1 TCH requested
- user initiated modification upto 2 TCH requested
- user initiated modification upto 3 TCH requested
- user initiated modification upto 4 TCH requested

Asymmetry preference indication (Note 12)

This element is relevant between the MT and the BSS.

Value: no preference
up link biased asymmetry preference
down link biased asymmetry preference

NOTE 12:These GBS-related parameters are optional.

For a multislot configuration, the following applies to the parameters contained in the BC-IE:

- Half rate channels are not supported. The MS shall code the radio channel requirement as “Full rate support only MS” or “Dual rate support MS, full rate preferred’. In the second case, the network shall assign full rate channel(s) only.

- The ‘fixed network user rate’ and ‘other modem type’ (ref. table B.4a) takes precedence over the ‘user rate’ and ‘modem type’.

- The ACC indicates which channel coding is acceptable and supported by the MS. In case of CE:NT the TCH/F4.8 and TCH/F9.6 acceptable is equivalent to the support of NIRR. If TCH/F4.8 acceptable only or TCH/F9.6 acceptable only or TCH/F14.4 acceptable only is indicated, the assigned channel type which can be chosen by the network is TCH/F4.8 or TCH/F9.6 or TCH/F14.4, respectively.

- The ‘intermediate rate’ parameter is overridden. The intermediate rate used per each TCH/F is derived from the chosen channel type:

channel type	**IR per TCH/F**
TCH/F4.8	8 kbit/s
TCH/F9.6	16 kbit/s
TCH/F14.4	intermediate rate is to be defined

- The user rate per TCH is derived from the chosen channel type:

channel type	**user rate per TCH**
TCH/F4.8	4.8 kbit/s
TCH/F9.6	9.6 kbit/s

  For CE:T, the padding procedure described in GSM 04.21 can be applied.

Annex B (Normative): Setting of Bearer Capability, Low Layer Compatibility and High Layer Compatibility Information Element for GSM Bearer Services and GSM TeleServices

B.0 Scope

This annex describes the relationship between the various parameters of the GSM Bearer Capability Information Element (BC-IE), their validity and the possible settings with reference to each GSM Bearer service/Teleservice defined in GSM 02.02 and GSM 02.03 as well as the various occurrences during the connection control (section B.1). Furthermore, the contents of the Low Layer (LLC) and the High Layer (HLC) Compatibility Information Elements are described (section B.2).

B.1 Bearer Capability Information Element

B.1.1 Introduction

B.1.1.1 General Consideration

In general, the purpose of the bearer capability information element (BC-IE) is to request a particular bearer service to be provided by the network. This indication is carried by certain connection control messages which for the subject matter of this document may be categorized into those messages:

- related to the call set-up phase and those
- used during the established connection.

During the call set-up phase the GSM BC-IE (single or multiple) is included in:

- the SETUP message generated by the requesting entity (either MS or MSC) to establish a mobile-originated or mobile-terminated call, respectively, and in
- the CALL CONFIRMED or CALL PROCEEDING messages, respectively, generated by the responding entity (either MS or MSC) in order to negotiate certain parameter values. If no BC-IE is contained in the SETUP message (PSTN-originated call with single-numbering scheme) the CALL CONFIRMED message indicates the complete applicable BC-IE. In this case neither the value "unrestricted digital" for the information transfer capability nor the multislot for TCH/14 related parameters shall be used.

During the established connection the GSM BC-IE is included in the MODIFY, MODIFY COMPLETE, and MODIFY REJECT messages in order to change the service (bearer capability) or to change the maximum number of traffic channels and/or wanted air interface user rate when a non-transparent multislot data service is in use.

If the maximum number of traffic channels and/or wanted air interface user rate is to be changed, the BC-IE included in the MODIFY message shall not indicate a different bearer service than the one used at this stage of the connection - the values of the parameters ‘maximum number of traffic channels’ and/or ‘wanted air interface user rate’ may be changed, only.

The subsequent tables and subsections of section B.1 deal with the representation of the individual contents of the GSM BC-IE during the call set-up phase. For the use during the established connection refer to GSM 04.08.

With respect to the individual parameter settings at the MS the following cases may be distinguished (ref. GSM 07.02 and GSM 07.03):

- Mobile-originated call set up by a MS consisting of a MT with R interface:

  The setting results from respective MMI actions and/or MT internal settings.

- Mobile-originated call set up by a MS consisting of a MT with S interface:

  The setting of the GSM BC is derived from the ISDN BC and LLC/HLC elements contained in the ISDN SETUP message received from the terminal. It is complemented by information resulting from respective MMI actions and/or MT internal settings.

- Mobile-terminated call set up to a MS consisting of a MT with R interface:

  The BC related part of the compatibility check is carried out according to the knowledge of the MT concerning its implemented functions (i.e. answering the call). The requested field values of the non-negotiable parameters and the selected field values of the negotiable parameters determine the selection of the terminal function to be used for the intended connection.

- Mobile-terminated call set up to a MS consisting of a MT with S interface:

  The GSM BC received from the MSC is mapped by the MT onto an applicable ISDN BC. In some cases a HLC may be generated, if it is not otherwise available (e.g. for group 3 facsimile). The BC related part of the compatibility check is up to the terminal connected to the S interface of the MT, as is the selection of the terminal function (i.e. answering the call) to be used for the intended connection.

B.1.1.2 Interpretation of the Diagrams

The purpose of the subsequent diagrams is to achieve unambiguous representation of the individual contents of the GSM BC-IE for the various occurrences during the call set-up phase, covering all bearer services and teleservices according to GSM 02.02 and GSM 02.03.

The basic principle adopted is a graphic scheme, or mask, wherein the ordinate designates the individual parameters of the GSM BC-IE and the abscissa gives the possible field values of these parameters. The abbreviations used in these sections are defined in table B.5. The allowed content of any GSM BC-IE is represented by a number of graphs connecting parameter values (abscissa points) of all parameters (ordinate points). Each graphic scheme is subdivided into two independent parts:

- "Layer/Protocol related" part and

- "Radio Channel related" part.

The generation of all GSM BC-IEs in all call set-up messages shall be in accordance with these graphs. Sections B.1.2 through B.1.11 show individual sets of graphs for each service group (BS/TS) and for each type of applicable Information Transfer Capability.

In addition, the following rules apply:

- Those parameters which have only one possible field value for all recognized services are shown in table B.5, where they are marked accordingly in the column "common setting of field values". They are not represented in the graphic scheme.

- Not all parameters of the GSM BC-IE are relevant for each service (BS/TS). This is represented by specific abscissa points with a value of "NA" (Not Applicable) allocated to these parameters. The graphs pass through these points for each such parameter. The actual field value to be used in the GSM BC-IE is marked in the column "default setting of field values (NA)" of table B.5. An abscissa point with a value of "NAV" (Not AVailable) indicates that the entire octet carrying this parameter (ref. table B.2 "General Structure of the GSM BC-Information Element") shall be omitted.

- There is a particular dependency of the parameters "User Information Layer 2 Protocol (UIL2P)" and "Connection Element (CE)":

  - If the MS sends a GSM BC-IE with a CE value other than "Transparent (T)", the parameter UIL2P is essential. Its field value must be set as indicated in the applicable graph.

- If the MSC sends a GSM BC-IE in the SETUP message, the parameter UIL2P may also be absent in the case of the CE parameter value being other than "Transparent (T)".

- Certain parameters of the GSM BC-IE may be negotiated during the connection establishment phase. Table B.1 shows these parameters and the relations of their values in the SETUP message and in the CALL CONFIRMED/CALL PROCEEDING message, respectively, both for the mobile-originated and mobile-terminated case. A parameter may indicate a field value of one of the following types:

  - "requested value" indicating a request which cannot be changed by the responding entity;

  - "offered value" indicating a proposal which may be changed by the responding entity;

  - a particular choice value leaving it up to the responding entity which value ultimately applies;

  - "as requested" indicating that the requested value applies and is confirmed (by returning it);

  - "selected value" indicating that a particular value applies either out of the offered set or as a free choice out of the defined set of values.

  - "supported value" indicating a value supported by the responding entity.

Table B.1: BC-Parameters subject to negotiation procedure

Mobile Originated Call:

	Message	
BC-parameter	SETUP	CALL PROC
NDB	requested value	as requested
NPB	requested value	as requested
NSB	requested value	as requested
CE	requested value (T/NT)	as requested
	“both” with the preferred value indicated (e.g. both NT)	selected value (T/NT)
UIL2P	requested value 2) or NAV 1)	as requested or NAV 4)
User Rate	requested value	as requested
DC	requested value 2)	as requested or “NO” 7)
FNUR	requested value	supported value
Other MT	requested value	supported value
UIMI	requested value	supported value

Mobile Terminated Call:

	Message	
BC-parameter	SETUP	CALL CONF
NDB	offered value	selected value (free choice)
NPB	offered value	selected value (free choice)
NSB	offered value	selected value (free choice)
CE	requested value (T/NT)	as requested or selected value (T/NT) (free choice) 3)
	“both” with the preferred value indicated (e.g. both NT)	selected value (T/NT)
UIL2P	offered value 2) or NAV 4)	selected or NAV 1)
User Rate	offered value	selected value 5)
DC	requested value 2)	as requested or “NO” 7)
FNUR	offered value	selected value 6)
Other MT	offered value	selected value 6)
UIMI	offered value	selected value 8)

1) for CE:T only or out-band flow control requested by the MS

2) not for CE:T
3) when the SETUP message contains no BC-IE (single numbering scheme)
4) "NAV" shall not be interpreted as an out-band flow control request by the MS
5) The modification of User Rate must be in conjunction with Modem Type and Intermediate Rate
6) The modification of the Fixed Network User Rate shall be in conjunction with the Modem Type and/or Other Modem Type.
7) In case of a Mobile Terminated Call, if the SETUP message does not contain a BC-IE, the MS shall behave as if the DC is set to "data compression not possible ".
In case of a MOC or a MTC where no BC-IE is included in the CALL PROCEEDING or CALL CONFIRMED message, respectively, the MS or the network shall behave as if the DC was set to "data compression not possible" or “data compression not allowed”, respectively.
8) less or equal to the offered value

Table B.2: General Structure of the BC-Information Element

OCTET	INFORMATION ELEMENT FIELD	
3	Radio channel requirements Coding standard Transfer mode Information Transfer Capability	
4	Structure Duplex mode Configuration Establishment Negotiation of Intermediate Rate Requested Compression	2)
5	Rate adaption Signalling access protocol	2)
5a	Other ITC Other rate adaption	2) 3)
5b	Rate adaption header / no header Multiple frame establishment support in data link Mode of operation Logical link identifier negotiation Assignor / assignee In-band / out-band negotiation	2) 3)
6	User information layer 1 protocol Synchronous / asynchronous	2)
6a	Number of stop bits Negotiation Number of data bits User rate	2)
6b	Intermediate rate NIC on transmission NIC on reception Parity information	2)
6c	Connection element Modem type	2)
6d	Fixed network user rate Other modem type	4)
6e	Maximum number of traffic channels Acceptable channel codings	4)

6f	Wanted air interface user rate User initiated modification indication	4)
6g	Acceptable Channel codings Asymmetry preference indication	5) 6)
7	User information layer 2 protocol	1) 2)

1) octets optional.
2) octets only available if the parameter "Information Transfer Capability" does not indicate "Speech".
3) for V.120 rate adaption only
4) optional octes available only if the parameter "Information Transfer Capability" does not indicate "Speech".
5) Extension of the 'Acceptable channel codings' field in octet 6e in case EDGE channel codings are supported.
6) only used if EDGE channels are among the 'Acceptable channel codings'. The value shall be set to 'no preference' in case the connection element is T.

Table B.3a: Selection of flow control method (for CE:NT with SA:A only)

	flow control method		
information element	in-band	out-band3)	none
number of data bits	7 or 8	7 or 8	7 or 8
user information layer 2 protocol	ISO 64291)	NAV	COPnoFlCt2)

1) ISO6429 stands for "ISO 6429, codeset 0, DC1/DC3" and is applicable for 7 and 8 bit codes.
2) COPnoFlCt stands for a character oriented protocol with no flow control mechanism (no reserved characters for flow control).
3) "out-band" flow control requires V.42 in case of PSTN or V.110 in case of ISDN.
If the V.110 flow control mechanism is not supported, where required, the call pending shall be terminated.
If the V.42 functionality is not supported by the modem in the IWF or in the fixed network, the call will be supported with a fallback to the non-V.42 mode. In this case the IWF will release the call if due to temporary throughput problems on the radio interface or initiation of flow control by the MS and the inability to flow control the fixed network modem an overflow of the L2R buffers occurs.
Note that a phase 1 network may release the call, if the V.42 functionality is not provided by the IWF or the fixed network modem. As V.42 does not apply to V.21 ~~and V.23~~ modems, outband flow control can not be supported for these modem types.

Table B.3b: Selection of GSM Profile (for CE:NT with SA:S only)

Mobile Terminated Call:

BC-parameter	Message SETUP	Message CALL CONF
UIL2P	X.25	X.25 or X.75

Table B.4a: Modem Type subject to negotiation procedure

Mobile Originated Call:

	BC-parameter MT and OMT 6)	
BC-parameter CE	Message SETUP	Message CALL PROC
T	V-series	V-series
NT	V-series	V-series
	autobauding type 1	autobauding type 1 or V-series 1)
bothT or bothNT	V-series	V-series
	autobauding type 1	autobauding type 1 or V-series 1)2)

Mobile Terminated Call:

	BC-parameter MT and OMT 6)	
BC-parameter CE	Message SETUP	Message CALL CONF
T	V-series	V-series
NT	V-series	V-series or autobauding type 1 3)
	autobauding type 1	autobauding type 1 or V-series 4)
bothT or bothNT	V-series	V-series
	autobauding type 1	autobauding type 1 or V-series 4)5)

1) No autobauding capability in the IWF:MSC
2) CE:T selected by IWF/MSC
3) Free choice if the SETUP contains no BC-IE (single numbering scheme)
If the IWF/MSC has no autobauding capability, a V-series modem type is used
4) When the MS does not allow the use of autobauding capability
5) CE:T selected by the MS
6) When the MT indicates “autobauding” , “modem for undefined interface” or “none”, the OMT shall be set to “no other modem type”. Any other values of the MT is overriden by the OMT value.

Table B.4b: Intermediate Rate negotiation procedure

If the user rate is 9.6 kbit/s the intermediate rate negotiation procedure is not applicable and NIRR shall be set to "No meaning".

Recipient of SETUP supports full rate, non transparent, 6 kbit/s radio interface rate and the user rate is up to/equal 4.8 kbit/s:

BC-parameter	Message SETUP	Message CALL CONF or CALL PROC
NIRR	6 kbit/s	6 kbit/s
IR	16 kbit/s	8 kbit/s
User Rate	up to/equal 4.8 kbit/s	as requested

NOTE 2: In case of a Mobile Terminated Call, if the SETUP message does not contain a BC-IE, the MS shall behave as if NIRR set to "No meaning".

In case of a MOC or a MTC where no BC-IE is included in the CALL PROCEEDING or CALL CONFIRMED message, respectively, the MS or the network shall behave as if the NIRR was set to "No meaning".

Recipient of SETUP does support full rate, non transparent, but not in connection with 6 kbit/s radio interface rate:

BC-parameter	Message SETUP	Message CALL CONF or CALL PROC
NIRR	6 kbit/s	No meaning
IR	16 kbit/s	16 kbit/s
User Rate	up to/equal 4.8 kbit/s	as requested

NOTE 3: If no other parameter needs negotiation, the CALL CONF/PROC message need not contain any BC-IE.

In case of a MOC or a MTC where no BC-IE is included in the CALL PROCEEDING or CALL CONFIRMED message, respectively, the MS or the network shall behave as if the NIRR was set to "No meaning".

NOTE 4: In case a GBS-operation is requested and acknowledged, the MS indicates the acceptable channel codings. The indicated acceptance of TCH/F4.8 is equivalent to the support of 6 kbit/s radio interface rate per TCH/F and therefor overrides the NIRR parameter.

Table B.4c Negotiation of fixed network user rate

BC-parameter	Message SETUP	Message CALL PROC/CONFIRMED
FNUR	requested value	equal or lower than the requested value

The network might accept the modified value or reject the call. The FNUR negotiation is applicable in case of a HSCSD-operation, only.

Table B.4d Negotiation of user initiated modification indication

BC-parameter	Message SETUP	Message CALL PROC/CONFIRMED
UIMI	offered value	equal to or a value indicating a request for modification to a lower number of traffic channels than offered

Table B.5: BC parameter setting (part 1)

Abbreviations for Parameters and Values:		common setting of field values	default setting of field values (NA)
		v	v
ITC...Information Transfer Capability:	- Speech - UDI..Unrestricted Digital - FAX3..Group 3 Facsimile - 3.1 kHz..3.1 kHz Ex PLMN - RDI..Restricted Digital		
TM....Transfer Mode:	- ci..Circuit	X	X
S.....Structure:	- SDU..Service Data Unit Integrity - Unstructured	X	
C.....Configuration:	- pp..Point to point	X	X
E.....Establishment:	- de..Demand	X	X
SA....Sync/Async:	- S..Synchronous - A..Asynchronous		
N.....Negotiation	- ibn..in band negotiation not possible	X	X
UR....User Rate:	- 0.3..0.3 kbit/s - 1.2..1.2 kbit/s ~~- 1.2/0.075..1200/75 bit/s~~ - 2.4..2.4 kbit/s - 4.8..4.8 kbit/s - 9.6..9.6 kbit/s		
IR....Intermediate Rate:	- 4.. 4 kbit/s - 8.. 8 kbit/s - 16.. 16 kbit/s - not_used..not used	X	
NICT..Network Independent Clock on Tx:	- not_required.. Not required - required	X	X
NICR..Network Independent Clock on Rx:	- not_accepted..not accepted - accepted	X	X
NSB...Number of Stop Bits:	- 1..1 bit - 2..2 bit	X	
NDB...Number of Data Bits Excluding Parity If Present:	- 7.. 7 bit - 8.. 8 bit	X	
NPB...Parity Information:	- Odd - Even - None - 0.. Forced to 0 - 1.. Forced to 1	X	
UIL1P.User Information Layer 1 Protocol	- def..default layer 1 protocol	X	X

Table B.5: BC parameter setting (part 2)

Abbreviations for Parameters and Values		common setting of field values	default setting of field values (NA)
		v	v
DM....Duplex Mode:	-		
	- fd.. Full Duplex	X	X
MT....Modem Type:	- V.21		
	- V.22		
	- V.22 bis		
	- ~~V.23~~		
	- V.26 ter		
	- V.32		
	- auto1.. autobauding type 1		
	- none	X	
RCR...Radio Channel Requirement:	- FR Full Rate support only Mobile Station		
	- dual HR Dual Rate support Mobile Station/ Half Rate preferred		
	- dual FR Dual Rate support Mobile Station/ Full Rate preferred		
CE....Connection Element:	- T.. Transparent		
	- NT.. Non Transparent		
	- bothT both transparent preferred		
	- bothNT both non Transparent preferred		
UIL2P.User Information Layer 2 Protocol:	- ISO6429..ISO6429,codeset 0,DC1/DC3		
	- X.25		
	- X.75..X.75 layer 2 modified (CAPI)		
	- COPnoFlCt..Character oriented protocol with no flow control mechanism		
SAP...Signalling Access Protocol:	- I.440.. I.440/450	X	
	- X.21		
	- ~~X.28deIN.. X.28, dedicated PAD,individual NUI~~		
	- ~~X.28deUN.. X.28, dedicated PAD,universal NUI~~		
	- X.28nond.. X.28, non dedicated PAD		
	- X.32		
RA....Rate Adaptation:	- V.110.. V.110/X.30		
	- X.31Flag.. X.31 flagstuffing		
	- NO.. no rate adaptation	X	
	- V.120		
CS....Coding Standard:	- GSM	X	X
NIRR..Negotiation of Intermediate Rate Requested:	NM..No Meaning associated with this value 6kbit/s..6kbit/s radio interface rate requested	X	
DC....Data Compression	- DC.. compression possible/allowed		
	- NO.. compression not possible/allowed		

Table B.5: BC parameter setting (part 3)

Abbreviations for Parameters and Values

common setting of field values

default setting of field values (NA)

FNUR...Fixed Network User Rate	- FNUR not applicable		
	- 9.6.. 9.6 kbit/s		
	- 14.4.. 14.4 kbit/s		
	- 19.2.. 19.2 kbit/s		
	- 28.8.. 28.8 kbit/s		
	- 38.4.. 38.4 kbit/s		
	- 48.0.. 48.0 kbit/s		
	- 56.0.. 56.0 kbit/s		
	- 64.0.. 64.0 kbit/s		
WAIUR...Wanted Air Interface User Rate	- WAIUR not applicable		
	- 9.6.. 9.6 kbit/s		
	- 14.4.. 14.4 kbit/s		
	- 19.2.. 19.2 kbit/s		
	- 28.8.. 28.8 kbit/s		
	- 38.4.. 38.4 kbit/s		
	- 43.2.. 43.2 kbit/s		
	- 57.6.. 57.6 kbit/s		
	- int 38.4.. interpreted by the network as 38.4 kbit/s		
ACC.....Acceptable channel codings	- 4.8.. TCH/F4.8 acceptable		
	- 9.6.. TCH/F9.6 acceptable		
	- 14.4..TCH/F14.4 acceptable		
	- 28.8..TCH/F28.8 acceptable		
	- 32.0..TCH/F32.0 acceptable		
	- 43.2..TCH/F28.8 acceptable		
MaxNumTCH...Maximum Number of Traffic Channels			
	- 1.. 1 TCH		
	- 2.. 2 TCH		
	- 3.. 3 TCH		
	- 4.. 4 TCH		
	- 5.. 5 TCH		
	- 6.. 6 TCH		
	- 7.. 7 TCH		
	- 8.. 8 TCH		
OMT...Other modem type	- no other MT.. no other modem type		
	- V.34.. V.34		
User initiated modification indication	- not req.. user initiated modification not required		
	- upto 1 TCH.. user initiated modification upto 1 TCH may be requested		
	- upto 2 TCH.. user initiated modification upto 2 TCH may be requested		
	- upto 3 TCH.. user initiated modification upto 3 TCH may be requested		
	- upto 4 TCH.. user initiated modification upto 4 TCH may be requested		
Asymmetry preference indication	- 00 no preference		
	- 01 up link biased asymmetry preferred		
	- 10 down link biased asymmetry preferred		

Table B.6: Channel combinations

Single Bearer and Teleservices

MS indication **BC**	**Network selection CT** **CT**
FR	FR
dual FR	FR or HR
dual HR	HR or FR

Alternate services

MS indication		**Network selection**				
BC(1)	**BC(2)**	**CT(1)**	**CT(2)**	**or**	**CT(1)**	**CT(2)**
FR	FR	FR	FR			
FR	dual Rate	FR	FR			
dual Rate	dual Rate	FR	FR	or	HR	HR
dual Rate	FR	FR	FR			

Followed-by services

MS indication		**Network selection**							
BC(1)	**BC(2)**	**CT(1)**	**CT(2)**	**or**	**CT(1)**	**CT(2)**	**or**	**CT(1)**	**CT(2)**
FR	FR	FR	FR						
FR	dual Rate	FR	FR						
dual Rate	dual Rate	FR	FR	or	HR	HR	or	FR	HR
dual Rate	FR	FR	FR						

BC Bearer Capability
CT Channel Type
dual Rate {dual FR | dual HR}

Table B.7: TS61/TS62 Negotiation rules

Mobile Originating Call

Subscription	**SETUP**	**CALL PROCEED**
TS61	TS61 s/f TS61 f/s	TS61 s/f or TS62 TS61 f/s or TS62
	TS62	TS62
TS62	TS61 s/f TS61 f/s	TS62 TS62
	TS62	TS62

Mobile Terminating Call

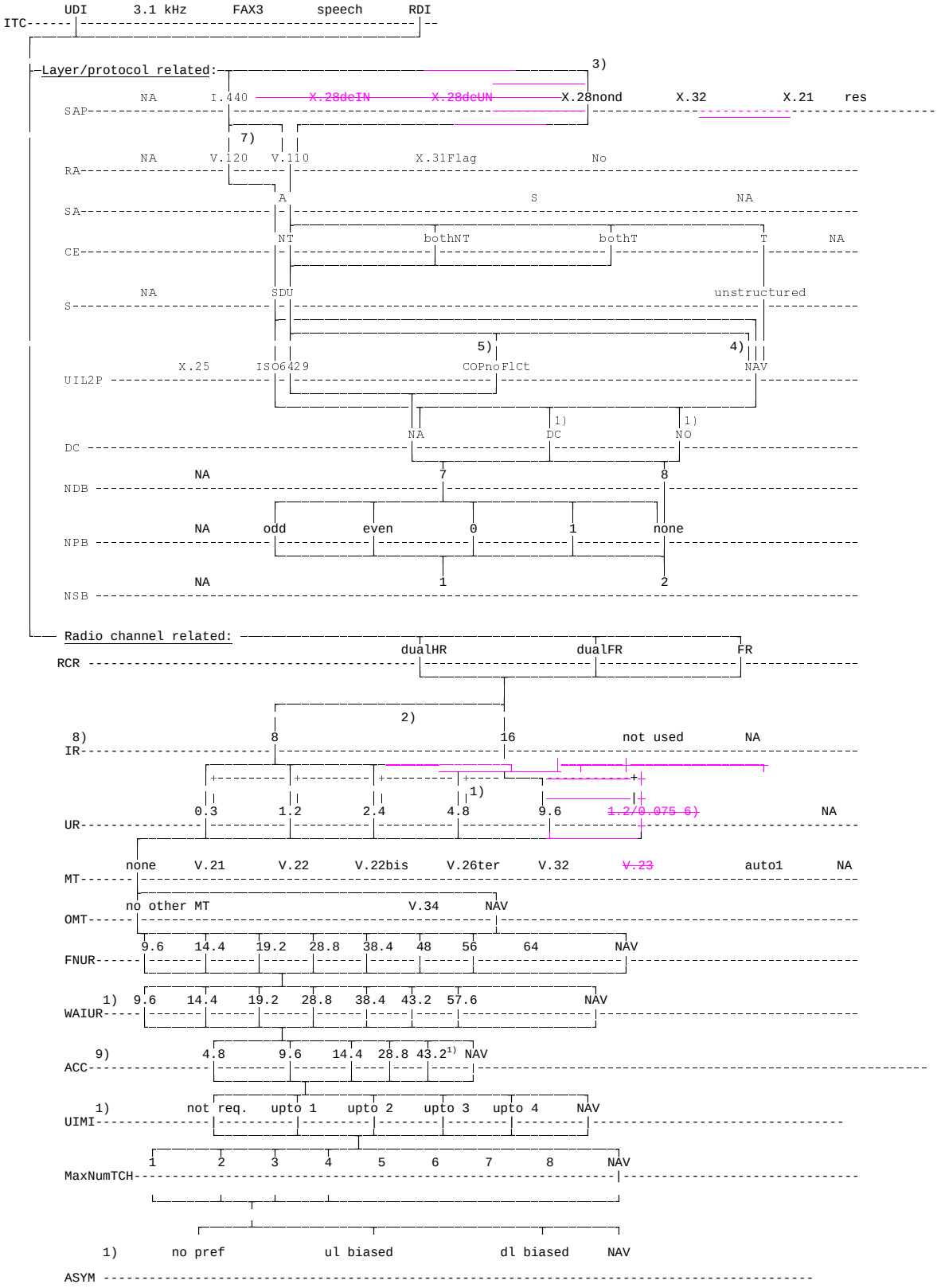
Subscription	**SETUP**	**CALL CONFIRMED**
TS61	TS61 s/f	TS61 s/f or TS61 f/s or TS62
	TS61 f/s	TS61 s/f or TS61 f/s or TS62
	TS62	TS62
	no BC	TS61 s/f or TS61 f/s or TS62
TS62	TS62	TS62
	no BC	TS62 (Note1)

s/f = speech then fax
f/s = fax then speech

NOTE 1: TS61 is also accepted if the VMSC supports TS61 and does not perform subscription checking on a CALL CONFIRMED message (see GSM 02.01 and GSM 09.07).

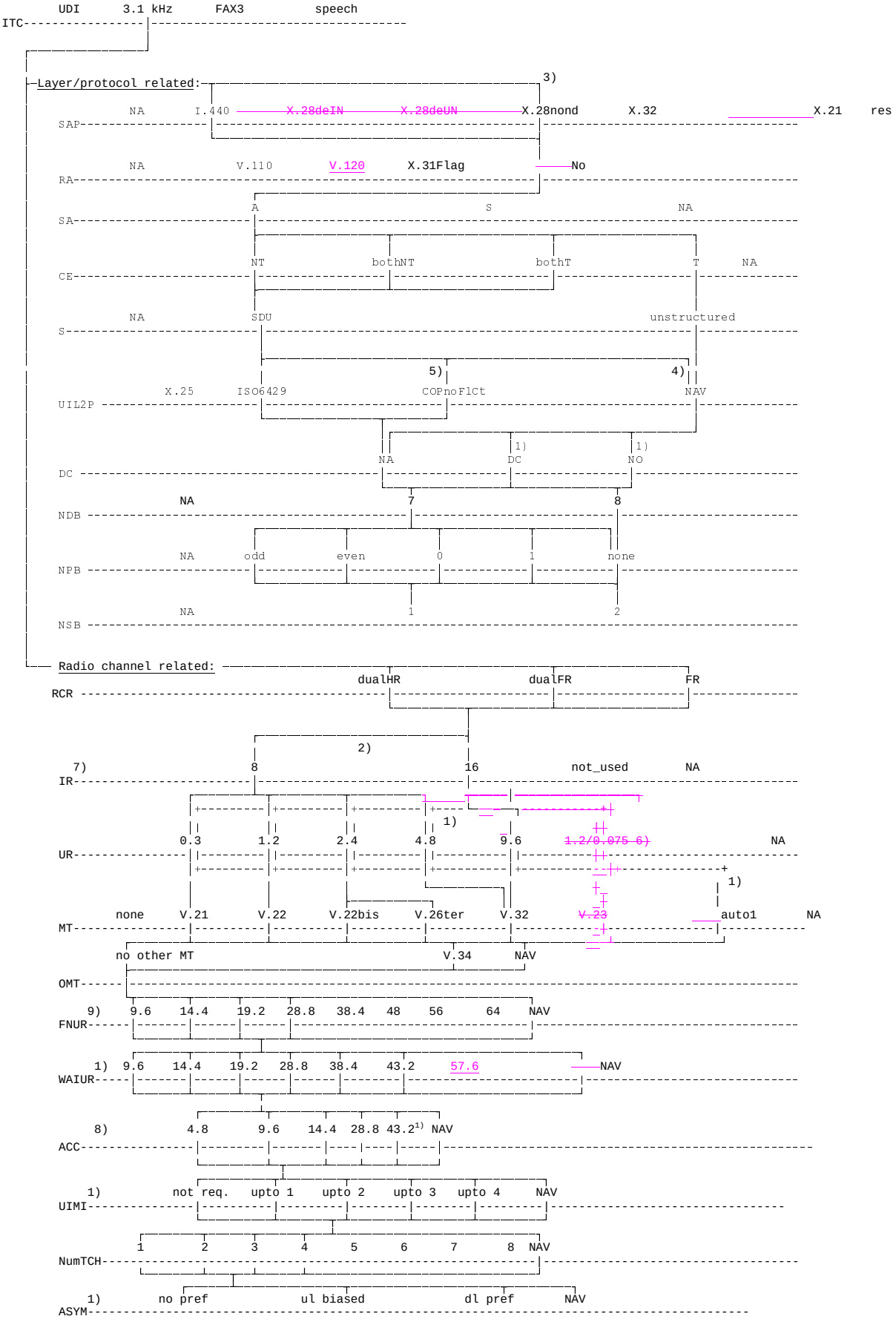
B.1.2 Bearer Service 20~~... 26~~, Data Circuit Duplex Asynchronous

B.1.2.1 Unrestricted / restricted digital information transfer capability



1) for CE:NT or "both";
2) for CE:T only or CE:NT and NIRR:6kb/s (not for the SETUP message);
3) for MOC only;
4) for MTC in the SETUP message or MOC/MTC with "out-band" flow control requested
5) for MOC/MTC with no flow control requested;
~~6) MOC only, 75 bit/s in the uplink, 1200 bit/s in the downlink direction;~~
7) the V.120 relevant BC parameters (octet 5b) shall be set according to the LLC (see annex B.2);
8) IR and UR are overridden if FNUR, ACC and MaxNumTCH are available.
9) ACC may have several values simultaneously (bit map coding).

B.1.2.2 3.1 kHz audio ex-PLMN information transfer capability



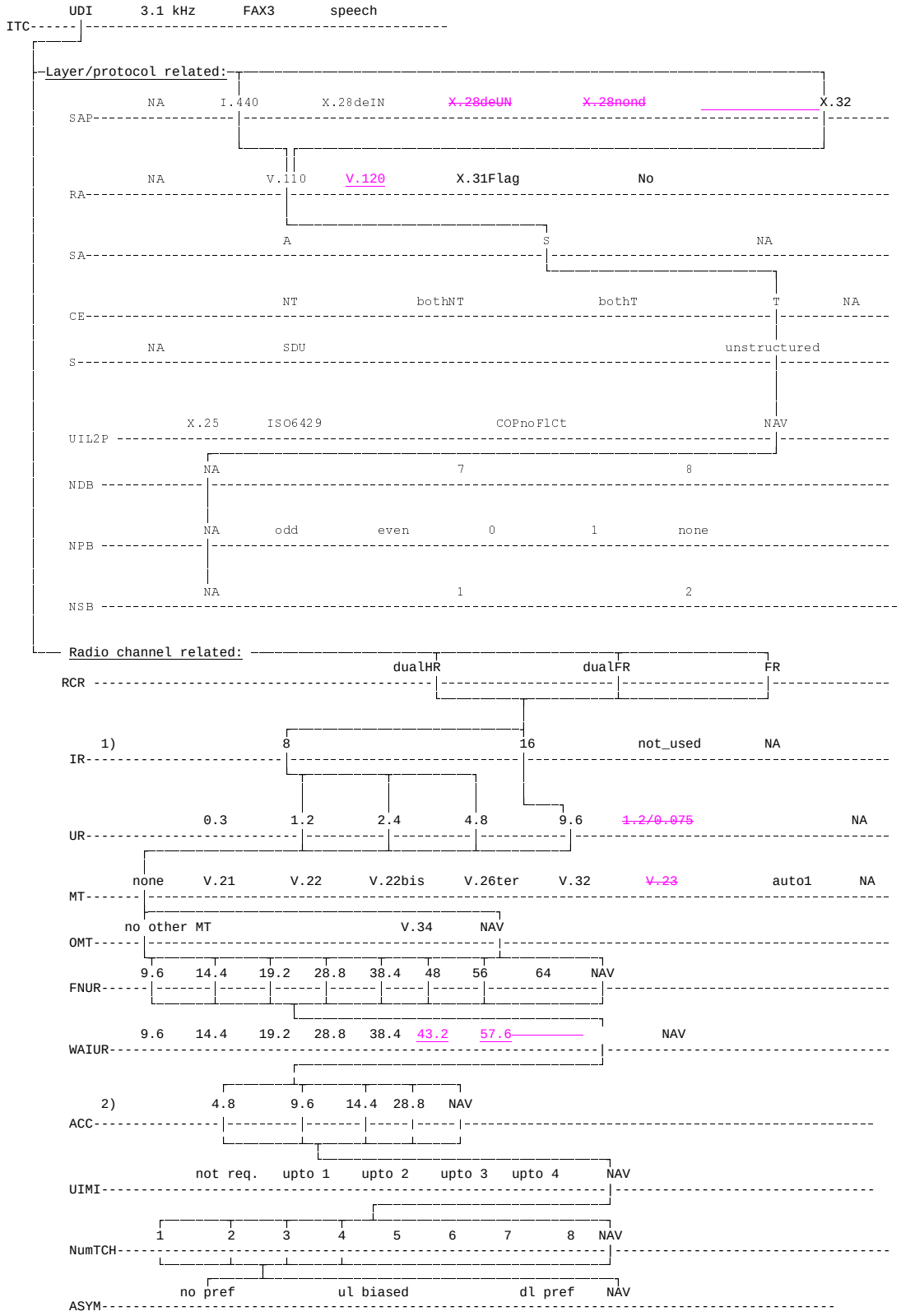
1) for CE:NT or "both";
2) for CE:T only or CE:NT and NIRR:6kb/s (not for the SETUP message);
3) for MOC only;
4) for MTC in the SETUP message or MOC/MTC with "out-band" flow control requested (not for V.21 and V.23 modem types);
5) for MOC/MTC with no flow control requested;

6) MOC only, 75 bit/s in the uplink, 1200 bit/s in the downlink direction;
7) IR and UR are overridden if FNUR, ACC and MaxNumTCH are available.
8) ACC may have several values simultaneously (bit map coding).
9) in case of MT = auto1 the value of FNUR has no meaning.

B.1.3 Bearer Service 30 ... 34, Data Circuit Duplex Synchronous

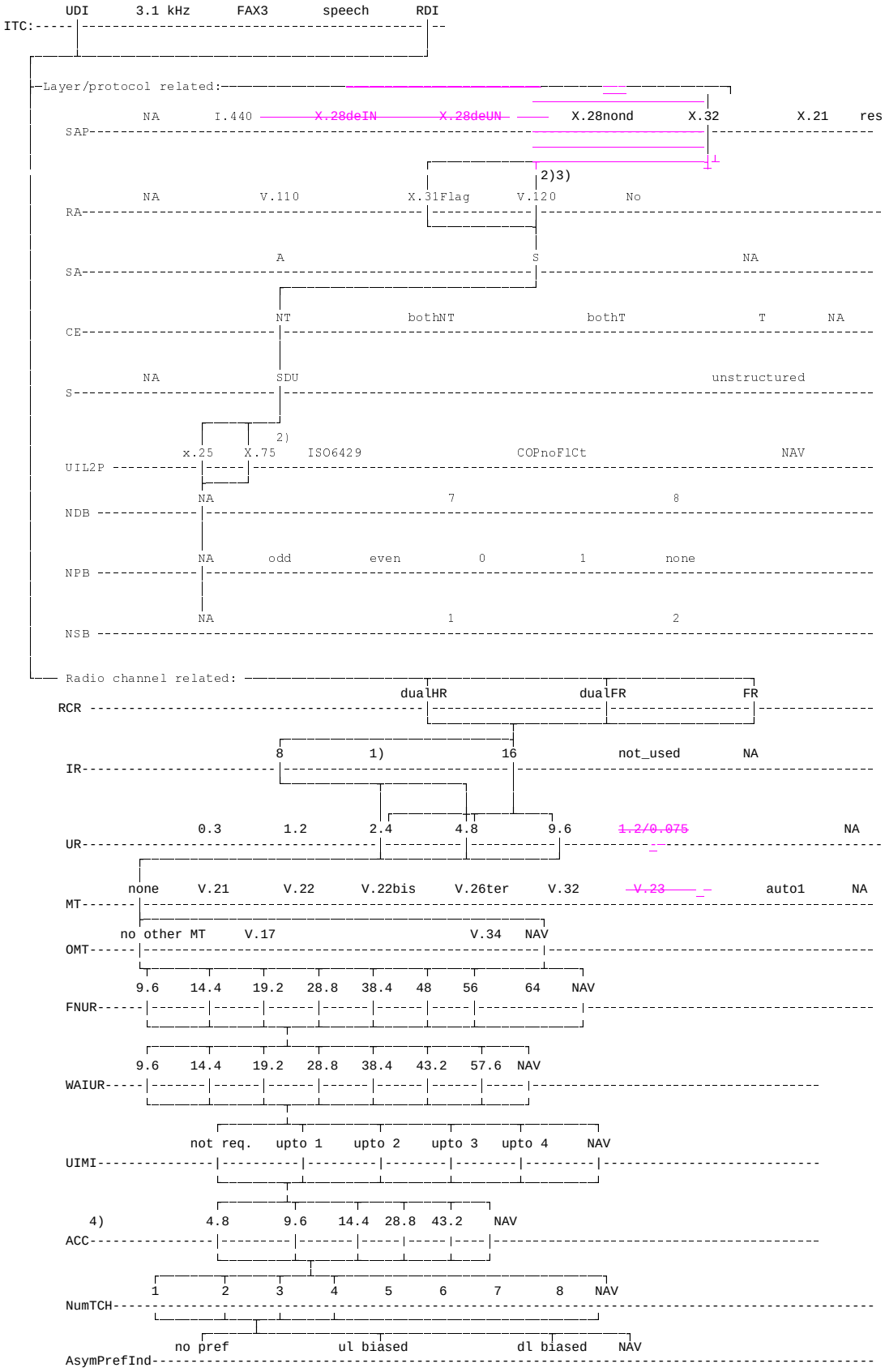
B.1.3.1 Unrestricted/restricted digital information transfer capability

B.1.3.1.1 Non-X.32 Cases



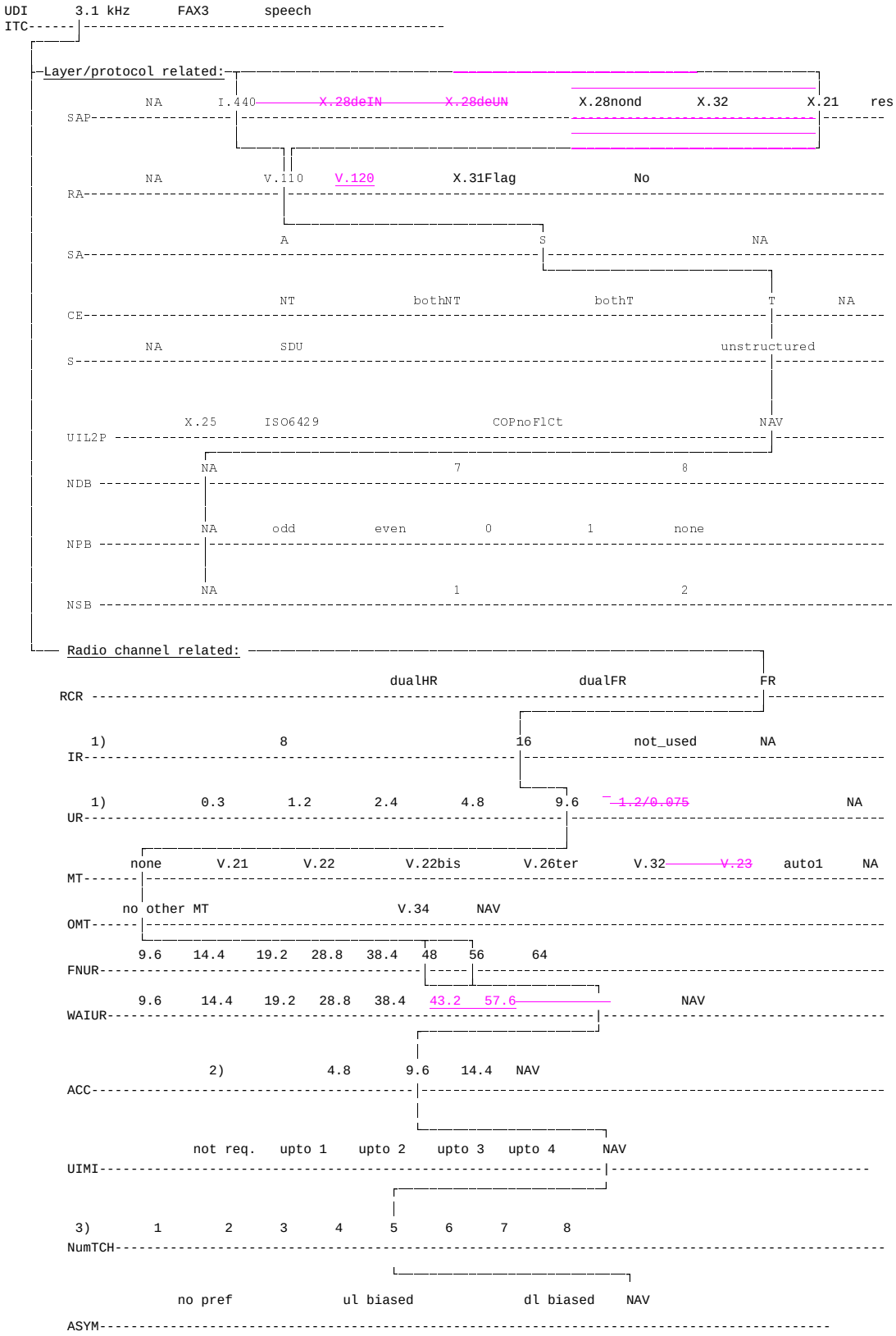
1) IR and UR are overridden if FNUR, ACC and MaxNumTCH are available
2) ACC may have several values simultaneously (bit map coding).

B.1.3.1.2 X.32 Case (Packet Service)



1) for NIRR:6kb/s (not for the SETUP message)
2) not for packet handler access
3) the V.120 relevant BC parameters (octet 5b) shall be set according to the LLC (see annex B.2)
4) ACC may have several values simultaneously (bit map coding).

B.1.3.1.4 48kbit/s and 56 kbit/s transparent Case (TCH/F9.6)



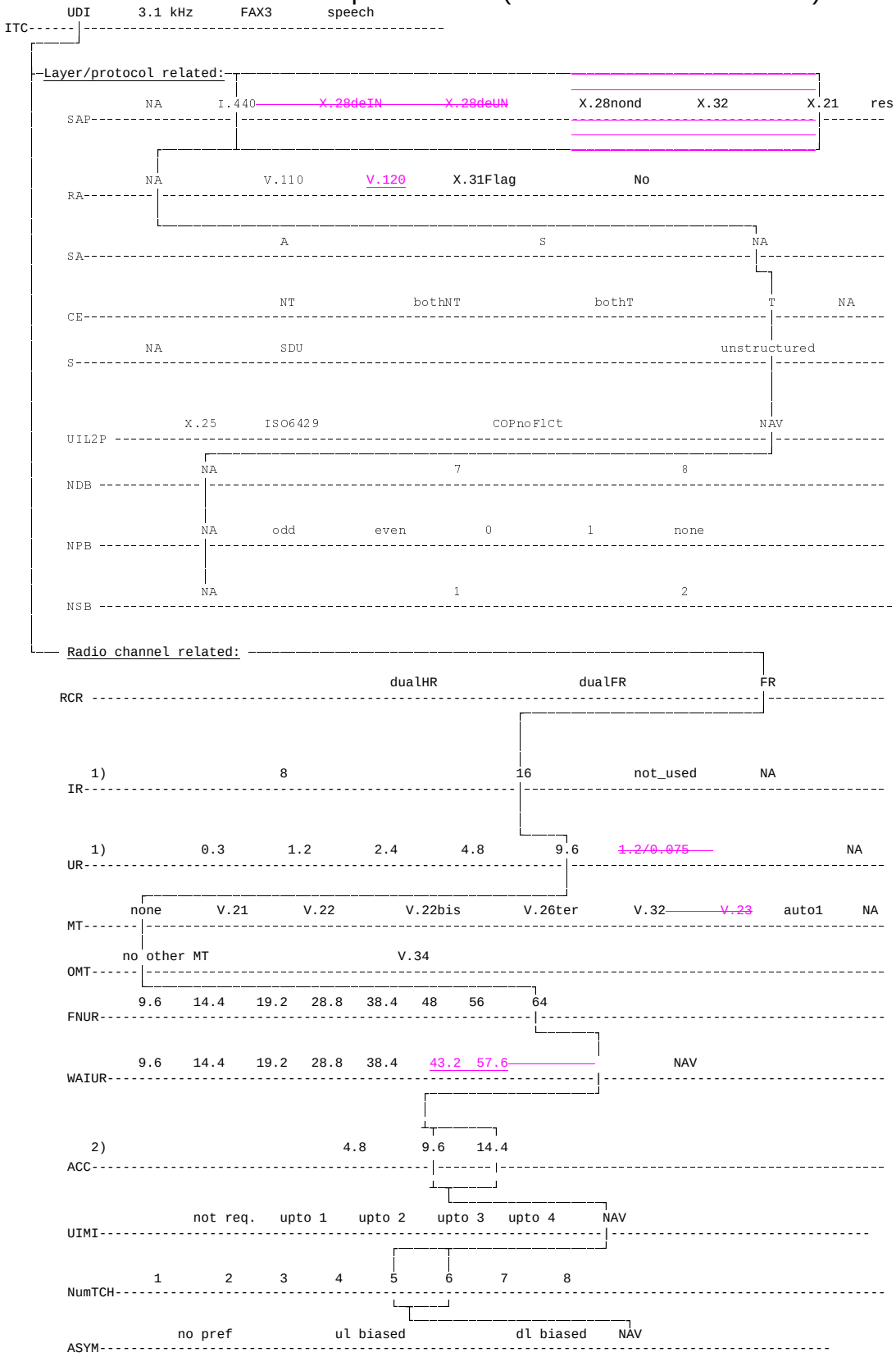
1) IR and UR are overridden by FNUR, ACC and MaxNumTCH are available

2) ACC may have several values simultaneously (bit map coding).

3) For a 4 channel operation see table B.1.3.1.1.

NOTE: The parameters FNUR, OMT, ACC and MaxNumTCH are mandatory for this service.

B.1.3.1.5 64kbit/s bit transparent Case (TCH/F9.6 and TCH/F14.4)

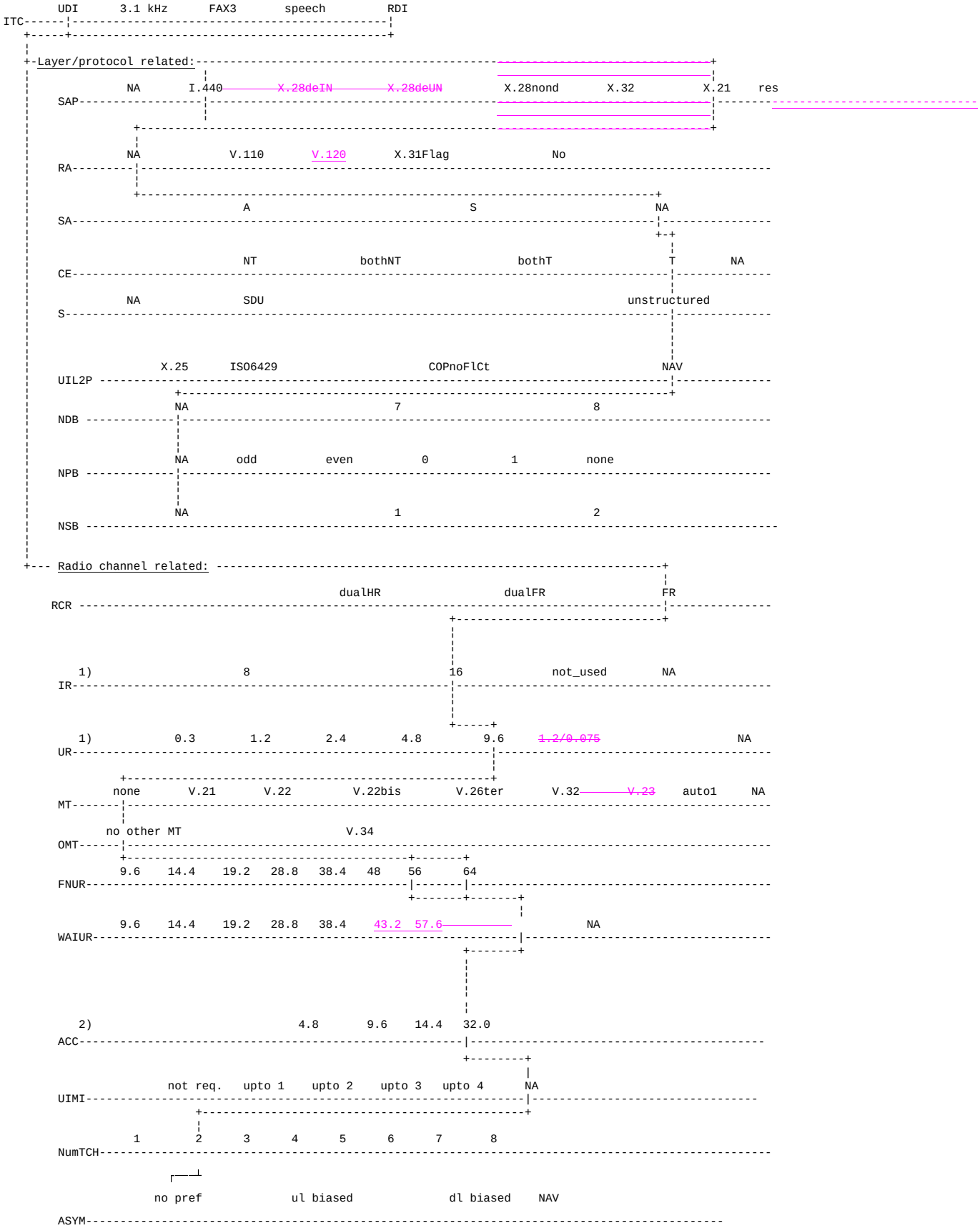


1) IR and UR are overridden by FNUR, ACC and MaxNumTCH are available

2) ACC may have several values simultaneously (bit map coding).

NOTE: The parameters FNUR, OMT, ACC and MaxNumTCH are mandatory for this service.

B.1.3.1.6 Bit transparent 56 kbit/s (RDI) and 64kbit/s (UDI) (TCH/F32.0)



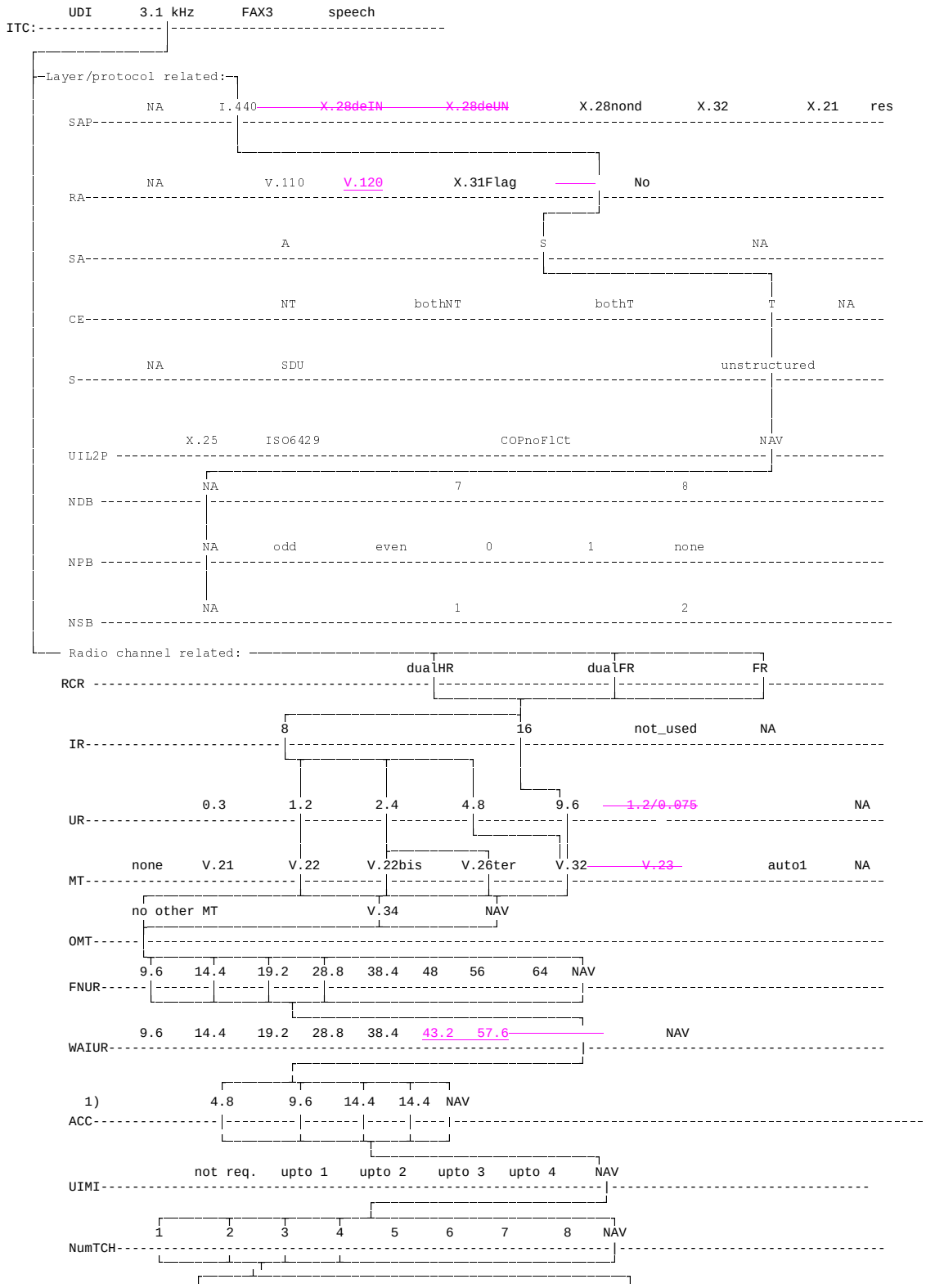
1) IR and UR are overridden by FNUR, ACC and MaxNumTCH are available

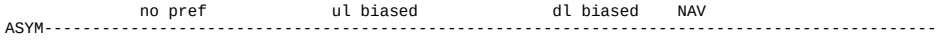
2) ACC may have several values simultaneously (bit map coding).

NOTE: The parameters FNUR, OMT, ACC and MaxNumTCH are mandatory for this service.

B.1.3.2 3.1 kHz audio ex-PLMN information transfer capability

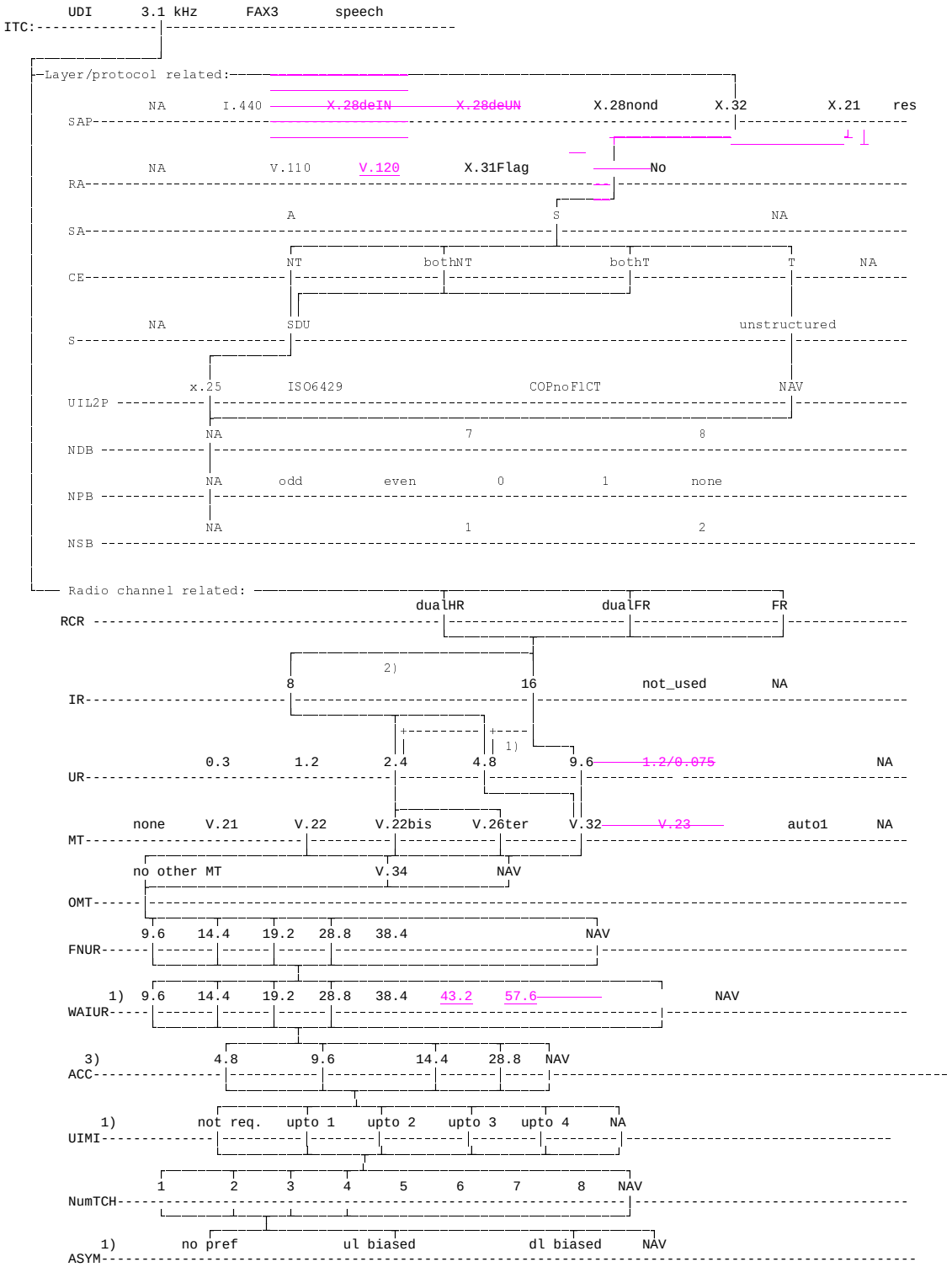
B.1.3.2.1 Non-X.32 Cases





1) ACC may have several values simultaneously (bit map coding).

B.1.3.2.2 X.32 Case (Packet Service)

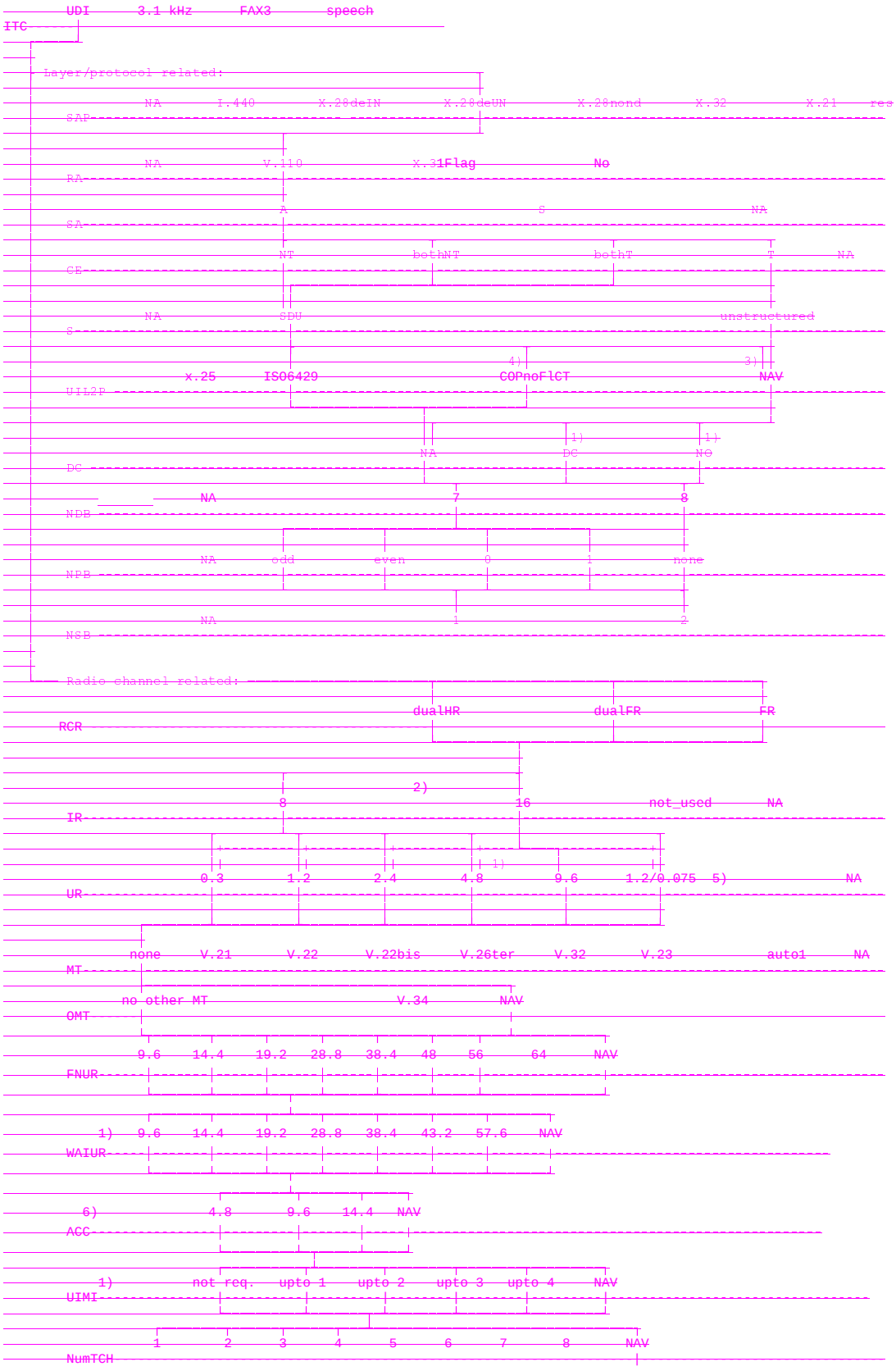


1) for CE:NT or "both"

2) for CE:T or CE:NT and NIRR:6kb/s (not for the SETUP message)

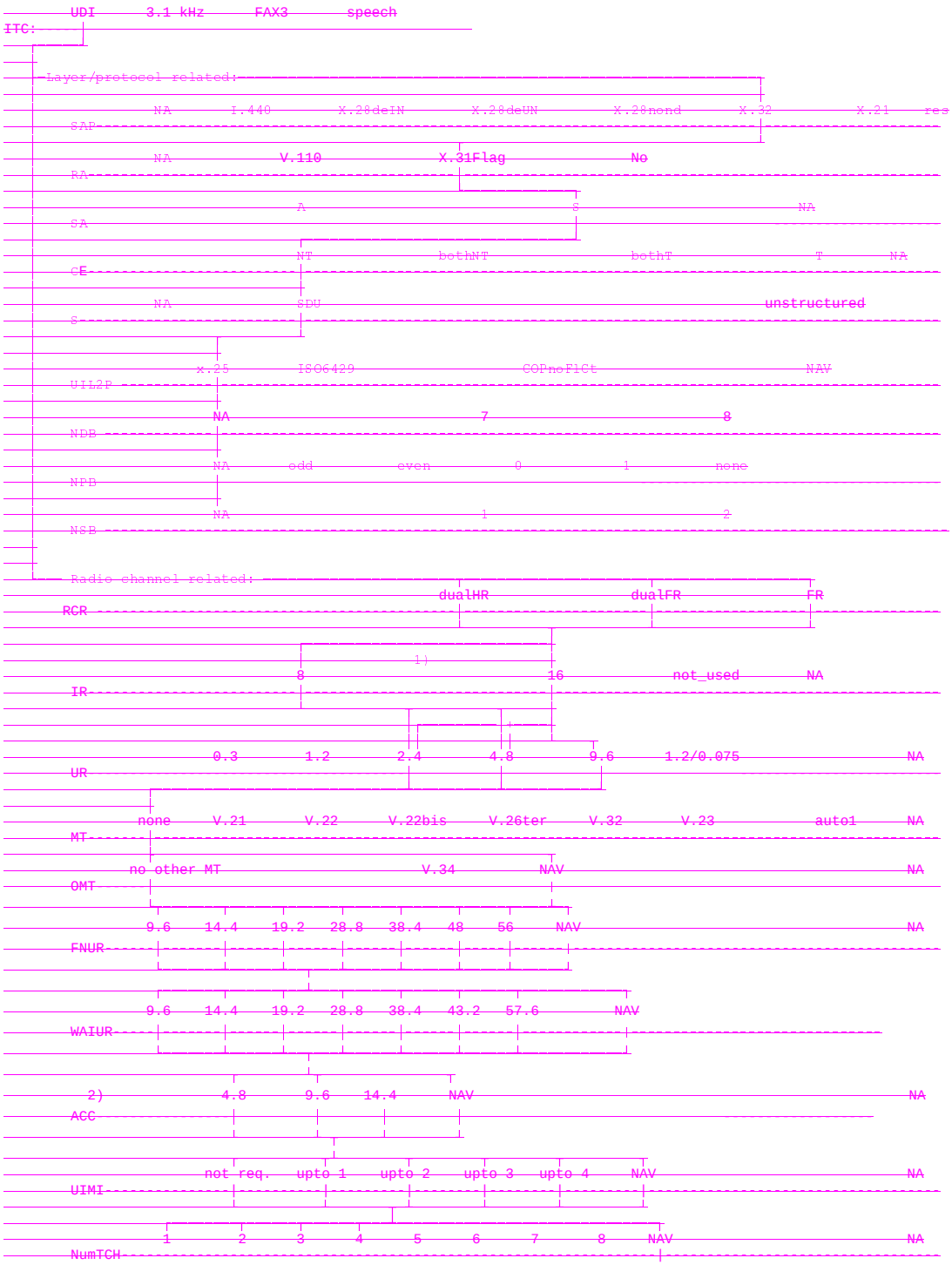
3) ACC may have several values simultaneously (bit map coding).

B.1.4 Bearer Service 40 ... 46, PAD Access Asynchronous



~~1) for CE:NT or "both";~~
~~2) for CE:T only or CE:NT and NIRR:6kb/s (not for the SETUP message);~~
~~3) for MOC with "outband" flow control requested;~~
~~4) for MOC with no flow control requested;~~
~~5) MOC only, 75 bit/s in the uplink, 1200 bit/s in the downlink direction.~~
~~6) ACC may have several values simultaneously (bit map coding).~~

B.1.5 Bearer Service 50 ... 53 ,Data Packet Duplex Synchronous, Unrestricted digital information transfer capability



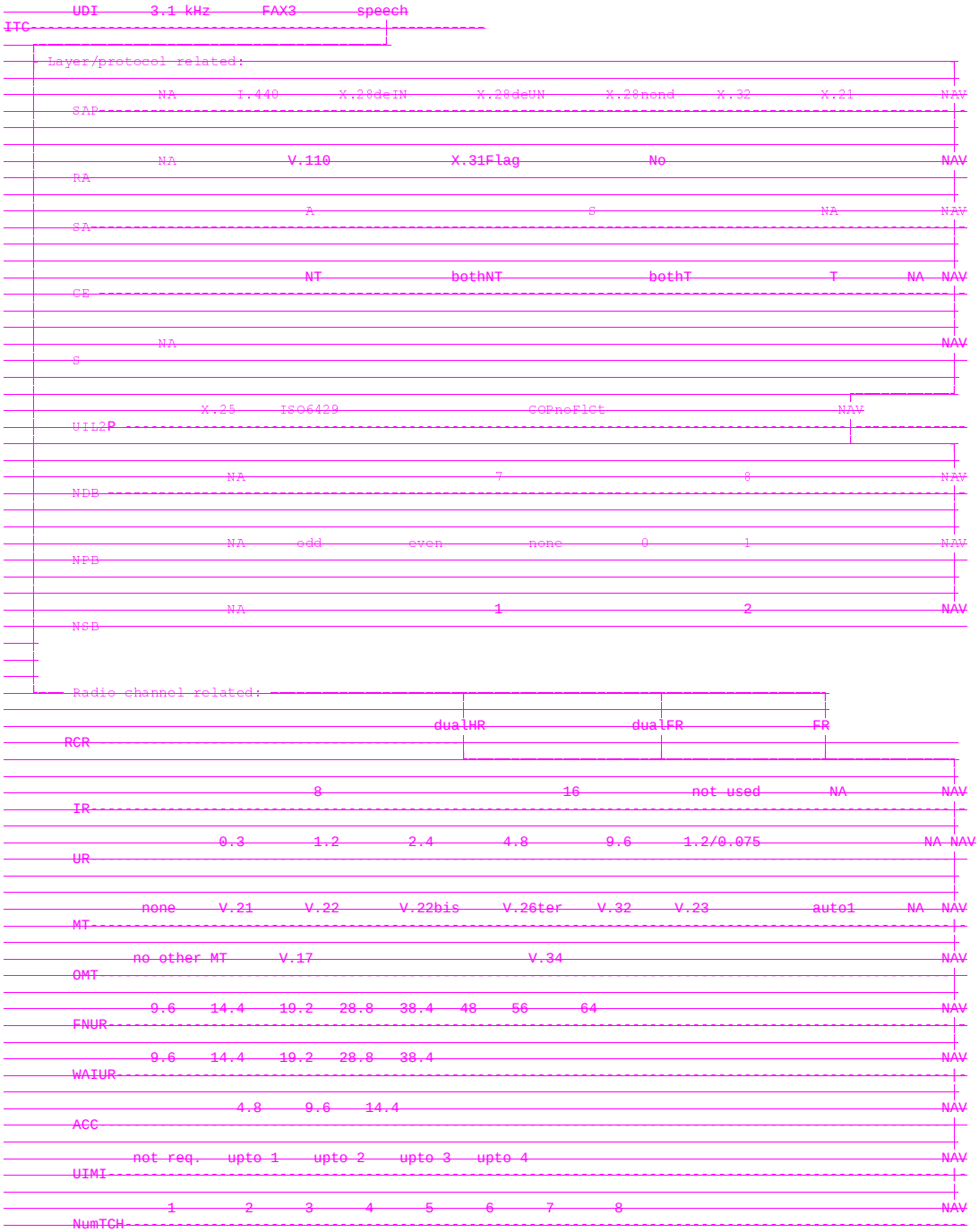
1) for NIRR:6kb/s (not for the SETUP message)

2) ACC may have several values simultaneously (bit map coding).

B.1.6 Bearer Service 61, Alternate Speech/Data

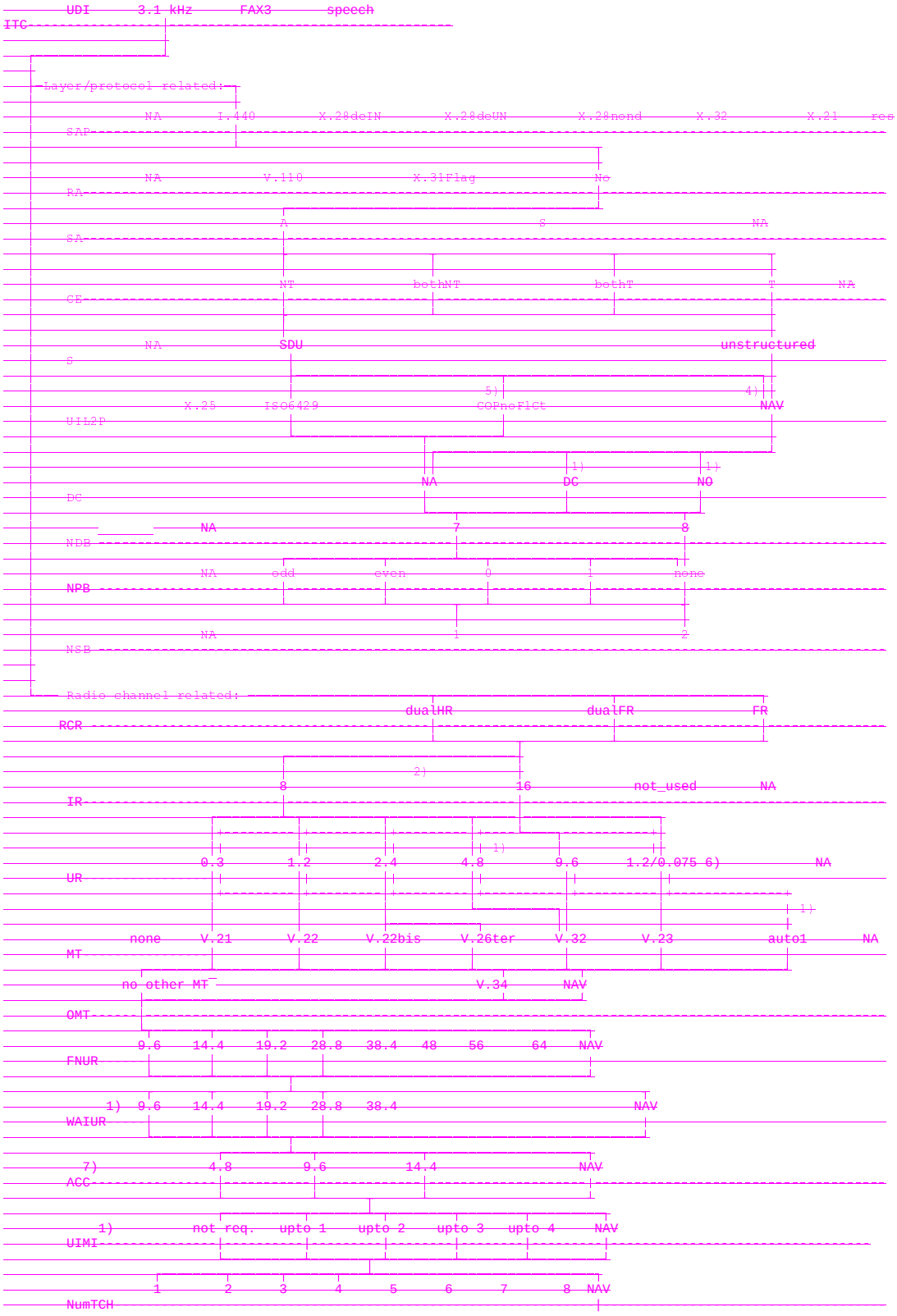
The information element of the "repeat indicator" is set to the value "circular for successive selection (alternate)".

B.1.6.1 Bearer Service 61,Speech



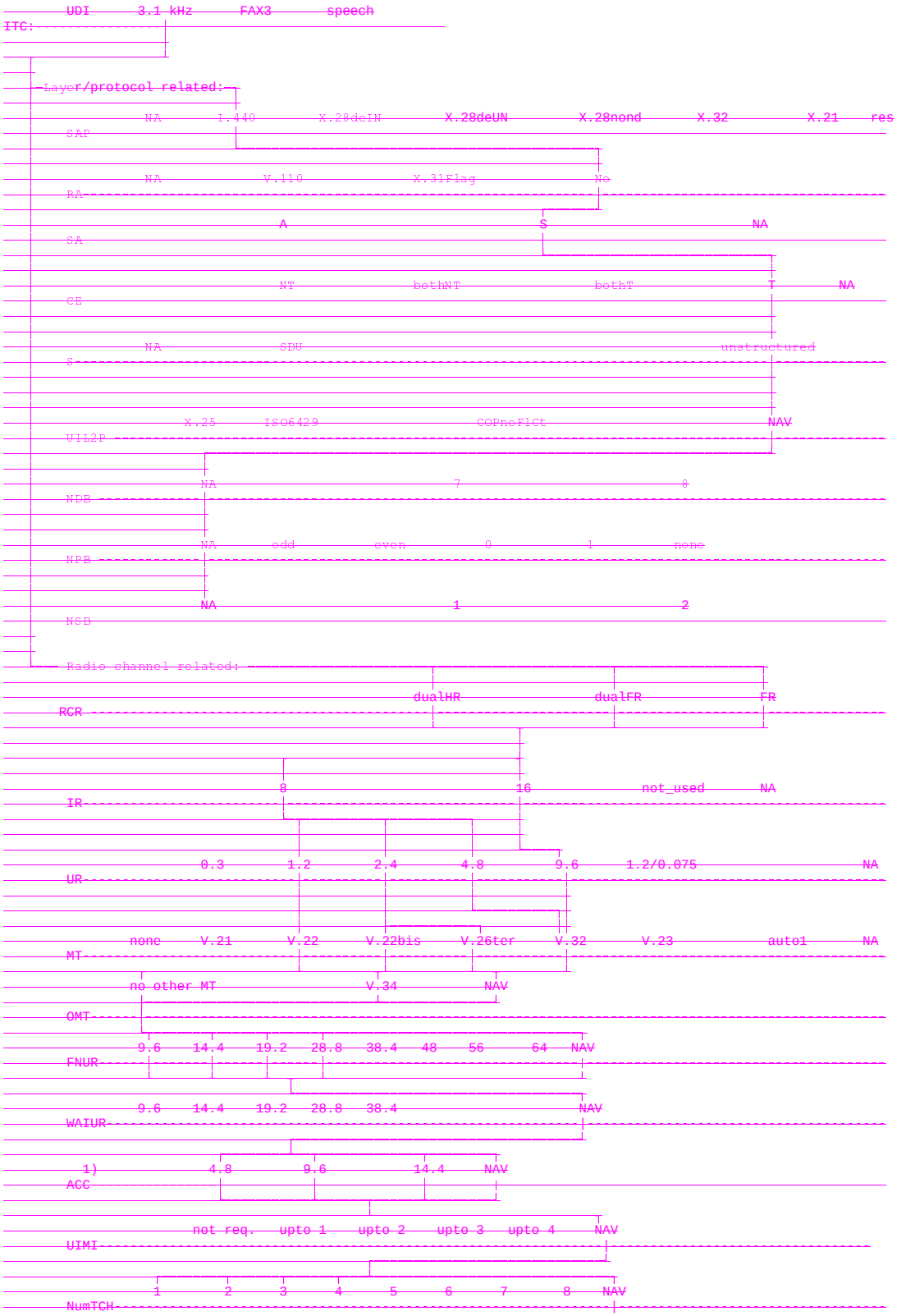
B.1.6.2 Bearer Service 61, 3.1 kHz audio ex-PLMN information transfer capability

B.1.6.2.1 Asynchronous



~~1) for CE:NT or "both"~~
~~2) for CE:T only or CE:NT and NIRR:6kb/s (not for the SETUP message)~~
~~3) for MOC only~~
~~4) for MTC in the SETUP message or MOC/MTC with "out band" flow control requested (not for V.21 and V.23 modem types)~~
~~5) for MOC/MTC with no flow control requested~~
~~6) MOC only, 75 bit/s in the uplink, 1200 bit/s in the downlink direction~~
~~7) ACC may have several values simultaneously (bit map coding).~~

B.1.6.2.2 Synchronous



1) ACC may have several values simultaneously (bit map coding).

~~B.1.7 Bearer Service 81, Speech followed by Data~~

~~The information element of the "repeat indicator" is set to the value "sequential for successive selection (followed by)".~~

~~B.1.7.1 Bearer Service 81,Speech~~

~~Ref. section B.1.6.1.~~

~~B.1.7.2 Bearer Service 81, 3.1 kHz audio ex-PLMN information transfer capability~~

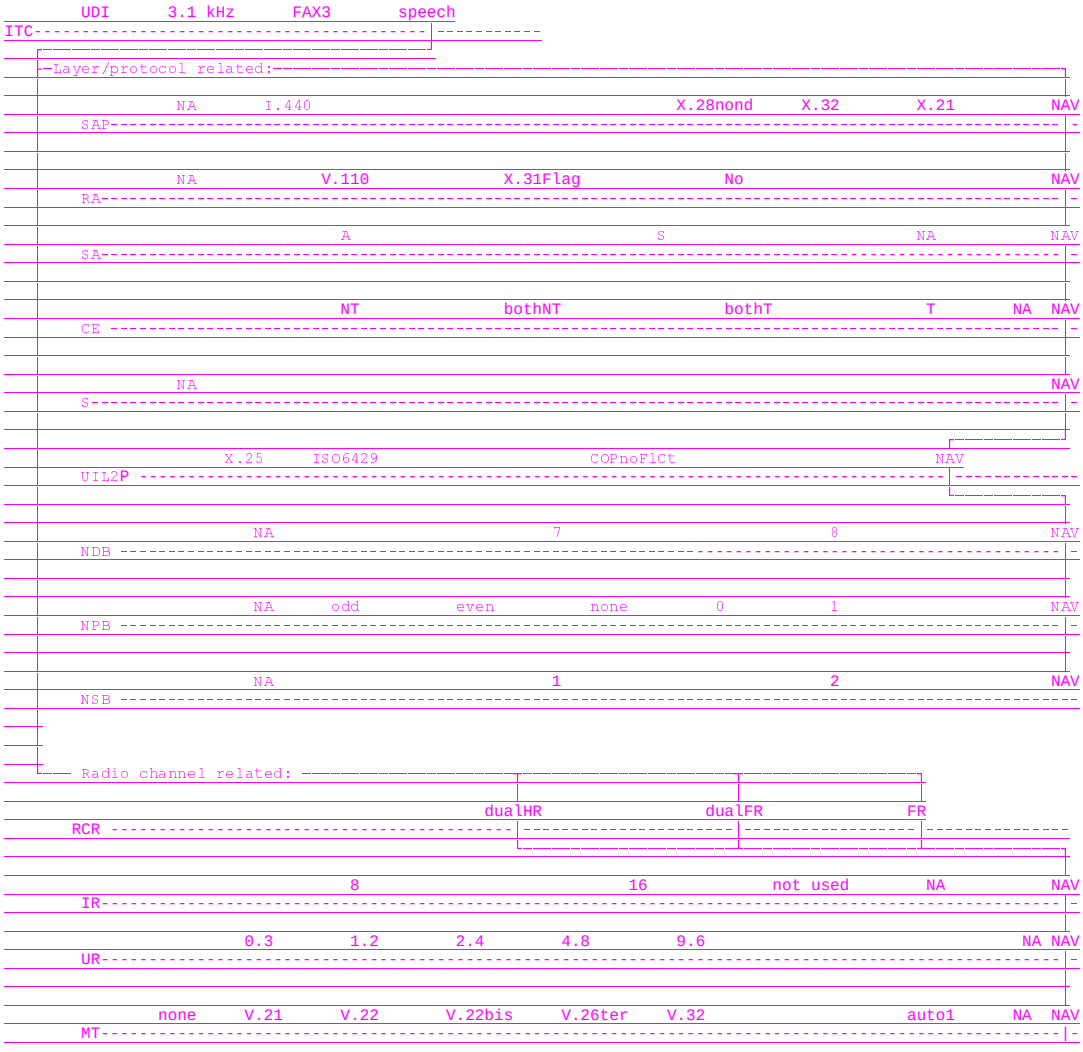
~~B.1.7.2.1 Asynchronous~~

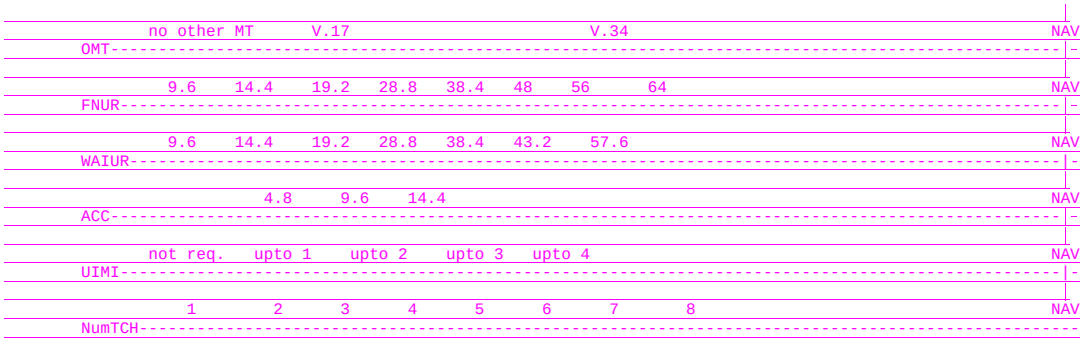
~~Ref. section B.1.6.2.1.~~

~~B.1.7.2.2 Synchronous~~

~~Ref. section B.1.6.2.2.~~

B.1.8 Teleservice 11 ... 12, Speech





~~Ref. section B.1.6.1.~~

B.1.9 Teleservice 21 ... 23, Short Message

not applicable.

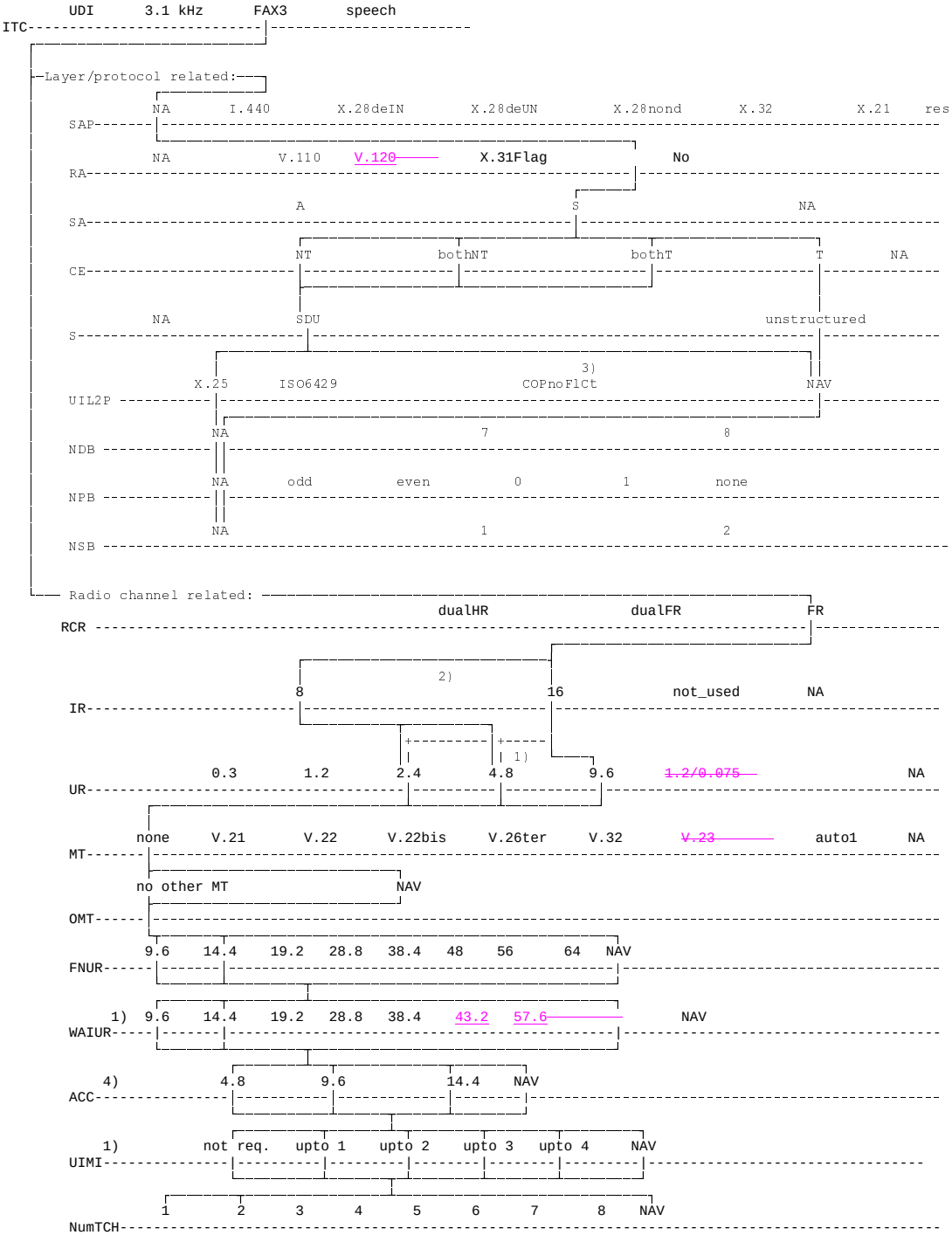
B.1.10 Teleservice 61, Alternate Speech and Facsimile group 3

The information element of the "repeat indicator" is set to the value "circular for successive selection (alternate)".

B.1.10.1 Teleservice 61, Speech

Ref. section B.1.~~6.1~~8.

B.1.10.2 Teleservice 61, Facsimile group 3



1) for CE:NT or "both";
2) for CE:T only;
3) for MTC in the SETUP message only;
4) ACC may have several values simultaneously (bit map coding).

B.1.11 Teleservice 62, Automatic Facsimile group 3

Ref. section B.1.10, the information element "repeat indicator" is not available/valid.

B.1.12 Valid combinations of FNUR, WAIUR, ACC, mTCH

B.1.12.1 Transparent Services

The MS is allowed to signal any combination of FNUR, ACC and mTCH compliant to the following table. The network is allowed to assign any Channel Mode compliant to the following table.

FNUR	mTCH (Note 7)	ACC (Note 1,6)					Channel Mode (Note 4,5)				
		TCH/F 4.8	TCH/F 9.6	TCH/F 14.4	TCH/F 28.8	TCH/F 32.0	TCH/F 4.8	TCH/F 9.6	TCH/F 14.4	TCH/F 28.8	TCH/F 32.0
9.6 kbit/s	1	*	+	*	*	*	-	1	-	-	-
	2	+	*	*	*	*	2	1	-	-	-
14.4 kbit/s	1	*	*	+	*	*	-	-	1	-	-
	2	*	+	*	*	*	-	2 (N2)	1	-	-
	3	+	*	*	*	*	3	2 (N2)	1	-	-
19.2 kbit/s	2	*	+	*	*	*	-	2	-	-	-
	4	+	*	*	*	*	4	2	-	-	-
28.8 kbit/s	1	*	*	*	+	*	-	-	-	1	-
	2	*	*	+	*	*	-	-	2	1	-
	3	*	+	*	*	*	-	3	2	1	-
38.4 kbit/s	3	*	*	+	*	*	-	-	3 (N2)	-	-
	4	*	+	*	*	*	-	4	3 (N2)	-	-
48.0 kbit/s	4	*	*	+	*	*	-	-	4 (N2)	-	-
	5	*	+	*	*	*	-	5	4 (N2)	-	-
56.0 kbit/s	2	*	*	*	*	+	-	-	-	-	2(N8)
	4	*	*	+	*	*	-	-	4 (N2)	-	2(N8)
	5	*	+	*	*	*	-	5 (N3)	4 (N2)	-	2(N8)
64.0 kbit/s	2	*	*	*	*	+	-	-	-	-	2(N8)
	5	*	*	+	*	*	-	-	5 (N2)	-	2(N8)
	6	*	+	*	*	*	-	6 (N2,3)	5 (N2)	-	2(N8)

NB; In the table above, N stands for NOTE.

NOTE 1: A '+' indicates that a certain channel coding must be included in the ACC and a '*' indicates that it may or may not be included.

NOTE 2: Padding Required, ref GSM 04.21.

NOTE 3: Air interface user rate 11.2 kbit/s, ref. GSM 04.21.

NOTE 4: A '-' indicates that this channel coding cannot be assigned for this FNUR.

NOTE 5: A certain channel coding may only be assigned if indicated as acceptable in the ACC.

NOTE 6: In case the MS signals an ACC containing TCH/F4.8 only and the network does not support TCH/F4.8 channel coding, then the network may act as if TCH/F9.6 were included in the ACC.

NOTE 8: Can only be used for bit transparent 56 (RDI) and 64 (UDI) kbit/s connections in 56 kbit/s and 64 kbit/s environments, respectively.

NOTE 7: The MS is allowed to signal higher values for mTCH than indicated in the table for the signalled FNUR and ACC. Before initiating the assignment procedure, the MSC, if necessary, will lower the value of the mTCH to the highest value applicable for the signalled FNUR and ACC.

The final decision about the radio interface configuration is taken by the BSS during the Assignment procedure subject to the restrictions that the number of assigned TCH/F may not exceed the mTCH, that the channel coding is among the ACC and that the AIUR equals the FNUR.

The radio interface configuration may be changed by the BSS during the call as long as the channel coding used is among the ACC, the mTCH is not exceeded and the AIUR is kept constant (ref. GSM 02.34).

B.1.12.2 Non-transparent services

The MS is allowed to signal any combination of WAIUR, ACC and mTCH compliant to the following table. The network is allowed to assign any Channel Mode compliant to the following table.

WAIUR	mTCH (Note 5)	ACC (Note 1,4)					Channel Mode (Note 2,3,6)				
		TCH/F 4.8	TCH/F 9.6	TCH/F 14.4	TCH/F 28.8	TCH/F 43.2	TCH/F 4.8	TCH/F 9.6	TCH/F 14.4	TCH/F 28.8	TCH/F 43.2
9.6 kbit/s	1	*	+	*	*	*	1	1	-	-	-
	2	+	*	*	*	*	1 - 2	1	-	-	-
14.4 kbit/s	1	*	*	+	*	*	1	1	1	-	-
	3	+	*	*	*	*	1 - 3	1 - 2	1	-	-
19.2 kbit/s	2	*	+	*	*	*	1 - 2	1 - 2	1	1	-
	4	+	*	*	*	*	1 - 4	1 - 2	1	1	-
28.8 kbit/s	1	*	*	*	+	*	1	1	1	1	-
	2	*	*	+	*	*	1 - 2	1 - 2	1 - 2	1	-
	3	*	+	*	*	*	1 - 3	1 - 3	1 - 2	1	-
38.4 kbit/s	4	*	+	*	*	*	1 - 4	1 - 4	1 - 3	1 - 2	1
43.2 kbit/s	1	*	*	*	*	+	1	1	1	1	1
	3	*	*	+	*	*	1 - 3	1 - 3	1 - 3	1 - 2	1
57.6 kbit/s	2	*	*	*	+	*	1 - 2	1 - 2	1 - 2	1 - 2	1
	4	*	*	+	*	*	1 - 4	1 - 4	1 - 4	1 - 2	1

NOTE 1: A '+' indicates that a certain channel coding must be included in the ACC and a '*' indicates that it may or may not be included.

NOTE 2: A '-' indicates that this channel coding cannot be used for this WAIUR.

NOTE 3: A certain channel coding may only be assigned if indicated as acceptable in the ACC.

NOTE 4: In case the MS signals an ACC containing TCH/F4.8 only and the network does not support TCH/F4.8 channel coding, then the network may act as if TCH/F9.6 were included in the ACC.

NOTE 5: The MS is allowed to signal higher values for mTCH than indicated in the table for the signalled WAIUR and ACC. Before initiating the assignment procedure, the MSC, if necessary, will lower the value of the mTCH to the highest value applicable for the signalled WAIUR and ACC.

NOTE 6: Unless an EDGE channel is assigned in one direction at least, the same channel coding is assigned in both directions, and an equal or lesser number of channels is assigned in the up link direction than in the down link direction. If an EDGE channel is assigned in one direction, TCH/F14.4 or an EDGE channel is assigned in the other direction. If the user has indicated up or down link biased asymmetry preference, TCH/F14.4 is assigned in the unbiased direction. The number of channels assigned is the same in each direction unless restricted by the mobile classmark, and is always within the limits given in the corresponding column.

The final decision about the radio interface configuration is taken by the BSS during the Assignment procedure. The BSS may assign any number of TCH/F ranging from 1 to mTCH and use any of the channel codings among the ACC. The BSS shall try to reach the WAIUR if the resource situation allows it. The maximum possible AIUR shall not exceed the WAIUR unless the higher AIUR can be reached with a smaller number of TCH/F (ref. GSM 02.34).

The radio interface configuration may be changed by the BSS during the call as long as the channel coding used is among the ACC and the mTCH is not exceeded.

B.2 Low Layer/High Layer Compatibility Information Element

B.2.1 Introduction

B.2.1.1 General Consideration

The purpose of the Low Layer/High Layer Compatibility Information Element (LLC/HLC-IE) is to provide a means for additional end-to-end compatibility checking by an addressed entity (e.g. a remote user, an interworking unit or a high layer function network node). The LLC/HLC-IE may be manipulated by the GSM PLMN to maintain consistency with the setup parameter negotiation between the mobile station and the network (ref. to GSM TS 09.07). The LLC/HLC-IE is transferred transparently by the ISDN between the call originating GSM PLMN and the addressed entity.

With respect to the individual parameter settings at the MS the following cases may be distinguished (ref. GSM 07.02 and GSM 07.03):

- Mobile-originated call set up by a MS consisting of a MT with R interface:

  The setting results from respective MMI actions and/or MT internal settings.

- Mobile-originated call set up by a MS consisting of a MT with S interface:

  The LLC/HLC-IEs which are contained in the ISDN SETUP message received from the terminal are passed unchanged to the MSC.

- Mobile-terminated call set up to a MS consisting of a MT with R interface:

  The LLC/HLC related part of the compatibility check is carried out according to the knowledge of the MT concerning its implemented functions (i.e. answering the call). The offered field values determine the selection of the terminal function for the intended connection.

- Mobile-terminated call set up to a MS consisting of a MT with S interface:

  The LLC/HLC received from the MSC is passed to the terminal by the MT. The LLC/HLC related part of the compatibility check is up to the terminal connected to the S interface of the MT, as is the selection of the terminal function (i.e. answering the call).

Where applicable, the same settings and rules concerning LLC and/or HLC apply as for ISDN use (ref. ETS 300 102-1 and ETR 018). However, considering that GSM PLMN data transmission is based on CCITT V.110 rate adaptation, the MS shall provide the LLC-IE for mobile-originated calls when using unrestricted or restricted digital information transfer capability. This is to assure the conveyance of the e.g. "V.110" indication towards the called entity, as the comparable indication in the ISDN BC-IE may be lost. It shall also be possible to choose whether or not the LLC-IE is provided for the case of an information transfer capability "3.1 kHz audio ex PLMN".

There shall be no contradiction of the information between the BC-IE and LLC-IE at the originating side. However, as some parts of the bearer capability may be modified during the transport of the call, there should be minimum duplication of this information between the BC-IE and the LLC-IE.

If as a result of duplication, a contradiction occurs between the BC-IE and the LLC-IE at the terminating side, the receiving entity shall ignore the conflicting information in the LLC-IE.

B.2.1.2 Interpretation of the Tables

The individual contents of the LLC/HLC-IE are represented in the following tables. The indication of the applicable service group defines the link between the GSM BC-IE and its associated LLC/HLC-IEs.

If the appropriate message includes multiple BC-IEs and if LLC and/or HLC information is available, multiple LLCs and HLCs shall be included in the message. The LLC/HLC associated with the BC-IE indicating speech shall be marked as "not applicable" (see GSM 04.08).

Legend: { xxxx | yyyy } choice of values
---- not relevant for this service (set to appropriate value)
[zzzz] optional

B.2.2 LLC Bearer Service 201 ... 26

B.2.2.1 Unrestricted / restricted digital information transfer capability

Low layer compatibility information element:

Octet	Information element field	field value
3	Coding standard Information transfer capability	CCITT { unrestricted digital | restricted digital }
4	Transfer mode Information transfer rate	circuit mode 64 kbit/s
5	User information layer 1 protocol	{ V.110/X.30 | V.120 }
5a	Synchronous / asynchronous Negotiation User rate	asynchronous in-band not possible { 0.3 | 1.2 | 2.4 | 4.8 | 9.6 ~~| 1.2/0.075~~ | 14.4 | 19.2 | 28.8 | 38.4 | 48 | 56 } kbit/s
5b 2)	Intermediate rate NIC on Tx NIC on Rx Flow control on Tx Flow control on Rx	{ 8 | 16 } kbit/s ----- ----- { not required 1)| required } { not accepted 1)| accepted }
5b 3)	Rate adaption header / no header Multiple frame establishment support Mode of operation Assignor / assignee In-band / out-band negotiation	Rate adaption header included Multiple frame establishment supported Protocol sensitive mode of operation ----- -----
5c	Number of stop bits Number of data bits Parity	{ 1 | 2 } bits { 7 | 8 } bits { odd | even | none | forced to 0 | forced to 1 }
5d	Duplex mode Modem type	á[duplex] -----

1) only these values are applicable to Mobile Originated Calls
2) octet 5b for V.110/X.30
3) octet 5b for V.120

B.2.2.2 3.1 kHz audio ex-PLMN information transfer capability

Low layer compatibility information element:

Octet	Information element field	field value
3	Coding standard Information transfer capability	CCITT 3.1kHz audio
4	Transfer mode Information transfer rate	circuit mode 64 kbit/s
5	User information layer 1 protocol	{G.711 A-law G.711 u-law (PCS-1900)}
5a	Synchronous / asynchronous Negotiation User rate	(may be set depending on user's requirement)
5b	Intermediate rate NIC on Tx NIC on Rx Flow control on Tx Flow control on Rx	not relevant but cannot be omitted in order to have octet 5d
5c	Number of stop bits Number of data bits Parity	(may be set depending on the user's requirement)
5d	Duplex mode Modem type	á[duplex] á[{V.21|V.22|V.22bis|~~V.23|~~V.26ter|V.32|V.34}]

NOTE: If octet 5d is not specified, the whole LLC is not required.

B.2.3 LLC Bearer Service 301 ... 34

B.2.3.1 Unrestricted / restricted digital information transfer capability

Low layer compatibility information element:

Octet	Information element field	field value
3	Coding standard Information transfer capability	CCITT { digital unrestricted | restricted digital }
4	Transfer mode Information transfer rate	circuit mode 64 kbit/s
5	User information layer 1 protocol	{ V.110/X.30 | X.31 flag stuffing | V.120 }
5a	Synchronous / asynchronous Negotiation User rate	synchronous in-band not possible { 1.2 | 2.4 | 4.8 | 9.6 | 14.4 | 19.2 | 28.8 | 38.4 | 48 | 56 } kbit/s
5b 2)	Intermediate rate NIC on Tx NIC on Rx Flow control on Tx Flow control on Rx	{ 8 | 16 } kbit/s { not required | required } { not accepted | accepted } ----- -----
5b 3)	Rate adaption header / no header Multiple frame establishment support Mode of operation Assignor / assignee In-band / out-band negotiation	Rate adaption header included Multiple frame establishment supported Protocol sensitive mode of operation ----- -----
5c 1)	Number of stop bits Number of data bits Parity	not relevant but cannot be omitted in order to have octet 5d
5d 1)	Duplex mode Modem type	[duplex] -----
6	User information layer 2 protocol	[X.25]
7	User information layer 3 protocol	[X.25]

1) If octet 5d is not specified, octet 5c may be omitted.
2) octet 5b for V.110/X.30
3) octet 5b for V.120

B.2.3.2 3.1kHz audio ex-PLMN information transfer capability

Low layer compatibility information element:

Octet	Information element field	field value
3	Coding standard Information transfer capability	CCITT 3.1kHz audio
4	Transfer mode Information transfer rate	circuit mode 64 kbit/s
5	User information layer 1 protocol	{G.711 A-law G.711 u-law (PCS-1900)}
5a	Synchronous / asynchronous Negotiation User rate	(may be set depending on the user's requirement)
5b	Intermediate rate NIC on Tx NIC on Rx Flow control on Tx Flow control on Rx	not relevant but cannot be omitted in order to have octet 5d
5c	Number of stop bits Number of data bits Parity	(may be set depending on the user's requirement)
5d	Duplex mode Modem type	[duplex] [{ V.22 | V.22bis | V.26ter | V.32 | | V.34 }]
6	User information layer 2 protocol	[X.25]
7	User information layer 3 protocol	[X.25]

NOTE: If octet 5d is not specified, octets 5a..5d may be omitted.

B.2.4 LLC Bearer Services 41 ... 46

May be optionally available with the settings according to B.2.2.1.

B.2.5 LLC Bearer Services 51 ... 53

B.2.5.1 Unrestricted digital information transfer capability

Low layer compatibility information element:

Octet	Information element field	field value
3	Coding standard Information transfer capability	CCITT unrestricted digital
4	Transfer mode Information transfer rate	circuit mode 64 kbit/s
5	User information layer 1 protocol	X.31 flag stuffing
5a	Synchronous / asynchronous Negotiation User rate	synchronous in-band not possible { 2.4 | 4.8 | 9.6 | 14.4 | 19.2 | 28.8 | 38.4 | 48 | 56 } kbit/s
6	User information layer 2 protocol	X.25
7	User information layer 3 protocol	X.25

B.2.6 LLC Bearer Service 61

B.2.6.1 3,1 kHz audio ex-PLMN information transfer capability, Asynchronous

Ref. section B.2.2.2.

B.2.6.2 3,1 kHz audio ex-PLMN information transfer capability, Synchronous

Ref. section B.2.3.2.

B.2.7 LLC Bearer Service 81

B.2.7.1 3,1 kHz audio ex-PLMN information transfer capability, Asynchronous

Ref. section B.2.2.2.

B.2.7.2 3,1 kHz audio ex-PLMN information transfer capability, Synchronous

Ref. section B.2.3.2.

B.2.8 HLC Teleservices 11 ... 12

High layer compatibility information element:

Octet	Information element field	Field value
3	Coding standard Interpretation Presentation method of protocol profile	CCITT first high layer characteristic identification to be used in the call high layer protocol profile
4	High layer characteristics identific.	Telephony

B.2.9 HLC Teleservices 21 ... 23

Not applicable.

B.2.10 HLC Teleservice 61

High layer compatibility information element:

Octet	Information element field	Field value
3	Coding standard Interpretation Presentation method of protocol profile	CCITT first high layer characteristic identification to be used in the call high layer protocol profile
4	High layer characteristics identific.	Facsimile G2/G3

B.2.11 HLC Teleservice 62

High layer compatibility information element:

Octet	Information element field	Field value
3	Coding standard Interpretation Presentation method of protocol profile	CCITT first high layer characteristic identification to be used in the call high layer protocol profile
4	High layer characteristics identific.	Facsimile G2/G3

Annex C:
Change history

Change history						
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Apr 1999	GSM 07.01	7.1.0				Transferred to 3GPP CN1
CN#03	27.001				3.0.0	Approved at CN#03
CN#4	27.001	3.0.0	001	R99	3.1.0	Introduction of EDGE channel codings into the specifications
CN#5	27.001	3.1.0	002	R99	3.2.0	Asymmetry in EDGE
CN#5	27.001	3.1.0	003	R99	3.2.0	EDGE related correction

History

Document history		
V3.0.0	May 1999	Approved at TSG_CN #3. Under TSG TSG CN Change Control.
V3.1.0	September 1999	CR 001 Approved by E-mail after TSG_CN#4
V3.2.0	October 1999	CRs 002 and 003, Approved at TSG_CN#5

3GPP-N3/SMG3 WPD Meeting #7
Sophia Antipolis, France, 29 Nov-03 Dec 1999

***Document* N3-99353**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

27.002	CR	002	Current Version:	3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG_N#6 *list expected approval meeting # here ↑*

for approval [ ] for information [ ]

strategic [ ] non-strategic [ ] *(for SMG use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [ ]

Source: TSG_N3 **Date:** 21.11.1999

Subject: R99 service clean-up

Work item: R99 service clean-up

Category: *(only one category shall be marked with an X)*

F	Correction	[ ]	**Release:**	Phase 2	[ ]
A	Corresponds to a correction in an earlier release	[ ]		Release 96	[ ]
B	Addition of feature	[ ]		Release 97	[ ]
C	Functional modification of feature	[X]		Release 98	[ ]
D	Editorial modification	[ ]		Release 99	[X]
				Release 00	[ ]

Reason for change: Due to the deletion of services in GSM R99 (dual services, dedicated services) this specification has to be updated.

Clauses affected:

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments: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<---------- double-click here for help and instructions on how to create a CR.

3G TS 27.002 V3.1.0 (1999-09)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (3G TS 27.002 version 3.1.0)

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Contents

Foreword

This Technical Specification has been produced by the 3GPP.

This TS defines the interfaces and Terminal Adaptation Functions (TAF) integral to a Mobile Termination (MT) which enables the attachment of asynchronous terminals to a MT 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 this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 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 specification;

1 Scope

This Technical Specification (TS) defines the interfaces and Terminal Adaptation Functions (TAF) integral to a Mobile Termination (MT) which enables the attachment of asynchronous terminals to a MT (see GSM 04.02 [4]). The general aspects of Terminal Adaptation Functions are contained in GSM 07.01 [7]. This TS covers support of these services for the following interfaces and procedures:

(i) V.14 procedures
(ii) V.21 DTE/DCE interface
(iii) V.22bis DTE/DCE interface
~~(iv) V.23 DTE/DCE interface~~
(v) V.32 DTE/DCE procedures
(vi) I.420 S interface
(vii) V.25bis signalling procedures
(viii) V.25ter signalling procedures

The asynchronous data rates between the MT and the TE2 are defined in GSM 02.02 [2].

Note: From GSM R99 onwards the following services are no more required to be provided by a GSM PLMN:

- the dual Bearer Services “alternate speech/data” and “speech followed by data”
- the dedicated services for PAD and Packet access
- BS 21 ... 26 and BS 31 ... 34

The support of those services is still optional. The specification of these services is not within the scope of this TS. For that, the reader is referred to GSM Release 98.

1.1 Normative 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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.02: "Digital cellular telecommunication system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[3] GSM 03.10: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) connection types".

[4] GSM 04.02: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".

[5] GSM 04.08: "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification".

[6] GSM 04.21: "Digital cellular telecommunication system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface ".

[7] GSM 07.01: "Digital cellular telecommunication system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[8] GSM 07.07: "Digital cellular telecommunication system (Phase 2+); AT command set for GSM Mobile Equipment (ME)

~~[9] GSM 09.05: "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 (PAD) facility access".~~

[10] CCITT Recommendation V.4: "General structure of signals of international alphabet No.5 code for character oriented data transmission over public telephone networks".

[11] CCITT Recommendation V.25 bis (1988): Blue book, Volume VIII, Fascicle VIII.1 "Automatic Calling and/or Answering Equipment on the General Switched Telephone Network (GSTN) using the 100-Series Interchange Circuits".

[12] ITU-T Recommendation V.25 ter: "Serial asynchronous automatic dialling and control".

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

[14] CCITT Recommendation V.24 (1988): Blue book, Volume VIII, Fascicle VIII.1 "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment".

[15] CCITT Recommendation V.21 (1988): Blue book, Volume VIII, Fascicle VIII.1 "300 bits per second duplex modem standardized for use in the general switched telephone network".

[16] CCITT Recommendation V.14 (1988): Blue book, Volume VIII, Fascicle VIII.1 "Transmission of start-stop characters over synchronous bearer channels".

[17] CCITT Recommendation V.22bis (1988): Blue book, Volume VIII, Fascicle VIII.1 "2400 bits per second duplex modem using the frequency division technique standardized for use on the general".

~~[18] CCITT Recommendation V.23 (1988): Blue book, Volume VIII, Fascicle VIII.1 "600/1200 baud modem standardized for use in the general switched telephone network".~~

[19] CCITT Recommendation V.32 (1988): Blue book, Volume VIII, Fascicle VIII.1 "A family of 2-wire, duplex modems operating at data signalling rates of up to 9600 bit/s for use in the general switched telephone network and on leased telephone-type circuits".

[20] CCITT Recommendation V.42 (1988): Blue book, Volume VIII, Fascicle VIII.1 "error-correcting procedures for DCEs using asynchronous-to-synchronous conversion".

[21] ITU-T Recommendation V.42 bis: "Data compression procedures for data circuit terminating equipment (DCE) using error correction procedures

[22] 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".

[23] Recommendations I.310-I.470 (Study Group XVIII): Blue book, Volume III, Fascicle III.8, Overall network aspects and functions, ISDN user-network interfaces.

[24] CCITT Recommendation I.420: Blue book, Volume III, Fascicle III.8 "Basic user-network interface".

[25] Personal Computer Memory Card Association: "PCMCIA 2.1 or PC-Card 3.0 electrical specification or later revisions".

[26] Infrared Data Association IrDA "IrPHY Physical layer signalling standard".

[27] TIA-617: "Data Transmission Systems and Equipment - In-Band DCE Control".

[28] GSM 02.34: "Digital cellular telecommunications system (Phase 2+); High Speed Circuit Switched Data (HSCSD) - Stage 1"

[29] GSM 03.34: "Digital cellular telecommunications system (Phase 2+); High Speed Circuit Switched Data (HSCSD) - Stage 2 Service Description"

[30] ISO 2110: "Data communication -- 25-pole DTE/DCE interface connector and contact number assignments"

[31] GSM 09.07 (ETS 300 976): "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)".

[32] 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".

1.3 Abbreviations

Abbreviations used in this TS are listed in GSM 01.04 [1].

2 Reference Configuration

GSM 07.01 [7] and GSM 04.02 [4] describe the basic reference configurations.

2.1 Customer Access Configuration

This configuration is as shown in figure 1 of GSM 04.02 [4]. This TS specifically refers to the Mobile Terminations (MTs) which support terminals of the type TE1 and TE2 with asynchronous capabilities. The TAF is functionally a part of an MT1, MT2 or MT0 with an integral asynchronous data capability.

2.2 Terminal Adaptation Function (TAF)

The TAF provides facilities to allow manual or automatic call control functions associated with ~~alternate speech/data, speech followed by data and~~ circuit switched services. The following functions are also included:

- Conversion of electrical, mechanical, functional and procedural characteristics of the V series and ISDN type interfaces to those required by the PLMN.
- Bit rate adaptation of the V series data signalling rates and the ISDN 64 kbit/s to that provided in the PLMN.
- The mapping functions necessary to convert automatic calling and/or automatic answering procedures of recommendation V.25 bis or V.25 ter and parameters for asynchronous operation.
- The mapping functions necessary to convert S interface signalling to the PLMN Dm channel signalling.
- Flow control (in some cases resulting in non-transparency of data as described in subclause 4.3).
- Layer 2 Relaying (see annex A).
- In-call modification function.
- Synchronization procedure, which means the task of synchronizing the entry to and the exit from the data transfer phase between two user terminals. This is described in GSM 07.01 [7].
- Filtering of channel control information as described in GSM 07.01 [7].
- Terminal compatibility checking.
- Splitting and combining of the data flow in case of multiple substream data configurations.

3 Terminal Adaptation Functions for transparent services

GSM 03.10 [3] refers to the connection types supporting the transparent services.

3.1 Rate Adaptation

GSM 04.21 [6] describes the rate adaptation scheme to be utilized over the Base Station (BS) to Mobile Station (MS) link. GSM 03.10 [3] refers to the rate adaptation elements to be provided in the MS.

3.1.1 Rate Adaptation - R interface

This is provided as indicated in GSM 04.21 [6].

3.1.2 Rate Adaptation - S Interface (I.420)

The ISDN rate adapted frame format is modified to the PLMN rate adapted format as indicated in GSM 04.21 [6].

3.2 Interchange Circuit Signalling Mapping - V-series interface

The interchange circuit signalling at the interface between the TE2 and the MT shall conform to CCITT Recommendation V.24 [14]. The signals required at this interface are shown in table 3.

The mapping of these signals to the pins of a 25 pin D-type connector is given in ISO 2110. The mapping for a commonly used 9 pin connector is given in Annex B.

3.2.1 Mapping of V.24 circuits to status bits

Status bits SA, SB and X are used to convey channel control information associated with the data bits in the data transfer state. Table 1 shows the mapping scheme between the V.24 circuit numbers and the status bits for the transparent mode. It also shows how the unused status bits should be handled. It is derived from the general mapping scheme described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

The transport of these status bits by the various channel codings is described in subsequent sections.

Table 1: Mapping scheme at the MT for the transparent mode

Signal at TE2/MT interface or condition within the MT	Mapping direction: MT to IWF	Mapping direction: IWF to MT
CT 105	not mapped (note 1)	
CT 106		from status bit X (note 7)
CT 107		not mapped (note 5)
CT 108/2	not mapped (note 6)	
CT 109		from status bit SB (note 7)
CT 133	not mapped (note 2)	
always ON	to status bit SA (note 3)	
always ON	to status bit SB (note 1)	
always ON	to status bit X (note 4)	
ignored by MT		from status bit SA (note 3)

NOTE 1. The SB bit towards the IWF, according to the General Mapping (annex C), could be used to carry CT 105. However, CT 105 should always be ON in the data transfer state since only duplex operation is supported. Also, many DTEs use the connector pin assigned to CT 105 for CT 133. No interchange circuit shall be mapped to the SB bit which shall always be set to ON in the data transfer state.

NOTE 2. CT 133 is not mapped since there is no flow control in transparent mode.

NOTE 3. The SA bits in both directions are available only with certain channel codings. Therefore, for maximum compatibility, they should not be mapped.

NOTE 4. The X bit towards the IWF is not mapped and shall always be set to ON in the data transfer state since there is no flow control in transparent mode.

NOTE 5. CT 107 is controlled by the channel synchronisation process (07.01).

NOTE 6. CT 108/2 may be used in the call setup and answering processes.

NOTE 7. The status bits are filtered before being mapped to the V.24 circuits (07.01).

3.2.2 Single slot configurations (TCH/F9.6 or TCH/F4.8)

GSM 04.21 [6] refers to the frame structure and identifies the use of the status bits for the carriage of signalling information in transparent mode. The S bits are put into two groups. SA is carried by bits S1,S3,S6,S8 and SB by bits S4,S9 in the ITU-T V.110 80-bit intermediate rate frame.

3.2.3 Multislot configurations (TCH/F9.6 or TCH/F4.8)

In transparent multislot configurations, status bits S1, S3 and the X-bit between the D12 and D13 - in the ITU-T V.110 80-bit intermediate rate frame - are used for transferring substream numbering information. The S4-bit is used for frame synchronization between the parallel substreams (reference GSM 04.21). The remaining S bits are put into two groups. SA is carried by bits S6,S8 and SB by bit S9. The remaining X bits can be used as described in section 3.2.1.

3.2.4 Channel codings TCH/F14.4, TCH/F28.8

For information on the mapping of the interchange circuit signalling bits in the 14,5 kbit/s multiframe structure, refer to GSM 04.21. There is no SA bit in this channel coding. Only the SB and X bits are carried.

3.3 Interface Signal Levels - R interface

The signal levels at the interface between the TE2 and the MT shall conform to CCITT V.28, or to IrDA IrPHY physical signalling standard specification, or to PCMCIA 2.1, or to PC-Card 3.0 electrical specification or to later revisions.

3.4 Call Establishment and Clearing Signalling Mapping

3.4.1 V-series interface Autocalling/answering

The mapping of the V.25 bis [11] procedures to the messages of the PLMN signalling in GSM 04.08 [5] is defined in section 5.

a) Auto Calling

This procedure is provided according to V.25 bis [11] using only 108/2.

A subset of V.25 bis is shown in table 3. This subset gives minimum level of control and indication.

During the call establishment phase, i.e. after signalling, calling tone according to V.25 [32] shall be generated in the IWF (GSM 09.07 [31]).

An alternative to CCITT V.25bis [11] is to use the ITU-T V.25 ter [12] dial command as specified in GSM 07.07 [8].

b) Auto Answer

This procedure is provided according to V.25bis [11] or to V.25 ter [12].

During the call establishment phase:

- the states of the V.24 interchange circuits shall be according to GSM 07.01[7],
- the data and status bits from the IWF shall not be mapped,
- the data and status bits towards the IWF shall be according to GSM 07.01[7].

3.4.2 S Interface (I.420) Signalling Mapping

The mapping of Q.931 signalling to GSM 04.08 [5] signalling requires the inclusion, by the MT, of PLMN specific elements (e.g. transparent or not, half/full rate channel). For asynchronous Bearer services, requests for bearer capabilities not listed in table 4 (or where the "Users information layer 1 protocol" element does not indicate V.110) will result in call rejection.

~~3.4.3 Call Establishment Manual Operation - Utilizing Alternate Speech/Data or Speech Followed By Data Capabilities~~

~~During manual call establishment, the mobile user shall be able to hear network supervisory tones and answer tone.~~

~~On hearing answer tone, the user invokes the transition from speech to data in both the MS and the IWF. The mapping for this is shown in section 5.~~

3.4.4 Call Establishment Manual Operation - Utilizing the Unrestricted Digital Capability

In this case the user will not hear network supervisory tones or answer tone. The data transfer phase will be entered automatically.

3.4.5 V-series interface Call Clearing

This procedure is provided according to V.25 bis [11] using CT 108/2. An alternative to CCITT V.25bis [11] is to use the V.25 ter [12] hook control command or the hangup commands specified in GSM 07.07 [8]. The mapping of the V.25 bis [11] procedures to the messages of the PLMN signalling in GSM 04.08 [5] is defined in section 5.

During the call clearing phase:

- the states of the V.24 interchange circuits shall be according to CCITT V.24 [14],
- the data and status bits from the IWF shall not be mapped or used by the MT in any way,
- the data and status bits towards the IWF have no significance and may be set to 1 and OFF respectively.

4 Terminal Adaptation Functions for non-transparent services

GSM 03.10 [3] refers to the connection types supporting the non-transparent services.

4.1 Data Structure

4.1.1 Data Structure on S Interface

The protocol models for this are described in cases 3a and 3d of GSM 03.10. The data structure will be according to CCITT V.110.

4.1.2 Data Structure on R Interface

The protocol models for this are described in cases 3b and 3e of GSM 03.10. The data will consist of 7 or 8 bit characters with additional start and stop elements. The 7 bit data can additionally have an associated parity bit, 8 bit data cannot have an additional parity bit.

The interchange circuit signalling at the interface between the TE2 and the MT shall conform to CCITT Recommendation V.24 [14]. The signals required at this interface are shown in table 3.

The interface shall provide inband (XON/XOFF) and out of band (CT106) flow control. The use of CT133 for out of band flow control shall be implemented according to CCITT Recommendation V.42 [20].

4.1.3 Data Structure Provided by the L2R Function to the RLP Function

See annex A.

4.2 Signalling Mapping

4.2.1 Interchange Circuit Signalling Mapping - V-series interface

Status bits SA, SB and X are used to convey channel control information associated with the data bits in the data transfer state. Table 2 shows the mapping scheme between the V.24 circuit numbers and the status bits for the non-transparent mode. It also shows how the unused status bits should be handled. It is derived from the general mapping scheme described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

The transport of the status bits by the L2RCOP is described in annex A.

Table 2: Mapping scheme at the MT for the non-transparent mode

Signal at TE2/MT interface or condition within the MT	Mapping direction: MT to IWF	Mapping direction: IWF to MT
CT 105	not mapped (note 1)	
CT 106 (note 4)		from status bit X (note 7)
CT 107		not mapped (note 5)
CT 108/2	not mapped (note 6)	
CT 109		from status bit SB
CT 133 (note 8)	to status bit X (notes 3,8)	
always ON	to status bit SA (note 2)	
always ON	to status bit SB (note 1)	
ignored by MT		from status bit SA (note 2)

NOTE 1. The SB bit towards the IWF, according to the General Mapping (annex C), could be used to carry CT 105. However, CT 105 should always be ON in the data transfer state since only duplex operation is supported. Also, many DTEs use the connector pin assigned to CT 105 for CT 133. No interchange circuit shall be mapped to the SB bit which shall always be set to ON in the data transfer state.

NOTE 2. The SA bits (both directions) are not mapped since CTs 107 and 108/2 are handled locally (notes 5, 6).

NOTE 3. The condition of status bit X towards the IWF may also be affected by the state of the receive buffer in the MT.

NOTE 4. The state of CT 106 (or other local flow control mechanism) may also be affected by the state of the transmit buffer in the MT and the state of the RLP (RR/RNR).

NOTE 5. CT 107 is controlled by the channel synchronisation process (07.01).

NOTE 6. CT 108/2 may be used in the call setup and answering processes.

NOTE 7. For inband local flow control, changes in the condition of the status bit X from the IWF also result in the sending of XON or XOFF to the DTE.

NOTE 8. For inband local flow control, CT 133 is not mapped and the status bit X towards the IWF is controlled by the reception of XON and XOFF characters from the DTE.

4.2.2 Call Establishment and Clearing Signalling Mapping

This is identical to the transparent case with the exception of the transparent/non-transparent element, see section 5.

In addition, the L2R/RLP will give an explicit indication when the link into the connected network is established. If the link fails, an explicit "link lost" indication will be given.

4.3 Flow Control

The passage of flow control information between L2Rs is described in annex A. Subclauses 4.3.1, 4.3.2 and 4.3.3 describe the operation of the flow control mechanisms. These mechanisms apply for all the non-transparent services covered by this specification, with the exception of Character Orientated Protocol with No Flow Control which is treated in subclause 4.3.4.

4.3.1 Conditions Requiring Flow Control towards the Network

The L2R function will send immediately a "flow control active" indication in the following circumstances:

(i) If the receive buffer from the radio side reaches a preset threshold (BACKPRESSURE).

(ii) If local flow control is initiated by the TE2 (see subclause 4.3.3 a) or c)). On receipt of this flow control indication transmission of data from the receive buffer towards the TE2 is halted.

On removal of the buffer congestion or local flow control the L2R will send a "flow control inactive" indication.

In addition, for the local flow control condition, transmission of data from the receive buffers will be restarted.

4.3.2 Conditions Requiring Flow Control towards TE2

The L2R functions will immediately activate local flow control (see subclause 4.3.3 b) or d)) under the following circumstances:

(i) The transmit buffer reaches a pre-set threshold (BACKPRESSURE).

(ii) The L2R receives a "flow control active" indication.

On removal of buffer congestion or receipt of L2R/RLP "flow control inactive" the local flow control will be removed.

4.3.3 Local Flow Control

Two methods of local flow control are allowed:

Outband

a) From TE2: CT133 shall be turned OFF to indicate flow control active, and ON to indicate flow control inactive.

b) From TAF: CT106 shall be turned OFF to indicate flow control active, and ON to indicate flow control inactive.

Inband

c) From TE2: XOFF (DC3) is sent to indicate flow control active. XON (DC1) is sent to indicate flow control inactive. The XON/XOFF characters received from the TE2 are extracted by the L2R from the data stream and are not sent across the radio interface. Where XON/XOFF is utilized then the TAF will generate flow control active/inactive immediately, i.e. the XON/XOFF characters do not enter the transmit buffer.

d) From TAF: As from TE2

If the outband method is used, the L2R will pass the DC1/DC3 characters as data, i.e. no flow control indications will be generated on receipt of DC1/DC3.

4.3.4 Character Orientated Protocol with No Flow Control

If the users layer 2 indicates Character Orientated Protocol with no flow control then no flow control is used, i.e. the X-bit is not set to OFF and DC1/DC3 characters are passed through as data.

4.4 Buffers

4.4.1 TX Buffers

Data received on CT103 from the TE2 shall be buffered such that if the MT is unable to transfer the data over the radio path then data is not lost.

The buffer shall be capable of holding the data. Its size is up to the implementers.

When the buffer is half full, TE2 shall be flow controlled as per subclause 4.3.2, unless Character Orientated Protocol with No Flow Controlis being used (see subclause 4.3.4).

4.4.2 RX Buffers

Data for transfer to the TE2 on CT104 shall be buffered such that if the TE2 is unable to accept data then data transferred from the MT is not lost.

The buffer size should be up to the implementers.

When the buffer becomes half full, the L2R will send a "flow control active" indication, unless Character Orientated Protocol with No Flow Control is being used.

4.5 Bit Transparency

V.25bis indications generated by the TAF shall be even parity, even if the parity condition for the user's application is different.

4.6 Transportation of "BREAK" condition

The "BREAK" condition must be recognized by the L2R function and passed immediately to the IWF. The L2R will generate a "BREAK" condition to the TE2 on receipt of a "BREAK" indication from the IWF.

Annex A describes how the L2R will transport the "BREAK" indication.

4.7 Data Compression

L2R optionally includes a data compression function according to ITU-T V.42bis that spans from the MS to the IWF in the MSC. The error correction function is provided by RLP instead of ITU-T V.42. RLP XID is used to negotiate compression parameters. L2R includes the V.42bis control function especially for reinitializing in case of break recognition or RLP reset and error indication by the data compression function respectively.

Table 3: Minimum set of Interchange Circuits

Circuit Number	Circuit Name	Ground	Data		Control	
			To TE2	From TE2	To TE2	From TE2
CT102	Common return	x				
CT103	Trans-mitted data			x		
CT104	Received data return		x			
CT105	Request to send (Note 2)					x
CT106	Ready for sending				x	
CT107	Data set ready				x	
CT108/2	Data terminal ready					x
CT109	Data channel received line signal detector				x	
CT125	Calling indicator (Note 1)				x	
CT133	Ready for Receiving (Note 2)					x

NOTE 1: CT125 is used with the automatic answering function of the TAF.

NOTE 2: CT105 and CT133 are assigned to the same connector pin on both the standard 25 pin connector (ISO 2110) and the commonly used 9 pin connector (annex B). When this pin is used for CT133 then on the DCE (MT) side of the interface CT 105 is treated as being always in the ON condition. Similarly, when this pin is being used for CT105 then on the DCE (MT) side of the interface CT 133 is treated as being always in the ON condition. As circuit 133 is used only in duplex operation and circuit 105 is used only in half duplex operation (which is not supported by GSM) there should be no conflict.

Table 4: Minimum Set of Call Set-up Commands and Indications

	Description	IA5 Characters
Commands from TE2	Call Request with Number provided 0,1..9,*,#,A,B,C,D	CRN
	Connect Incoming Call	CIC
	Disregard Incoming Call	DIC
Indications to TE2	Call Failure Indication XX = CB,AB,NT,FC (Note)	CFI XX
	INcoming Call	INC
	VALid	VAL
	INValid	INV

NOTE: CB = Local MT busy
AB = Abort call
NT = No answer
FC = Forbidden call *

* Forbidden call indication results from contravention of rules for repeat call attempts as defined by the appropriate national approvals administration. It is recommended that this is the responsibility of the MT, not the TE2.

5 Terminal interfacing to GSM 04.08 Mapping

Only those elements/messages that are of particular relevance are considered.

Interface procedures not directly mappable to GSM 04.08 [5] (i.e. V.25 bis VAL/INV) are not considered. Mobile management procedures of GSM 04.08 [5] are not considered applicable.

Mapping of other call establishment or clearing messages to the S interface e.g. "Call proceeding" etc. have not been included. It is assumed these will be able to be mapped directly and are of no relevance to the V.25 bis or manual interface.

For the ~~Alternate speech/data,~~ Alternate speech/group 3 facsimile ~~and Speech followed by data~~ service~~s~~ it will be necessary for the TAF to generate a "Modify" message for transmission on the Dm channel. This shall be according to the defined procedure in GSM 04.08 [5].

~~In addition for the Alternate speech/data case it will be necessary for the TAF to respond to an incoming "Modify" command with "Ack" or "Reject".~~

5.1 Mobile Originated Calls

Call establishment is initiated by the keypad or DTE action:

a) Setup

Element	Derived from		
	MMI	V.25 bis message	S interface message
Called Address	Keypad	CRN/CRI/CRS	Setup
Called Sub Address	Keypad	CRI	Setup
HLC	Derived from internal settings or MMI infor- mation.		Setup
LLC	Same as HLC		Setup
BC	Same as HLC GSM 07.01 gives allowed values		Setup (with addi- tional information from MMI originated settings)

b) Release Complete

Element	Derived from		
	MMI	V.25 bis message	S interface message
Cause	Display (optional)	CFI	Release Complete

5.2 Mobile Terminated Calls

Call establishment is initiated by receipt of Setup at the MS:

a) Setup

Element	Mapped on to		
	MMI	V.25 bis message	S interface message
Called Address	Display (optional)	INC	Setup
Called Sub Address	Display (optional)	Not applicable	Setup
HLC	Display (optional)	Not applicable	Setup
LLC	Display (optional)	Not applicable	Setup
BC	Display (optional)	Not applicable	Setup (with PLMN specific elements removed)

b) Call Confirm

Information for the BC element in the call confirm is derived from e.g. MMI or by internal settings.

c) Connect

Connect is sent in response to connect from the S interface, from MMI, or when the timeout period referred to in V.25bis has expired. This period shall be between 5 and 10 seconds. During this time the automatic answering of the incoming call can be prevented by issuing a DIC command. The CIC can be used to cancel the effect of a preceding DIC command (see Recommendation V.25bis [11]).

5.3 Call Clearing

5.3.1 Mobile initiated

Call clearing is initiated by the keypad or DTE action:

Disconnect

Element	Derived from		
	MMI	V.25 bis	S interface message
Cause	Keypad	DTE shall turn CT 108/2 OFF	Disconnect or inband V.110 disconnect request

5.3.2 Network initiated

Call clearing is initiated by receipt of Disconnect at the MS:

Disconnect

Element	Mapped on to		
	MMI	V.25 bis	S interface message
Cause	Display (optional)	MS shall turn CT 107 OFF	Disconnect

~~6 Functionality for the Support of Dedicated PAD Services~~

~~The TAF will need to provide the following information in addition to the Bearer capability values shown in annex B of GSM 07.01 [7] in the case of Dedicated PAD access:~~

~~Numbering Plan Identifier : Private Number Plan~~

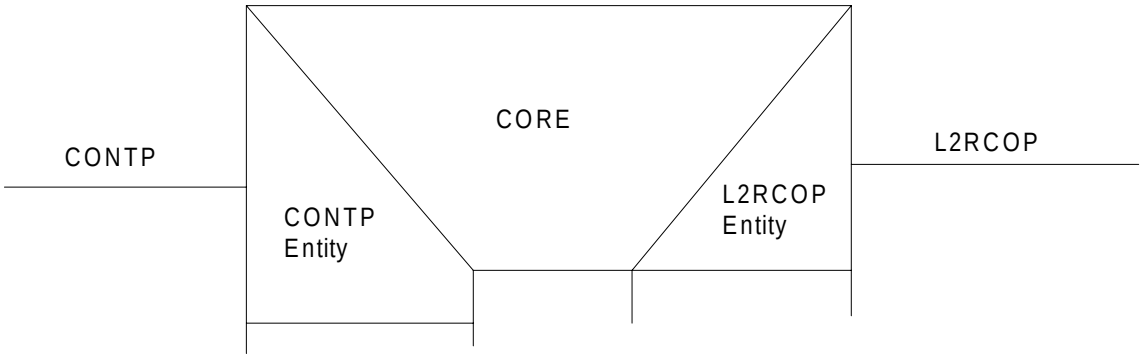
~~Type of Number : Dedicated PAD~~

~~In addition, the called number should be a short code, coded as indicated in GSM 09.05 [9].~~

Annex A (Normative): L2R Functionality

A.1 Introduction

This annex describes the L2R functionality for non-transparent character oriented protocols. The general aspects of L2Rs are described in GSM 07.01 [7]. Figure 1 shows the 3 sub-functions of a character oriented L2R.



CONTP Character Oriented Non-Transparent Protocol

CORE Character Oriented Relay Entity

L2RCOP L2R Character Oriented Protocol

Figure 1

Section 2 describes the L2R Character Oriented Protocol (L2RCOP) and section 3 the use of the L2RCOP.

A.2 The L2RCOP

Information is transferred between L2Rs in fixed length n octet Protocol Data Units (PDUs). This corresponds to the fixed length of the RLP frame information field. The octets within the L2RCOP-PDU are numbered 0 to n-1, octet 0 is transmitted first. The value of n depends on the negotiated RLP version and frame type (GSM 04.22). The bits within the octets are numbered 1 to 8, bit 1 is transmitted first.

The RLP version value 2 indicates RLP multi-link operation. The RLP version value 0 or 1 indicates RLP single-link operation.

- Each octet contains a status octet, an information octet or fill

  Octet 0 contains either a status octet or a user information octet.

- Octet 0 shall always contain a status octet in case at least one status octet is transported in the L2RCOP PDU. In RLP-versions 0 and 1 a PDU always carries at least one status octet. In RLP version 2 a PDU carries status octet(s) only if actual status change(s) has taken place within the period represented by the PDU. Here the L2R status flag in the RLP version 2 header is set to 1 when status octet(s) is carried in the PDU.

- Status octets contain 3 status bits and 5 address bits. In cases where two status octets within the PDU are separated by more than 23 octets, the first status octet in octet m is followed by a pointer octet in octet m+1 forming a two-octet status field. The pointer octet contains one reserved bit and seven address bits indicating the number of characters between the status field and the second status octet.

- The 3 status bits correspond to SA, SB and X in CCITT Recommendation V.110. The SA, SB and X bits use bit positions 8,7,6 in the status octets. When a status bit changes the current state of all three bits shall be transmitted.

- Information octets are character octets or encoded character octets

- Character octets are coded in the following way:

  - The first bit of the character received/transmitted corresponds to bit position 1 in the octet. The second bit to bit 2, ... and the seventh bit to bit 7. For order of transmission of IA5 characters see CCITT Recommendation V.4 [10].

  - 7 bit characters are padded with a 0 in bit position 8. Received parity (if used) is inserted in bit position 8, if parity is not used bit 8 is set to 0.

  - Any start/stop bits are removed by the L2R.

- Encoded character octets are provided by the compression function. They are encoded according to ITU-T V.42bis.

- Information octets are inserted into L2RCOP-PDUs in order of transmission in octets 1 to n-1 for RLP single-link operation, in octets 1 to n-1 for RLP multi-link operation with status octet transportation, and in octets 0 to n-1 for multi-link operation with no status octet transportation.

- The address field in the status octets indicates the position of next status octet within the L2RCOP-PDU. This indicates the number of characters between status octets. Thus if two status octets are inserted into L2RCOP-PDU at offsets l and m the address value will be defined by m-l-1. Address bit 2^0 corresponds to bit 1 in the status octets. Address bit 2^1 to bit 2 etc.

- Status octets are inserted in the character stream whenever a status change needs to be transmitted.

- Only address values 1 to n-2 ($n-2 \leq 23$) in the address field of status octets are used for addressing purposes. The implication of not allowing address value 0 to be used for addressing is that two status octets cannot be sent after each other. The remaining codes are used to indicate:

  - Last status change, remainder of L2RCOP-PDU empty. Address field value 31

  - Last status change, remainder of L2RCOP-PDU full of characters. Address field value 30

  - Destructive break signal, remainder of L2RCOP-PDU empty. Address field value 29

  - Destructive break acknowledge, remainder of L2RCOP-PDU empty. Address field value 28

    - L2RCOP-PDU contains at least two status octets which are separated by more than 23 characters; the address-field value in the first octet of the two-octet status field is 27 and the address bits in the pointer octet of the status field indicate the number of characters between the two-octet status field and the next status octet.

  - Address field values from n-1 to 26 are reserved. In case of a PDU more than 25 octets in length, address field values from 24 to 26 are reserved.

- When it is necessary to insert a status octet into the character stream when no status change has occurred, e.g. to indicate that the reminder of a L2RCOP-PDU is empty or to indicate a break signal, the current status shall be repeated.

- In case when 64 data octets are carried by a 66-octet PDU, a status octet is carried in octet 0 and another status octet within the first 24 data octets. (The first status octet gives the address of the second status octet, which carries value 30 in its address field.)

Three examples of an L2RCOP PDU are shown in Figure 2.

	8	7	6	5	4	3	2	1	
0	SA	SB	x	0	0	0	1	1	
1	1	1	0	0	0	1	1	1	IA5 "G" (odd parity)
2	1	1	0	1	0	0	1	1	IA5 "S" (odd parity)
3	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)
4	SA	SB	x	1	1	1	1	1	(last status change, rest of PDU empty)
.									
.									
.									
n-1									

Figure 2a Single-link RLP and multi-link RLP with status octet transfer in PDU.

	8	7	6	5	4	3	2	1	
0	1	1	0	1	0	0	1	1	IA5 "S" (odd parity)
1	1	1	0	0	0	1	1	1	IA5 "G" (odd parity)
2	1	1	0	1	0	0	1	1	IA5 "S" (odd parity)
3	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)
4									
.									
.									
.									
n-1	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)

Figure 2b Multi-link RLP L2RCOP PDU with no status octet transfer

	8	7	6	5	4	3	2	1	
0	SA	SB	X	0	0	0	1	1	
1	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)
2	1	1	0	0	0	0	0	1	IA5 "A" (odd parity)
3	1	1	0	1	0	0	1	0	IA5 "R" (odd parity)
4	SA	SB	X	1	1	0	1	1	
5	R	0	1	0	0	0	1	1	
.				.					
.				.					
41	SA	SB	X	0	0	0	0	1	
42	1	1	0	0	1	1	0	1	IA5 "K" (odd parity)
43	SA	SB	X	1	1	1	1	0	
.				.					
.				.					
65	1	1	0	0	1	1	1	1	IA5 "O" (odd parity)

Figure 2c A 66-octet RLP L2RCOP PDU with status octets separated by more than 23 octets

A.3 Use of the L2RCOP

The CORE relays status changes, break conditions and characters in both directions between the CONTP entity and the L2RCOP entity.

The L2RCOP entity performs the following functions.

A.3.1 Radio Link Connection Control

Given appropriate indications from the signalling mechanisms the L2RCOP entity uses the services of the radio link to establish and release the connection to its peer L2RCOP entity in the IWF.

A.3.2 Data Transfer

The L2RCOP entity will assemble and disassemble L2RCOP-PDUs. Data characters are assembled into L2RCOP-PDUs until either:

- The PDU is full
- The Radio Link service can accept another Radio Link service Data Unit.

L2RCOP-PDUs are transferred to the peer L2RCOP entity using the data transfer services of the radio link.

A.3.3 Status Transfer

The L2RCOP entity transfers interface status information between L2Rs using bits SA, SB and X in the status octets in L2RCOP-PDUs. Status changes are inserted in the L2RCOP-PDU in the position corresponding to the position in the character stream that the interface status change occurred. When the RLP is established or reset a L2RCOP-PDU with the current status values shall be sent.

The general mapping between V.24 interface circuit numbers and status bits is described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition. The specific mapping at the MT for the non-transparent bearer service is given in section 4.2.1. The mapping schemes used at the IWF are given in GSM 09.07 [31].

A.3.4 Flow Control

Flow control information is transferred between L2Rs in 2 ways, these are:

- back pressure caused by L2R buffer conditions
- use of the X-bit in status octets:
  - flow control active, X-bit = ONE
  - flow control inactive, X-bit = ZERO

A.3.5 Break

The transfer of break conditions between L2Rs is via the status octets with appropriate coding of the address field. Where the "Break Signal" is generated it shall conform to the definition shown in CCITT Recommendation X.28.

A.3.5.1 Normal Realization

The L2RCOP-PDU contains the mandatory status octet coded as the Destructive Break.

Upon the receipt of the "Break Signal", the L2R will destroy any existing data in front of the Break Signal in the same direction, and all the buffered data in the other direction. The L2R will then pass the Break Signal immediately on.

The termination of a break condition is indicated by sending an L2RCOP-PDU containing characters.

A.3.5.2 Realization in case of Data Compression is used

If the data compression function is used L2RCOP has to ensure the synchronization of the encoder and decoder according to ITU-T V.42bis.

Upon receipt of a L2RCOP-PDU containing a status octet that signals a Destructive Break L2R destroys all data in the TX and RX buffer and re-initializes the compression function. Then L2R will transmit a L2RCOP-PDU that contains the mandatory status octet coded as the Destructive Break Acknowledge. After that L2R will restart the data transfer.

Upon an receipt of the "Break Signal" by the CONTP, the L2R destroys any existing data in the TX and RX buffer and will then pass the Break Signal immediately by using L2RCOP-PDU containing a status octet coded as the Destructive Break. L2R will wait for a L2RCOP-PDU containing a mandatory status octet coded as Destructive Break Acknowledge. Following data received by the CONTP will be stored in the TX buffer. Data received in L2RCOP-PDUs will be discarded. After reception of the L2RCOP-PDU containing a mandatory status octet coded as Destructive Break Acknowledge L2R will re-initialize the data compression function and restart the data transfer.

Annex B (Informative): Use of a 9 pin connector as an MT2 type interface

For asynchronous data communications many of the physical pins on a standard 25 pin D-type connector (ISO 2110) are not used. As a result many communication devices have only a 9 pin connector to allow them to be made smaller. This interface is a MT2 type providing the correctV.24 signals are supported.

Table B1 gives the pin assignments for a 9 pin connector. Two variants are permitted -

1. Outband flow control

When outband (CT 133) flow control is required, pin number 7 carries CT 133 (Ready for Receiving). In this case CT 105 is not mapped to any physical pin. On the MT2 side of the interface, CT 105 is treated as being always in the ON condition.

2. No outband flow control

When no outband (CT 133) flow control is required, pin number 7 may carry CT 105 (Request to Send). In this case CT 133 is not mapped to any physical pin. On the MT2 side of the interface, CT 133 is treated as being always in the ON condition.

Table B1: Interchange circuit mappings

V.24 Circuit Number	Circuit Name	Pin Number
CT 102	Common ground	5
CT 103	TxD	3
CT 104	RxD	2
CT 105	RTS	7 (note)
CT 106	RFS (CTS)	8
CT 107	DSR	6
CT 108/2	DTR	4
CT 109	DCD	1
CT 125	CI	9
CT 133	RFR	7 (note)

NOTE: Only one of these mappings may exist at any one time.

Annex C (informative): General mapping of V.24 circuits to channel status bits

In the data transfer state, status bits SA, SB and X can be used to convey channel control information associated with the data bits. Table C1 shows the general mapping scheme between the V.24 circuit numbers and the status bits. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition. The specific mappings for the various GSM bearer types are given elsewhere in this specification.

Table C1: General mapping scheme at the MT

Signal at TE2/MT interface	Status bit direction: MT to IWF	Status bit direction: IWF to MT
CT 105 (note 3)	SB	
CT 106 (note 1)		X
CT 107		SA
CT 108/2	SA	
CT 109		SB
CT 133 (note 3)	X (note 2)	

NOTE 1. The condition of CT 106 may also be affected by the state of any transmit buffer in the MT.

NOTE 2. The condition of Status bit X towards the IWF may also be affected by the state of any receive buffer in the MT.

NOTE 3: CT105 and CT133 are assigned to the same connector pin on both the standard 25 pin connector (ISO 2110) and the commonly used 9 pin connector (annex B). When this pin is used for CT133 then on the MT side of the interface CT 105 is treated as being always in the ON condition. SB towards the IWF will therefore also always be ON.

Similarly, when this pin is being used for CT105 then on the MT side of the interface CT 133 is treated as being always in the ON condition. X towards the IWF will therefore also always be ON.

As circuit 133 is used only in duplex operation and circuit 105 is used only in half duplex operation (which is not supported by GSM) there should be no conflict.

Annex D:
Change history

Change history						
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Apr 1999	GSM 07.02	7.0.0				Transferred to 3GPP CN1
CN#03	27.002				3.0.0	Approved at CN#03
CN#04	27.002	3.0.0	001	R99	3.1.0	Introduction of EDGE channel codings into the specifications

History

Document history		
V3.0.0	May 1999	Approved at TSGN #3. Under TSG TSG CN Change Control.
V3.1.0	September 1999	CR 001 Approved by E-mail after CN#4

3GPP-N3/SMG WPD Meeting #7
Sophia Antipolis, France, 29 Nov-03 Dec 1999

***Document* N3-99354**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

27.003	CR	003	Current Version:	3.1.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG_N#6	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [ ]
(at least one should be marked with an X)

Source: TSG_N3 **Date:** 21-11-1999

Subject: R99 service clean-up

Work item: R99 service clean-up

Category: *(only one category shall be marked with an X)*

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature	X		Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Due to the deletion of services in GSM R99 (dual services, dedicated services) this specification has to be updated.

Clauses affected:

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM core specifications		→ List of CRs:
MS test specifications		→ List of CRs:
BSS test specifications		→ List of CRs:
O&M specifications		→ List of CRs:

Other comments:

help.doc

<--------- double-click here for help and instructions on how to create a CR.

3G TS 27.003 V3.1.0 (1999-09)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Core Network; Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities (3G TS 27.003 version 3.1.0)

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Contents

Foreword

This Technical Specification has been produced by the 3GPP.

This TS defines the interfaces and Terminal Adaptation Functions (TAF) integral to a Mobile Termination (MT) which enables the attachment of synchronous terminals to a MT 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 this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version 3.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 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 specification;

1 Scope

This Technical Specification (TS) defines Terminal Adaptation Functions (TAF) which are integrated in a Mobile Termination (MT) and which enable the attachment of Synchronous Terminals to an MT (see GSM 04.02 [4]). The general aspects of Terminal Adaptation Functions are contained in specification GSM 07.01 [8]. This ETS covers support of synchronous data services (see GSM 02.02 [2]) for the following interfaces and procedures:

- V.22 DTE/DCE Interface
- V.22 bis DTE/DCE Interface
- V.26 ter DTE/DCE Interface
- V.32 DTE/DCE Interface
- X.21 DTE/DCE Interface
- X.21 bis DTE/DCE Interface
- X.25 Procedure
- X.32 Procedure
- V.25 bis Procedure
- I.420 Interface (S)

LAPB is the only synchronous non-transparent protocol which is considered here.

Note: From GSM R99 onwards the following services are no more required to be provided by a GSM PLMN:

- the dual Bearer Services “alternate speech/data” and “speech followed by data”
- the dedicated services for PAD and Packet access
- BS 21 ... 26 and BS 31 ... 34

The support of those services is still optional. The specification of these services is not within the scope of this TS. For that, the reader is referred to GSM Release 98.

2 Normative references

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.02: "Digital cellular telecommunication system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[3] GSM 03.10: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) connection types".

[4] GSM 04.02: "Digital cellular telecommunication system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".

[5] GSM 04.08: "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification".

[6] GSM 04.21: "Digital cellular telecommunication system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[7] GSM 04.22: "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".

[8] GSM 07.01: "Digital cellular telecommunication system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[9] GSM 08.20 : "Digital cellular telecommunication system (Phase 2+); Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[10] GSM 09.06: "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".

[11] GSM 09.07: "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)".

[12] CCITT Series V Recommendations: "Data communication over the Telephone network".

[13] CCITT Series X Recommendations: "Data communication networks".

[14] CCITT Recommendation V.10: "Electrical characteristics for unbalanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications".

[15] CCITT Recommendation V.11: "Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications".

[16] 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".

[17] CCITT Recommendation V.25 bis: "Automatic Calling and/or Answering Equipment on the General Switched Telephone Network (GSTN) using the 100-series interchange circuits".

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

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

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

[21] 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".

[22] CCITT Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for terminals operating in Packet Mode and connected to Public Data Networks by dedicated Circuit".

[23] CCITT Recommendation X.21: "Interface between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for synchronous operation in public data networks".

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

[25] 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".

[26] 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".

[27] CCITT Recommendation X.30: "Support of X.21, X.21 bis and X.20 bis based Data Terminal Equipment (DTEs) by an ISDN".

[28] CCITT Recommendation X.31: "Support of Packet Mode Terminal Equipment in ISDN".

[29] CCITT Recommendation X.32: "Interface between Data Terminal Equipment (DTE) and Data Circuit Terminating Equipment (DCE) for terminals operating in Packet Mode and accessing a PSPDN through a PSTN or an ISDN or a CSPDN".

[30] CCITT Recommendation I.461: "Support of X.21, X.21 bis and X.20 bis based data terminal equipment (DTEs) by integrated services digital network (ISDN)".

[31] CCITT Recommendation I.463: "Support of data terminal equipment (DTEs) with V-Series type interfaces by an integrated services digital network (ISDN)".

[32] ISO Recommendation 8885: "Information technology - Telecommunication and information exchange between systems - High-level data link control (HDLC) procedures - General purpose XID frame information field content and format".

[33] ISO Recommendation 8886: "Information technology - Telecommunication and information exchange between systems - Data link service definitions for Open Systems interconnection".

[34] Personal Computer Memory Card Association: "PCMCIA 2.1 or PC-Card 3.0 electrical specification or later revisions".

[35] Infrared Data Association IrDA "IrPHY Physical layer signalling standard".

[36] TIA-617: "Data Transmission Systems and Equipment - In-Band DCE Control".

[37] GSM 02.34: "Digital cellular telecommunications system (Phase 2+); High Speed Circuit Switched Data (HSCSD) - Stage 1".

[38] GSM 03.34: "Digital cellular telecommunications system (Phase 2+); High Speed Circuit Switched Data (HSCSD) -Stage 2 Service Description".

2.1 Abbreviations

In addition to those below abbreviations used in this TS are listed in GSM 01.04 [1].

AU Access Unit

~~PF Packet Function~~

3 General

3.1 Customer access configuration

The GSM PLMN access reference configuration is described in figure 1 of GSM 04.02 [4]. This specification (GSM 07.03) specifically refers to the MTs which support terminal equipments (TE1 or TE2) that use synchronous bearer capabilities.

3.2 Terminal Adaptation Function

The TAF is functionally part of an MT0, MT1 or MT2 (see GSM 04.02 [4]). The terminal adaptation provides facilities to allow manual or automatic call control functions associated with alternate speech/data, speech followed by data and circuit switched data services, in case of V series interfaces. The X.21 DTE/DCE interface allows only for automatic call control functions. The following functions are included:

- Conversion of electrical, mechanical, functional and procedural characteristics of the V-series, X-series and ISDN type interfaces to those required by a GSM PLMN.
- Bit rate adaptation of V-series and X-series data signalling rates and the ISDN 64 kbit/s to that provided in the GSM PLMN.
- The mapping of V.25 bis AUTO CALL/AUTO ANSWER procedures and X.21 procedures to the GSM PLMN Dm-channel signalling.
- The mapping functions necessary to convert S-interface signalling to PLMN Dm-channel signalling.
- Synchronization procedure, which means the task of synchronizing the entry to and the exit from the data transfer phase between two subscriber terminals. This is described in the specification GSM 07.01 [8].
- Filtering of channel control information. This is described in the specification GSM 07.01 [8].
- Compatibility checking (see GSM 07.01 [8])
- Layer 2 relaying (see annex 1)
- Flow control
- In Call Modification function (see section 4)
- Splitting and combining of the data flow in case of multi substream data configurations

3.3 TAF Interfacing to other MT functions

TAF interfacing is shown in figure 1.

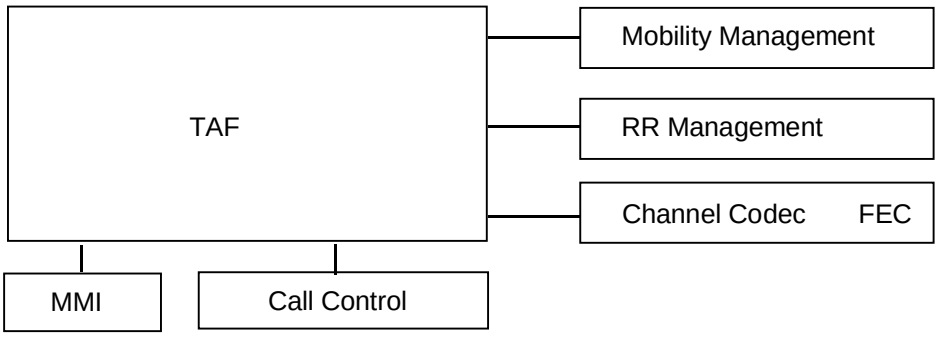


Figure 1: TAF interfacing to other MT functions

4 Terminal Adaptation Functions for synchronous transparent services

Specification GSM 03.10 [3] refers to the models for connection types supporting synchronous transparent services.

4.1 Rate Adaptation

Rate adaptation on the MS-BS interface is described in GSM 04.21. The synchronous data services make use of the following rate adaptation functions: RA1, RA2, RA1/RA1', RA1' and in case of TCH/F28.8 usage, EDGE-MUX. See also Figures 6, 7 and 8 in GSM 03.10. The D-bits of the rate adaptation frames are used to convey user data and the S- and X-bits are used to convey channel status information associated with the data bits in the data transfer state, or to carry substream numbering between the Split/Combine functions in case of mult substream operation. For the S- and X-bits, a ZERO corresponds to the ON condition, a ONE to the OFF condition.

4.1.1 Rate adaptation - V-series

This is provided as indicated in specification GSM 04.21 [6]. The functions applied in this case are shown in figure 2 (see model 2b in figures 6, 7 and 8 of GSM 03.10 [3]).

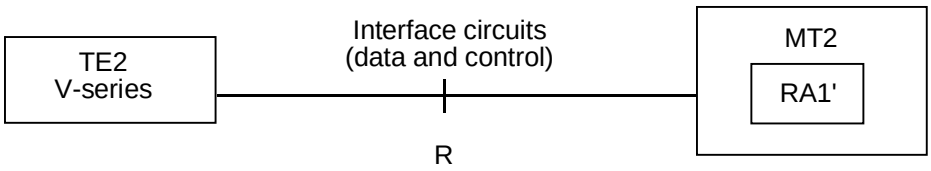


Figure 2: Rate adaptation for V-series terminals

4.1.2 Rate adaptation - X.21

This is provided as indicated in specification GSM 04.21 [6]. The functions applied in this case are shown in figure 3 (see model 2b in figures 6, 7 and 8 of GSM 03.10 [3]).

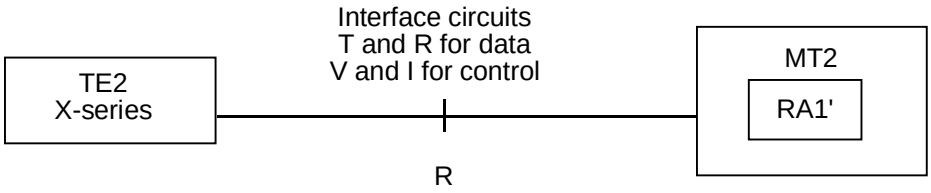


Figure 3: Rate adaptation for X.21 terminals

4.1.3 Rate adaptation - S-interface

The functions applied in this case are shown in figure 4 (see model 2a in figures 6, 7 and 8 of GSM 03.10 [3]).

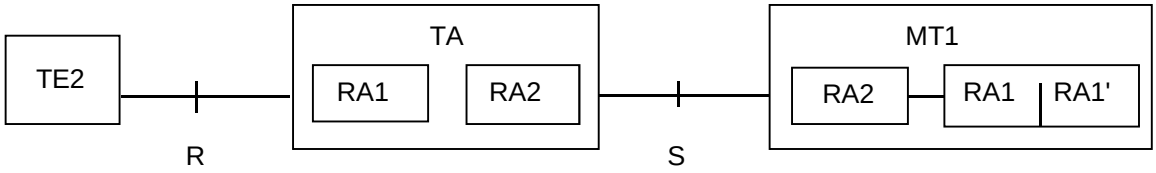


Figure 4a: Rate adaptation for S-interface

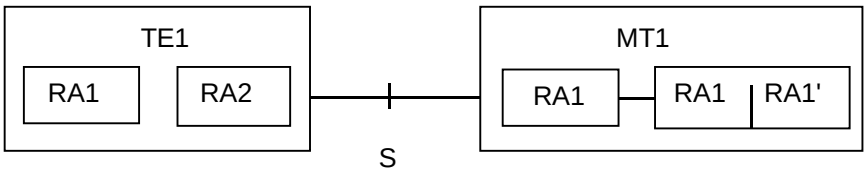


Figure 4b: Rate adaptation for S-interface (continued)

There are two cases to be considered for the RA1 function:

a) V-series interface

For the V-series type of terminal equipments the rate adaptation functions are as described in GSM 04.21 [6].

b) X.21-interface

For terminal equipments using the X.21-interface the rate adaptation functions are identical to those described in GSM 04.21 [6], but the notation used is as described in CCITT recommendation X.30/I.461.

The notation used is as follows:

The conversion of the user rates of 2.4 and 4.8 kbit/s to 8 kbit/s and user rate of 9.6 kbit/s to 16 kbit/s shall be implemented by means of the 40 bit frame structure shown in figure 5.

Figure 5 shows that in addition to the basic frame, a two frame multiframe is employed. In odd frames, octet 0 contains all zeros, whilst in even frames octet 0 consists of a one followed by seven E bits. The order of bit transmission of the 40 bit frame is from left-to-right and top-to-bottom.

This two frame multiframe corresponds to the 80 bit frame structure presented in GSM 04.21 [6] as shown in figure 6. The 24 information bits P1,..,P8, Q1,..Q8, R1,..,R8 of odd frames correspond with D1,..,D24 and those of even frames correspond with D25,..,D48 respectively. For the status bits there is the following correspondence: odd frame SQ,X,SR,SP = S1,X,S3,S4 and even frame SQ,X,SR,SP = S6,X,S8,S9.

Option for a manufacturer of mobile stations:

In transparent mode support of a packet mode TE1 or TE2/TA, which uses flag stuffing.

	Bit number							
	1	2	3	4	5	6	7	8
Octet 0 Odd frames	0	0	0	0	0	0	0	0
Even frames	1	E1	E2	E3	E4	E5	E6	E7
Octet 1	1	P1	P2	P3	P4	P5	P6	SQ
Octet 2	1	P7	P8	Q1	Q2	Q3	Q4	X
Octet 3	1	Q5	Q6	Q7	Q8	R1	R2	SR
Octet 4	1	R3	R4	R5	R6	R7	R8	SP

NOTE: Bit X, if not used for the optional flow control or for the indication of the far end synchronization, shall be set to 0 (see CCITT Recommendation I.463/V.110).

Figure 5: 40 bit frame structure of CCITT X.30

	X.30 Two frame multifr.								V.110 80-bit frame							
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
odd	1	P1	P2	P3	P4	P5	P6	SQ	1	D1	D2	D3	D4	D5	D6	S1
frame	1	P7	P8	Q1	Q2	Q3	Q4	X	1	D7	D8	D9	D10	D11	D12	X
	1	Q5	Q6	Q7	Q8	R1	R2	SR	1	D13	D14	D15	D16	D17	D18	S3
	1	R3	R4	R5	R6	R7	R8	SP	1	D19	D20	D21	D22	D23	D24	S4
	1	E1	E2	E3	E4	E5	E6	E7	1	E1	E2	E3	E4	E5	E6	E7
even	1	P1	P2	P3	P4	P5	P6	SQ	1	D25	D26	D27	D28	D29	D30	S6
frame	1	P7	P8	Q1	Q2	Q3	Q4	X	1	D31	D32	D33	D34	D35	D36	X
	1	Q5	Q6	Q7	Q8	R1	R2	SR	1	D37	D38	D39	D40	D41	D42	S8
	1	R3	R4	R5	R6	R7	R8	SP	1	D43	D44	D45	D46	D47	D48	S9

Figure 6: Correspondence of X.30 and V.110 frames

4.2 Interchange Circuit Signalling Mapping

4.2.1 V-series interchange circuit mapping

The interchange circuit signalling mapping at the interface between the TE2 and the MT shall conform to CCITT recommendation V.24; while the signal levels at the interface shall conform either to CCITT recommendation V.28, or to IrDA IrPHY Physical signalling standard specification, or to PCMCIA 2.1, or to PC-Card 3.0 electrical specifications or to later revisions.

The signals required at this interface are shown in table 2.

Specification 04.21 refers to the frame structure and identifies the use of status bits for the carriage of signalling information~~.~~

~~Status bits~~

~~The bits S and X are used to convey channel status information associated with the data bits in the data transfer stage as shown below. The S bits are put into two groups SA and SB to carry the condition of two interchange circuits. The X bit is used to control the condition of circuit 106.~~

~~The mechanism for proper assignment of the control information from the transmitting signal rate adapter interface via these bits to the receiving signal rate adapter interface is shown below in table 1.~~

~~For the S and X bits, a ZERO corresponds to the ON condition, a ONE to the OFF condition.~~

Status bits SA, SB and X are used to convey channel control information associated with the data bits in the data transfer state. Table 1 shows the mapping scheme between the V.24 circuit numbers and the status bits for the transparent mode. It also shows how the unused status bits should be handled. It is derived from the general mapping scheme described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

The transport of these status bits by the various channel codings is described in subsequent sections.

Table 1: Mapping scheme at the MT for the transparent mode

Signal at TE2/MT interface or condition within the MT	Mapping direction: MT to IWF	Mapping direction: IWF to MT
CT 105	not mapped (note 1)	
CT 106		from status bit X (note 7)
CT 107		not mapped (note 5)
CT 108/2	not mapped (note 6)	
CT 109		from status bit SB (note 7)
CT 133	not mapped (note 2)	
always ON	to status bit SA (note 3)	
always ON	to status bit SB (note 1)	
always ON	to status bit X (note 4)	
ignored by MT		from status bit SA (note 3)

NOTE 1. The SB bit towards the IWF, according to the General Mapping (27.002, annex C), could be used to carry CT 105. However, CT 105 should always be ON in the data transfer state since only duplex operation is supported. Also, many DTEs use the connector pin assigned to CT 105 for CT 133. No interchange circuit shall be mapped to the SB bit which shall always be set to ON in the data transfer state.

NOTE 2. CT 133 is not mapped since there is no flow control in transparent mode.

NOTE 3. The SA bits in both directions are available only with certain channel codings. Therefore, for maximum compatibility, they should not be mapped.

NOTE 4. The X bit towards the IWF is not mapped and shall always be set to ON in the data transfer state since there is no flow control in transparent mode.

NOTE 5. CT 107 is controlled by the channel synchronisation process (27.001).

NOTE 6. CT 108/2 may be used in the call setup and answering processes.

NOTE 7. The status bits are filtered before being mapped to the V.24 circuits (27.001).

~~General mapping scheme~~

~~Table 1: General mapping scheme for V-series interchange circuits~~

Table 2: Minimum set of V-series interchange circuits

Circuit Number	Circuit Name	Ground	Data		Control	
			to TE2	from TE2	to TE2	from TE2
CT102	Common Return	X				
CT103	Transmitted data			X		
CT104	Received data		X			
CT105	Request to send					X
CT106	Ready for sending				X	
CT107	Data set ready				X	
CT108.2	Data terminal ready					X
CT109	Data channel received line signal detector				X	
CT114	Transmitter signal element timing				X	
CT115	Receiver signal element timing				X	
CT125	Calling in-dicator (note)				X	

NOTE: CT125 is used with the AUTO ANSWER function of the TAF.

Use of Network Independent Clocking:

Network Independent Clocking is only applicable to calls using ITC value "3.1 kHz audio ex PLMN".

Within the GSM network the coding of the values for bits associated with NIC is specified in GSM specifications GSM 04.21 [6]/GSM 08.20 [9]. In the forward (transmitting) direction the multiframes shall be coded in exact accordance with that specified in those specifications. Bit E6 is set to "1" in alternate modified V.110 frames at the transmitter. However, the use of this bit at the receiver for monitoring frame Synchronization, or any other purpose, is not specified and is left to the discretion of the implementor.

A "perfect linear block Code" is used in C1-C5, whose error correction properties may be utilized in the receiver, in order to ensure reliable operation of NIC.

The NIC sending function has to recognize when the difference between the applicable clock speed of the GSM network and the interface speed generates a positive or negative whole bit requirement. When this positive or negative condition occurs, the NIC codewords specified in specification GSM 04.21 [6] are used to transport this condition to the receiving NIC function. Transmission of the codeword shall clear the positive or negative condition related to that codeword at the sending function. The sending function shall not send more than one positive or negative compensations within a contiguous period of time corresponding to 10 000 user data bits minus the number of user data bits necessary to make up an even number of V.110 frames between compensations (NIC compensation is coded in two V.110 frames). This results from the requirements to compensate for maximum clock differences of ± 100 parts per million. If the receiving

function receives NIC compensations more often than a contiguous period of time corresponding to 10 000 user data bits, there is no guarantee that data will not be lost.

The NIC receiving function has to provide the capability to support the compensation requirements of the sending function. This compensation is managed by manipulating the clock speed of the interface, within the standard constraints of that interface.

Overall, the compensation functions have to be capable of managing clock tolerances of ± 100 parts per million.

The NIC function has to recognize and manage the conversion of the NIC information received incoming from an ISDN terminal Interface. The conversion has to be made to the NIC format used within the GSM System as defined in specifications 04.21/08.20. The NIC function has to manage the conversion of the GSM NIC format into that used within the ISDN in the traffic direction towards the ISDN terminal interface.

Due to the incompatibility between the ISDN and the GSM requirements NIC interworking is nor provided between these two formats. as such no NIC function is required in providing interworking to the ISDN for unrestricted digital.

Action on loss of synchronization:

If five consecutive NIC multiframes have incorrect framing bit values in E7, the receiver shall stop applying clocking compensation to the received data. Resynchronization will be attempted and compensation will resume when synchronization is achieved.

Signal element timing:

Receiver signal element timing (CT115) is generated by MT2. In the transparent case, this shall be synchronized to the output of RA1' function. In the non transparent case it is output from the L2R on the basis of the current user data rate. A transition from ON to OFF condition shall nominally indicate the centre of each signal element on CT104.

Transmitter signal element timing is generated by MT2 (CT114), this may be synchronized to CT115.

In the case of alternate Speech/Group 3 Facsimile, there may be a Channel Mode Modify during the course of the facsimile portion of the call. If this occurs, the user data rate changes and this is reflected to the V.24 interface as a change in the clock speed on CT 114 and CT 115.

4.2.1.1 Multislot configurations (Channel coding TCH/F9.6 or TCH/F4.8 kbit/s)

In transparent multislot configurations status bits S1, S3 and the X-bit between the D12 and D13 in the ITU-T V.110 80-bit intermediate rate frame - are used for transferring substream numbering information. The S4-bit is used for frame synchronization between the parallel substreams (ref GSM 04.21).

4.2.1.2 Channel coding TCH/F14.4 and TCH/F28.8

For information on the mapping of the interchange circuit signalling bits in the 14.5 multiframe structure, refer to GSM 04.21.

4.2.2 X.21 Interchange circuit mapping

The interchange circuit signalling mapping at the interface between the TE2 and the MT shall conform to CCITT recommendations X.21 and X.24; while the signal levels at the interface shall conform either to CCITT recommendation X.26 (v.10), or to X.27 (V.11) - see also paragraph 2.1 of CCITT recommendation X.21, or to IrDA IrPHY Physical signalling standard specification, or to PCMCIA 2.1, or to PC-Card 3.0 electrical specifications or to later revisions.

The signals required at this interface are shown in table 3.

Specification 04.21 refers to the frame structure and identifies the use of status bits for the carriage of signalling information.

Status bits (S1,S3,S4,S6,S8,S9):

For the purpose of alignment with the case where the X.21 TE2 is connected to the MT via a TA conforming to CCITT recommendation X.30 (I.461), the notation for the S-bits will be SP, SQ and SR as in figure 5/GSM 07.03. For the bits SP, SQ and SR, a ZERO corresponds to the ON condition, a ONE to the OFF condition.

The bits SP, SQ and SR are used to convey channel associated status information. The mapping of the information on circuit C of the X.21 interface to the S bits and from the S bits to the circuit I in the distant interface should be done in such a way that the SP, SQ and SR bits are associated with the bit-groups P, Q and R. To assure proper and secure operation the mapping scheme has to be consistent with CCITT recommendations X.21 and X.24.

The mechanism for mapping is as follows:

- In all cases where X.21-byte timing interchange circuit B is not provided, the status bits SP, SQ and SR of the bit groups P, Q and R are evaluated by sampling the circuit C in the middle of the 8th bit of the respective preceding bit group. On the other hand, the conditions of the status bits SP, SQ and SR are adopted by the circuit I beginning with transition of the respective 8th bit of a bit-group P, Q and R to the first bit of the consecutive bit group on the circuit R.

- In the case where X.21-byte timing interchange circuit B is provided for character alignment, the circuit C is sampled together with the bit 8 of the preceding octet and the circuit I is changing its state at the boundaries between the old and new octets at the circuit R. This operation is defined in CCITT recommendation X.24.

Table 3: X.21 interchange circuits

Interchange circuit	Interchange circuit name	Data		Control		Timing toTE2
		to TE2	from TE2	to TE2	from TE2	
G	Common return					
Ga	TE2 common return					
T	Transmit		X		X	
R	Receive	X				
C	Control				X	
I	Indication			X		
S	Signal element timing					X
B	Byte timing (note)					X

NOTE: According to CCITT recommendation X.21 the provision of the 8 bit timing interchange circuit B is not mandatory.

4.2.3 Case of S-interface

At the S-interface an X.30 rate adapted bit stream is provided by the TE1 or TE2-TA combination (see figure 4). The terminal adaptation function within the MT does not have any interchange circuit signalling mapping function to perform.

4.3 Call establishment signalling mapping at TE/MT interface

4.3.1 V-series interfaces

4.3.1.1 Call establishment manual operation - utilizing Alternate Speech/Data or Speech followed by Data Capabilities

During manual call establishment, the mobile user shall be able to hear network supervisory tones and answer tone.

On hearing answer tone, the user invokes the transition from speech to data in both Mobile Station and the IWF. The mapping for this is shown in section 6.

4.3.1.2 Call establishment manual operation - utilizing the Unrestricted Digital Capability

In this case the user will not hear network supervisory tones or answer tone. The data transfer phase will be entered automatically.

4.3.1.3 V.25 bis auto call/auto answer

The mapping of the V.25 bis procedures to the messages of the PLMN Dm-channel signalling (GSM 04.08 [5]) is defined in section 4.

Auto Call:

This procedure is provided according to V.25 bis using only circuit 108/2. A subset of V.25 bis is shown in table 4. This subset gives minimum level of control and indication.

During the call establishment phase, i.e. after signalling, call tone according to V.25 bis shall be generated in the IWF, where appropriate.

Auto Answer:

This procedure is provided according to V.25 bis.

Table 4: Minimum set of V.25 bis Call Set-up Commands and Indications

	Description	IA5Characters
Commands from TE2	Call Request with Number provided 0,1..9,*,#,A,B,C,D	CRN
	Disregard Incoming Call	DIC
	Connect Incoming Call	CIC
Indications to TE2	Call Failure Indication XX = CB,AB,NT,FC (Note)	CFI XX
	INcoming Call	INC
	VALid	VAL
	INValid	INV

NOTE to table 4: CB = Local MT busy
AB = Abort call
NT = No answer
FC = Forbidden call *

* Forbidden call indication results from contravention of rules for repeat call attempts as defined by the appropriate national approvals administration. It is recommended that this is the responsibility of the MT, not the TE2.

4.3.2 X-series interfaces

4.3.2.1 X.21 bis call establishment manual operation - utilizing the Unrestricted Digital Capability

In this case the user will not hear network supervisory tones or answer tone. The data transfer phase will be entered automatically.

4.3.2.2 X.21 bis/V.25 bis call establishment signalling mapping

The mapping of the V.25 bis procedures to the messages of the PLMN Dm-channel signalling (GSM 04.08 [5]) is defined in section 6.

Auto Call:

This procedure is provided according to V.25 bis using only circuit 108/2. A subset of V.25 bis is shown in table 4. This subset gives minimum level of control and indication.

Auto Answer:

This procedure is provided according to V.25 bis.

4.3.2.3 X.21 call establishment signalling mapping

The mapping of the X.21 procedures to the messages of the PLMN Dm-channel signalling (GSM 04.08 [5]) is defined in section 7.

4.3.3 S-interface (I.420) signalling mapping

The mapping of Q.931 signalling to 04.08 signalling requires the inclusion, by the MT, of PLMN specific elements (eg. transparent or not, half or full rate channel). The required Bearer Capability Elements are shown in GSM 07.01 [8] Annex 2.

4.3.4 X.25 procedures mapping

User terminals are connected to mobile termination either at S reference point (TE1 or TE2/TA) or at R reference point (TE2). For the physical interface of TE2s all different possibilities are shown in table 9 in section 8.

For more details, see CCITT X.25 and the appropriate interface recommendations.

The mapping is described in section 8.

5 Terminal Adaptation Functions for synchronous non-transparent services

This section deals with the specific requirements for non-transparent X.25 access. Other cases, e.g. teletex, are dealt within other specifications.

Layer 2 Relay function is described in annex 1.

5.1 Rate Adaptation and protocol model

5.1.1 R-interface

For the protocol model and rate adaptation function applied in this case see Models 4b and 4e of Figures 6, 7 and 8/GSM 03.10).

5.1.2 S-interface

For the cases where the method indicated in CCITT X.30 is used see Models 4a and 4d of Figures 6, 7 and 8/GSM 03.10).

For the cases where the HDLC interframe flag stuffing shown in the recommendation CCITT X.31 is used see Models 4c and 4f of Figures 6, 7 and 8/GSM 03.10).

5.2 Signalling Mapping

5.2.1 Interchange circuit signalling mapping

Status bits SA, SB and X are used to convey channel control information associated with the data bits in the data transfer state. Table 2 shows the mapping scheme between the V.24 circuit numbers and the status bits for the non-transparent mode. It also shows how the unused status bits should be handled. It is derived from the general mapping scheme described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

The transport of the status bits by the L2RCOP is described in annex A.

Table 2: Mapping scheme at the MT for the non-transparent mode

Signal at TE2/MT interface or condition within the MT	Mapping direction: MT to IWF	Mapping direction: IWF to MT
CT 105	not mapped (note 1)	
CT 106 (note 4)		from status bit X (note 7)
CT 107		not mapped (note 5)
CT 108/2	not mapped (note 6)	
CT 109		from status bit SB
CT 133 (note 8)	to status bit X (notes 3,8)	
always ON	to status bit SA (note 2)	
always ON	to status bit SB (note 1)	
ignored by MT		from status bit SA (note 2)

NOTE 1. The SB bit towards the IWF, according to the General Mapping (27.002, annex C), could be used to carry CT 105. However, CT 105 should always be ON in the data transfer state since only duplex operation is supported. Also, many DTEs use the connector pin assigned to CT 105 for CT 133. No interchange circuit shall be mapped to the SB bit which shall always be set to ON in the data transfer state.

NOTE 2. The SA bits (both directions) are not mapped since CTs 107 and 108/2 are handled locally (notes 5, 6).

NOTE 3. The condition of status bit X towards the IWF may also be affected by the state of the receive buffer in the MT.

NOTE 4. The state of CT 106 (or other local flow control mechanism) may also be affected by the state of the transmit buffer in the MT and the state of the RLP (RR/RNR).

NOTE 5. CT 107 is controlled by the channel synchronisation process (27.001).

NOTE 6. CT 108/2 may be used in the call setup and answering processes.

NOTE 7. For inband local flow control, changes in the condition of the status bit X from the IWF also result in the sending of XON or XOFF to the DTE.

NOTE 8. For inband local flow control, CT 133 is not mapped and the status bit X towards the IWF is controlled by the reception of XON and XOFF characters from the DTE.

~~The interchange circuit signalling mapping is identical to the transparent case described in section 4.2.~~

5.2.2 Call establishment signalling mapping

The physical interfaces are mentioned in section 4.3.4 and the signalling mapping is described in section 8.

5.3 Flow Control

The passage of flow control information between L2Rs is described in annex 1.

5.3.1 Conditions requiring flow control towards the network

The L2R function will send immediately a "flow control active" indication in the following circumstances:

(i) If the receive buffer from the radio side reaches a preset threshold.

(ii) If local flow control is initiated by the TE2 (see section 5.3.3 a)). On receipt of this flow control indication transmission of data from the receive buffer towards the TE2 is halted.

On removal of the buffer congestion or local flow control the L2R will send a "flow control inactive" indication.

In addition, for the local flow control condition, transmission of data from the receive buffers will be restarted.

5.3.2 Conditional requiring flow control towards TE2

The L2R function will immediately activate local flow control (see section 5.3.3 b)) under the following circumstances:

(i) The transmit buffer reaches a pre-set threshold.

(ii) The L2R receives a "flow control active" indication.

On removal of the buffer congestion or receipt of L2R/RLP "flow control inactive" the local flow control will be removed.

5.3.3 Local flow control

Only inband flow control is allowed:

a) from TE2:

RNR is sent to indicate flow control active. RR is sent to indicate flow control inactive. Where RR/RNR is utilized then the TAF will generate flow control active/inactive immediately.

b) From TAF: As from TE2.

Where this method is used, the L2R will pass the RNR/RR frames to the TE2.

5.4 Buffers

5.4.1 TX buffers

Data received from the TE2 shall be buffered such that if the MT is unable to transfer the data over the radio path then data is not lost.

The buffer shall be capable of holding n1 bytes. When the buffer is half full, TE2 shall be flow controlled as per section 5.3.2. The value for n1 is up to the implementors.

5.4.2 RX buffers

Data for transfer to the TE2 shall be buffered such that if the TE2 is unable to accept data then data transferred from the MT is not lost.

The buffer size should be n2 bytes. The value for n2 is up to the implementors.

When the buffer becomes half full, the L2R will send a "flow control active" indication.

6 V- and S-series interface procedures to 04.08 mapping

Interface procedures not directly mappable to GSM 04.08 [5] (ie. V.25 bis VAL/INV) are not considered. Mobile management procedures of GSM 04.08 are not considered applicable.

Mapping of other call establishment or clearing messages to the S interface e.g. "Call proceeding", etc. have not been included. It is assumed these will be able to be mapped directly and are of no relevance to the V.25 bis or manual interface.

For Alternate speech/data and Speech followed by data digital services it will be necessary for the TAF to generate a "Modify" message for transmission, this shall be generated manually derived from MMI. This shall be according to the defined procedure in GSM 04.08 [5].

6.1 Mobile Originated calls

a) SETUP

Element	Derived from		
	MMI	V.25 bis message	S interface message
Called Address	Keypad	CRN/CRI/CRS	Setup
Called Sub Address	Keypad	CRI	Setup
HLC	Derived from internal settings or MMI information.		Setup
LLC	Same as HLC		Setup
BC	Same as HSC GSM 07.01 gives allowed values		Setup (with additional information from MMI oriented settings)

b) RELEASE COMPLETE

Element	Derived from		
	MMI	V.25 bis message	S interface message
Cause	Display (optional)	CFI	Release complete

6.2 Mobile Terminated calls

Call establishment is initiated by receipt of Setup at the MS:

a) SETUP

Element	Mapped on to		
	MMI	V.25 bis message	S interface message
Called Address	Display (optional)	INC	Setup
Called Sub Address	Display (optional)	Not applicable	Setup
HLC	Display (optional)	Not applicable	Setup
LLC	Display (optional)	Not applicable	Setup
BC	Display (optional)	Not applicable	Setup (with PLMN specific elements removed)

b) CALL CONFIRM

Information for the BC element in the call confirm is derived from e.g. MMI or by internal settings.

c) CONNECT

Connect is sent in response to connect from the S-interface, CIC from V.25 bis or from MMI.

7 X.21 interface procedures to 04.08 mapping

7.1 X.21 procedures mapping

The X.21 procedures mapping is shown in figures 10 and 11. The Bearer Capability Elements required on Dm channel are shown in GSM 07.01 [8] Annex 2.

NOTE: DTE corresponds to TE2 and DCE corresponds to MT2 in the signal names of X.21 interface.

7.1.1 Mobile originated call (see figure 10)

Call Request of TE2 to Dm channel SET-UP:

At R interface: In Ready state both TE2 and MT transmit (1,OFF). When the calling TE2 indicates Call Request (0,ON), the MT transmits Proceed to Select (+,OFF). Then the TE2 sends the Selection signals (IA5,ON) and End of Selection (+,ON) and enters the state DTE Waiting (1,ON). The MT shall transmit DCE Waiting (SYN,OFF).

At MS-MSC interface: By receiving Call Request at R-interface, the MT shall start mobile originated call establishment (CHANNEL REQUEST message etc.). When the MT has received Selection signals and End of Selection from TE2, it shall send SET-UP, when possible.

CALL PROCEED:

After the traffic channel assignment is complete, the MT shall start sending (1,OFF) within the 40 bit frames (see sections 4.1.3 and 4.2.2) via the Bm (Lm) channel.

Dm channel ALERT to Call Progress to TE2:

This is applicable only to manually answered calls.

When the MT receives ALERT from Dm channel, it shall transmit Call Progress signals (IA5,OFF) to TE2 and then enter the state DCE Waiting (SYN,OFF).

Dm channel CONN to Ready For Data to TE2:

When the MT receives CONN from Dm channel, it shall respond with CONN ACK message and it may send DCE Provided Information to the calling TE2. The MT transmits then Connection in Progress (1,OFF) to TE2.

When the MT receives a frame with all data bits set to ONE, it performs the switch-through of data and control lines to TE2.

7.1.2 Mobile terminated call (see figure 10)

Dm channel SET-UP to Incoming Call to TE2:

When the TE2 is in Ready state and the MT receives SET-UP via Dm channel, the MT shall respond with ALERT in case of manual answering. Via R interface the MT transmits Incoming Call (Bell,OFF) to TE2.

Call Accepted of TE2 to Dm channel CONN:

When the MT receives Call Accepted via R interface (1,ON), it shall send CONN message via Dm channel.

Dm channel CONN ACK to Ready For Data to TE2:

When the MT receives CONN ACK from Dm channel, it shall start sending (1,OFF) within the 40 bit frames via the Bm (Lm) channel. Via R interface the MT transmits Connection in Progress (1,OFF) to TE2 after delivering DCE Provided Information if any.

When the MT receives a frame with all data bits set to ONE, it performs the switch-through of data and control lines to TE2.

7.1.3 Mobile termination clearing (see figure 11)

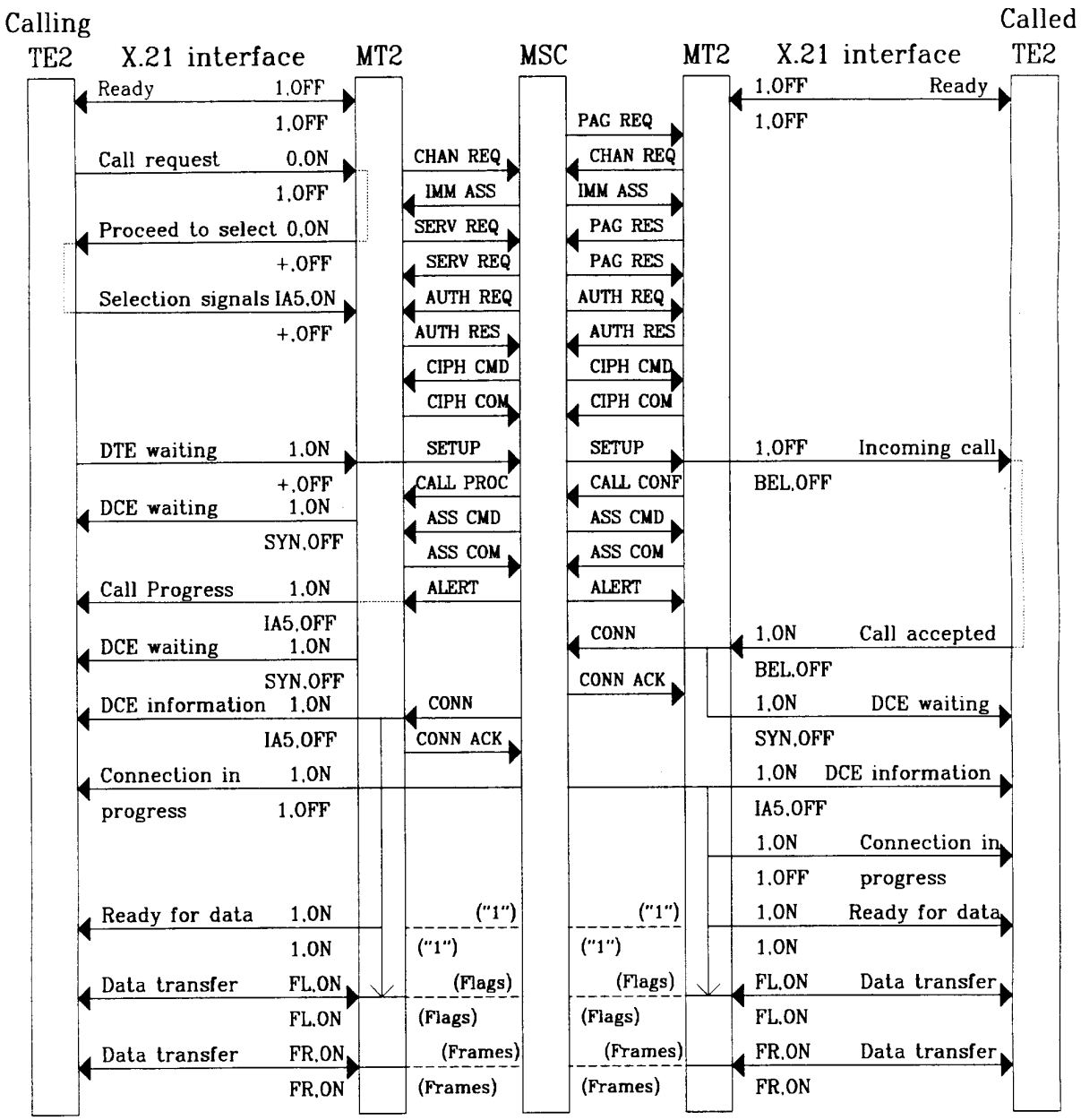
DTE Clear Request (0,OFF) is transmitted via Bm (Lm) channel to the cleared terminal. The MT at the clearing TE2 recognizes the Clear Request, transmits DCE Clear Confirmation (0,OFF) to TE2 and sends DISCONNECT message via Dm channel. When the radio channel is released, the MT shall transmit DCE Ready (1,OFF) and TE2 shall then enter the state DTE Ready (1,OFF).

7.1.4 Distant end terminal clearing

When the MT receives DCE Clear Request via Bm (Lm) channel, it shall transmit DCE Clear Indication (0,OFF) to its TE2 via R interface. After the MT has received DTE Clear Confirmation (0,OFF), it sends DISCONNECT message via Dm channel. When the radio channel is released, the MT shall transmit DCE Ready (1,OFF) and TE2 shall then enter the state DTE Ready (1,OFF).

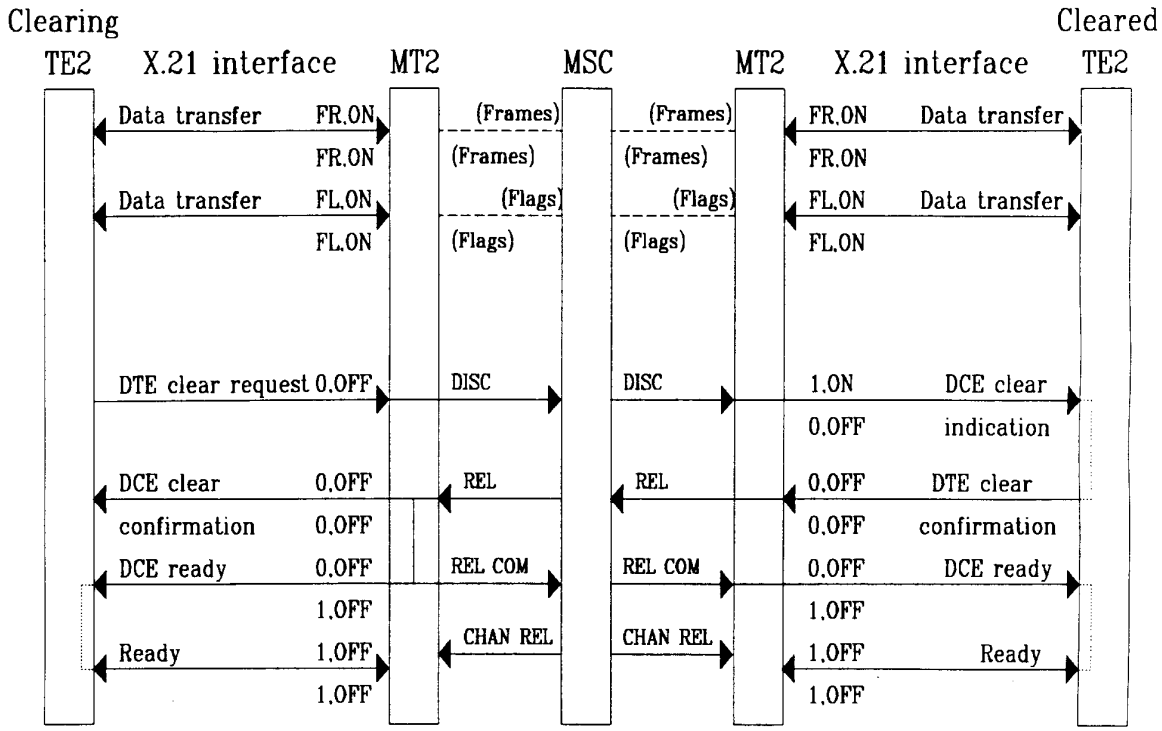
7.1.5 Network generated clearing (see figure 11)

When the MT has received DISCONNECT message via Dm channel, it shall transmit DCE Clear Indication (0,OFF) to its TE2 via R interface. After the MT has received DTE Clear Confirmation (0,OFF) and the radio channel is released, the MT shall transmit DCE Ready (1,OFF) and TE2 shall then enter the state DTE Ready (1,OFF).



NOTE: In the signal names of X.21 interface DTE corresponds with TE2 and DCE corresponds with MT2.

Figure 10: Example of a calling and a called TE2 (X.21)



NOTE: In the signal names of X.21 interface DTE corresponds with TE2 and DCE corresponds with MT2.

Figure 11: Example of a clearing and a cleared TE2 (X.21)

7.2 Dm Signalling causes mapping to X.21 call progress signals

The mapping of PLMN Dm channel signalling to X.21 call progress signals and DCE Provided Information is shown in table 7.

7.3. X.21 FACILITIES MAPPING

The X.21 facilities are shown in table 8. The mapping of these to PLMN supplementary services is for FS.

Table 7: Mapping of Dm cause fields to X.21 call progress signals

Item	Dm signalling cause	Code	X.21 call progress signal sign.	Code
01	Unassigned (unallocated) number	01	Not obtainable	43
02	No route to destination	03	Not obtainable	43
03	Channel unacceptable	06	Not obtainable	43
04	Normal call clearing	16	----	
05	User busy	17	Number busy	21
06	No user responding	18	No connection	20
07	User alerting, no answer	19	No connection	20
08	Call rejected	21	Controlled not ready	45
09	Number changed	22	Changed number	42
10	Destination out of order	27	Uncontrolled not ready	46
11	Invalid number format (incomplete)	28	Selection sign. procedure error	22
12	Facility rejected	29	Invalid facility request	48
13	Response to status enquiry	30	----	
14	Normal, unspecified	31	----	
15	No circuit/channel available	34	No connection	20
16	Network out of order	38	Out of order	44
17	Temporary failure	41	Out of order	44
18	Switching equipment congestion	42	Network congestion	61
19	Access information discarded	43	----	
20	Requested circuit/channel not available	44	No connection	20
21	Resources unavailable, unspecified	47	Network congestion	61
22	Quality of service unavailable	49	----	
23	Requested facility not subscribed	50	Invalid facility request	48
24	Bearer capability not authorized	57	Incompat. user class of service	52
25	Bearer capability not presently available	58	Network congestion	61
26	Service or option not available, unspecified	63	No connection	20
27	Bearer service not implemented	65	Invalid facility request	48
28	Only restricted digital information bearer capability is available	70	Invalid facility request	48
29	Service or option not implemented, unspecified	79	Invalid facility request	48
30	Invalid call reference value	81	Not obtainable	43
31	Incompatible destination	88	Not obtainable	43
32	Invalid transit network selection	91	Not obtainable	43
33	Invalid message, unspecified	95	Selection signal transmis. error	23
34	Mandatory info. element error	96	Selection signal procedure error	22
35	Message type non-existent or not implemented	97	Selection signal procedure error	22
36	Message not compatible with call state or message type non-existent or not implemented	98	Selection signal procedure error	22
37	Information element non-existent or not implemented	99	Selection signal procedure error	22
38	Invalid info. element contents	100	Selection signal transm. error	23
39	Message not compatible with call state	101	Selection signal procedure error	22
40	Recovery on timer expiry	102	Not obtainable	43
41	Protocol error, unspecified	111	Selection signal procedure error	22
42	Interworking, unspecified	127	RPOA out of order	72

Table 8: X.21 facilities

Facility request code	Facility
1	Closed user group
45	DTE inactive registration
45	DTE inactive cancellation
60	Multiple address calling
61	Charging information
62	Called line identification
63	Redirection of callactivation
63	Redirection of callcancellation
63	Redirection of callstatus
64	Reverse status
65	Direct call registration
65	Direct call cancellation
66	Abbreviated address registration
66	Abbreviated address cancellation

8 Support for packet service

There ~~are two ways~~is one way of supporting packet services via a circuit switched connection, namely as Basic PacketMode Service~~ and Dedicated PacketMode Service~~. In the Basic Packet Access case the GSM PLMN provides a connection to the PSPDN port or the PH of other networks~~, where as in the Dedicated Packet Mode Service case the GSM PLMN provides access to the PSPDN of its own~~ (see GSM 09.06 [10]).

8.1 Terminal configurations

The terminal configurations are shown in figure 12. The TE2 can be connected to MT2 or TA via X.21, X.21 bis or V-series interface. Table 9 shows various interface types at R reference point.

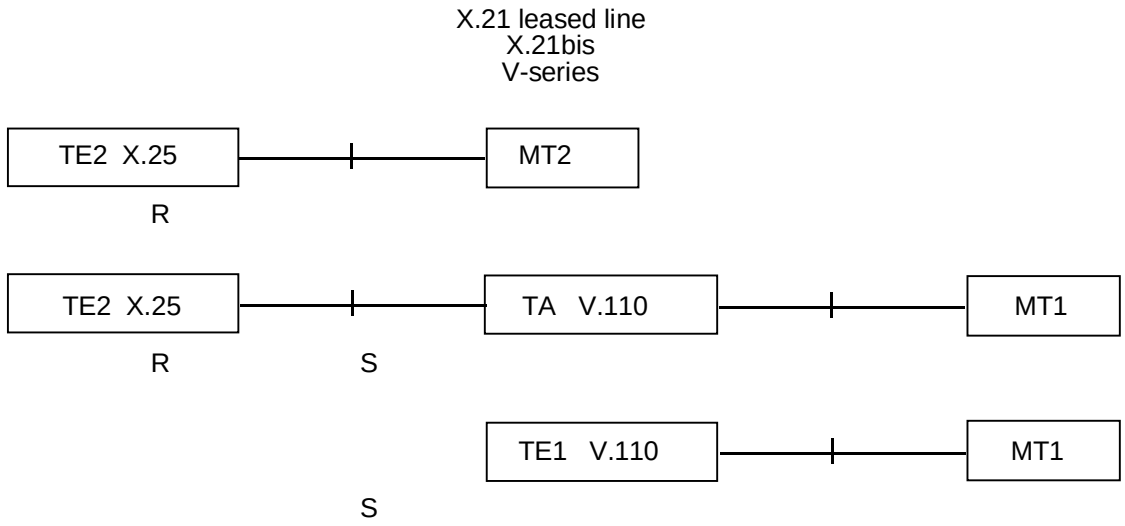


Figure 12: Packet mode terminal configurations

NOTE: For all configurations:

The proper operation of LAPB requires fixing of working parameters, this is detailed in specification GSM 09.06 [10].

Table 9: TE2/MT2 layer 1 specifications and procedures to initiate Bm channel establishment

Condition	TE2/MT2 Layer 1 specification		Events at the R reference point	Procedures according to:
Hot-line access (note)	X.25	X.21 leased circuit	TE2 sets C=N	CCITT Rec X.25 section 1.1
		X.21 bis	TE2 sets circuit 108=ON	CCITT Rec X.25 section 1.2
		V-series interface	TE2 sets circuit 108=ON	CCITT Rec X.25 section 1.3
	X.21 circuit-switched		TE2 signals direct call	CCITT Rec X.21 section 4.4
	X.21 bis direct call		TE2 signals direct call	CCITT Rec X.21 bis section 2.3.1
Full circuit-switched access	X.21 addressed call		TE2 enters call control phase	CCITT Rec X.21 section 4
	X.21 bis addressed call		TE2 performs automatic address call	CCITT Rec X.21 bis section 2.3.2 iii
	V25 bis addressed call		TE2 uses address call mode	CCITT Rec V.25 section 4

NOTE: In this case the terminal equipment assumes a semipermanent connection. After appropriate event at R reference point the MT2 will establish Bm channel to the PSPDN port or the PHF. MT2 requires the address of the PSPDN port or the PH and the setting of the parameters of the BC/LLC-IEs as described in sections 8.2 and 8.3.

8.2 Support for basic packet access

The GSM PLMN shall support the Basic Packet Mode Service in line with TS 09.06, thus the definitions laid down therein apply accordingly to the subject matter of this section.

For mobile originated call the Call Set-up message contains the E.164 address of the PSPDN port or the PHAU. This address will be provided by TE1 or TA in the case of S interface or by TE2 (R interface). The address must be provided either by MMI or by internal settings of MT2, if the TE2 is an ordinary X.25 terminal connected via "X.21 leased line", "X.21 bis" or "V-series" interface.

The required settings of the parameters of the BC/LLC-IE is shown in GSM 07.01 [8]. This setting might be performed via the MMI or being based on internal settings within the MT2.

For an incoming call the connection establishment is in line with GSM 09.06, 09.07 and 04.08. In the case of V-series interface (full circuit switched access) the TE2 must support V.25 bis Auto Answer procedure.

When the connection between the PSPDN port and the PH, respectively, and the TE is established, the TAF shall take care of mapping Bm channel to/from:

a) V series or X series interface data circuits

b) B channel in case of S interface

TE/MT and PSPDN port and the PH, respectively, take care of higher layer protocols, e.g. X.32 identification and X.25 LAPB and PLP.

~~8.3 Support for dedicated packet access~~

~~GSM 09.06 [10] applies in its parts dealing with the Dedicated Packet Mode Service.~~

~~In this case the GSM PLMN gives a uniform access to packet services based on the PH concept of the ISDN for case A, confined to mobile originated calls. The mobile subscriber indicates BC-IE elements as per GSM 07.01 [8]. The short code indicates the case of Dedicated Packet Access.~~

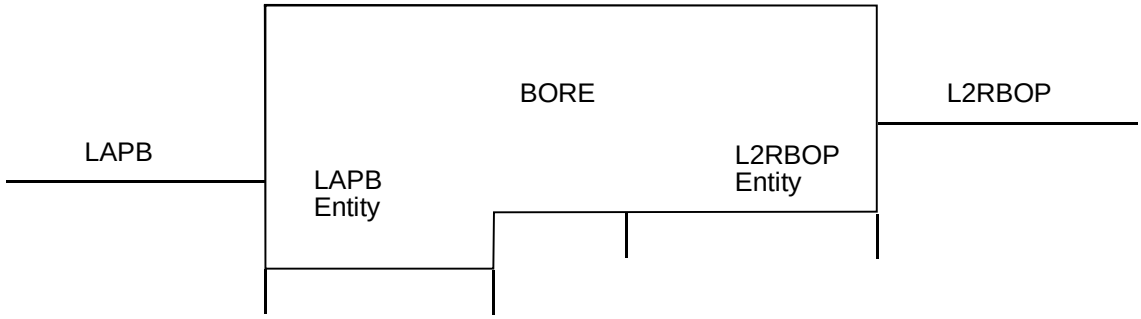
~~The mapping of data over V, X or S interface to/from Bm channel is identical to the Basic Packet Mode Service case.~~

~~The format of the numbering plan used in the X.25 Call Request Packet will be X.121. Numbering plan interworking in case of E.164 address is according to GSM 09.06 [10].~~

Annex A (normative): L2R Functionality

A.1 Introduction

This annex describes the Layer 2 Relay (L2R) functionality required to support LAPB non-transparently. The general aspects of L2Rs are described in specification GSM 07.01 [8]. Figure 1 shows the three sub-functions of the L2R.



LAPB Link Access Protocol Balanced
BORE Bit Oriented Relay Entity
L2RBOP L2R Bot Oriented Protocol

Figure 1: Sub-functions of the L2R

Section 2 describes the L2R Bit Oriented Protocol (L2RBOP) and section 3 describes the use of the L2RBOP to transport LAPB information fields.

A.2 L2RBOP

The LAPB user information fields and interface status changes are transferred between L2Rs using the services of the radio link. The L2RBOP entity segments and reassembles the LAPB user information fields to fit into the service data units (SDUs) handled by the radio link. I.e. segments of LAPB user information fields and interface status changes are transferred between L2Rs in n octet Protocol Data Units (PDUs). This corresponds to the fixed length of the RLP frame information field. The octets within the L2RBOP-PDU are numbered 0 to n-1, octet 0 is transmitted first. The value of n depends on the negotiated RLP version and frame type (GSM 04.22). The bits within the octets are numbered 1 to 8, bit 1 is transmitted first.

The RLP version value 2 indicates RLP multi-link operation. The RLP version value 0 or 1 indicates RLP single-link operation.

The L2RBOP also provides facilities for transferring LAPB connection control information between L2Rs. This LAPB connection control information allows concatenated LAPB connections to be established, reset and released.

The L2RBOP PDUs are coded as follows:

- Each octet contains a status octet, 1 - 8 bits of user information, control information or fill.
- Octet 0 shall always contain a status octet in case at least one status octet is transportet in the L2RBOP PDU. In RLP-versions 0 and 1 a PDU always carries at least one status octet. In RLP version 2 a PDU carries status octet(s) only if actual status change(s) has taken place within the period represented by the PDU. Here the L2R status flag in the RLP version 2 header is set to 1 when status octet(s) is carried in the PDU.
- Status octets contain 3 status bits and 5 address bits. In cases where two status octets within the PDU are separated by more than 23 octets, the first status octet in octet m is followed by a pointer octet in octet m+1

forming a two-octet status field. The pointer octet contains one reserved bit and seven address bits indicating the number of characters between the status field and the second status octet.

- The 3 status bits are used to convey the interface conditions that are conveyed by the S and X bits in CCITT recommendations V.110 and X.30. In the case of V series interfaces the 3 status bits correspond to SA, SB and X bits specified in V.110. In the case of X series interfaces only 2 bits are used and these correspond to S and X bits specified in X.30. The V series SA, SB and X bits use bit positions 8, 7 and 6 respectively in the status octets. The X series S and X bits use bit positions 7 and 6 respectively, in this case bit position 8 is unused.

- LAPB user information is carried in L2RBOP-PDU information octets such that the first LAPB user information bit, in any consecutive group of 8, received or transmitted corresponds to bit position 1 in the octet. The second to bit position 2, etc.

- Information octets are inserted into the L2RBOP-PDU in order of arrival in octets 1 to n-1 for RLP single-link operation, in octets 1 to n-1 for RLP multi-link operation with status octet transportation and in octets 0 to n-1 for multi-link operation with no status octet transportation.

- The address field in the status octets indicates the position of the next status octet within the L2RBOP-PDU. This indicates the number of information octets between status octets. Thus if two status octets are inserted into an L2RBOP-PDU at offsets l and m the address field value for the status octet at offset 1 will be defined by m-l-1 (m>l+1). The low order bit of the address corresponds to bit 1 of the octet and the high order bit to bit 5.

- Status octets are inserted in the information stream whenever a status change needs to be transmitted.

- Only address values 1 to n-2 (n-2 ≤ 23) in the address field of status octets are used for addressing purposes. The implication of not allowing address value 0 to be used for addressing is that two status octets can not be sent after each other. The remaining codes are used to indicate:

  - Last status change, remainder of L2RBOP-PDU is empty. Address field value is 31.

  - Last status change, remainder of L2RBOP-PDU full of information octets. Address field value is 30.

  - End of a LAPB user information field. Address field value is 29. This is used to delimit LAPB user information fields. In this case the 3 status bits do not have their usual meaning. They are used to indicate the number of information bits in the previous information octet. A binary number in the range 0 to 7 is contained in bit positions 8, 7 and 6, bit 6 is the low order bit. The values 1-7 indicate the number of information bits used, value 0 indicates all bits used. If this octet is not on the last position in a L2RBOP-PDU another status octet follows (e.g. an End of LAPB user information field in octet 0 is followed by a status octet in octet 1).

  - Abort a LAPB user information field transfer. The address field value is 28. This is used to abort the transmission of a LAPB user information field after sending one or more segments in L2RBOP-PDUs. If this octet is not on the last position in a L2RBOP-PDU another status octet is following (e.g. an Abort a LAPB user information field transfer in octet 0 is followed by a status octet in octet 1).

    - L2RBOP-PDU contains at least two status octets which are separated by more than 23 characters; the address-field value in the first octet of the two-octet status field is 27 and the address bits in the pointer octet of the status field indicate the number of characters between the two-octet status field and the next status octet.

  - Address field values from n-1 to **26** are reserved. In case of a PDU more than 25 octets in length, address field values from 24 to 26 are reserved.

- When it is necessary to insert a status octet into the information stream when no status change has occurred, e.g. to indicate that the remainder of an L2RBOP-PDU is empty or to indicate end of a LAPB user information field, the current status shall be repeated.

- In case when 64 data octets are carried by a 66-octet PDU, a status octet is carried in octet 0 and another status octet within the first 24 data octets. (The first status octet gives the address of the second status octet, which carries value 30 in its address field.)

- LAPB connection control information is transferred between L2Rs by use of a connection control PDU. Connection control PDUs consist of an L2RBOP PDU with the status octet in octet 0 containing address field value 0. The coding of the remainder of the L2RBOP connection control PDU is as follows:

  - Octet 1 contains the connection number, always 0 for LAPB. Other values are reserved for future use.

  - Octet 2 contains the connection control information. The connection control information values are 1 for Connect, 2 for Reset, 3 for Disconnect and 4 for loss of LAPB interframe fill. This octet is coded as a binary number with the low order bit corresponding to bit 1.

  - The use of octets 3 to n-1 is reserved.

- LAPB exchange identification frames (XID) are transferred between L2Rs by use of exchange identification PDUs. These PDUs consist of L2RBOP PDUs with the status octet in octet 0 containing address field values 0. The coding of the remainder of the PDU is as follows:

  - Octet 1 contains the connection number, always 0 for LAPB. Other values are reserved for future use.

  - Octet 2 contains the exchange identification indication. The values are 5 for an Exchange Identification Request and 6 for an Exchange Identification Acknowledge. The values 7 to 255 are reserved. This octet is coded as a binary number with the low order bit corresponding to bit 1.

  - The octet 3 contains a normal status octet. The rest of the PDU and of the following PDUs, if any, is used to transfer the XID information and it is treated like normal user data information PDUs as far as the coding is concerned.

A.3 Use of the L2RBOP

The L2R function required to support LAPB non-transparently consists conceptually of the three sub-functions shown in figure 1, i.e. the LAPB entity, the BORE and the L2RBOP entity. These perform the following functions:

- LAPB entity - This terminates the LAPB protocol from the terminal or the network. The service provided by the LAPB entity to the BORE is described in ISO DIS 8886.2 - OSI Data link service definition.

- L2RBOP entity - This uses the services provided by the radio link, see specification GSM 04.22 [7]. The service provided by the LAPB entity to the BORE.

- BORE - This concatenates the data link services provided by the use of the L2RBOP and LAPB.

The functions are described in more detail in the following sections.

A.3.1 Radio Link Connection Control

The L2RBOP entity uses the services of the radio link to establish, reset and release the connection to its peer L2RBOP entity. The radio link connection will be established and released as a result of indications from the signalling mechanisms when the supporting circuit switched connection is established.

After an RLP reset or RLP disconnect the L2RBOP entities shall assume that the remote LAPB connection is in disconnected state. No data can therefore be transported between the L2RBOP entities before an exchange of the connection control PDU "Connect" has taken place. All connection control PDUs transferred before the RLP reset are no longer valid and must not be acknowledged. All PDUs (except XID) received by the L2RBOP entities after an RLP reset or disconnect and before a new connection control PDU "Connect" has been received will be discarded by the L2RBOP entity.

A.3.2 Status transfer

The L2RBOP entity transfers interface status information between L2Rs via the status octets in the L2RBOP-PDUs. The meaning of the bits is exactly the same as that defined in CCITT recommendation V.110 and X.30. Status changes are inserted in the L2RBOP-PDU in the position corresponding to the position in the information stream at the DTE/DCE

interface that the interface status change occurred. When the RLP is established or reset a L2RBOP-PDU with the current status octet shall be sent.

A.3.3 LAPB connection control

The L2RBOP entity transfers LAPB connection control information between L2Rs via the L2RBOP connection control PDUs. This allows a LAPB connection to be established, reset and released when the remote LAPB connection is established, reset and released or vice versa. L2RBOP connection control PDUs containing connect or reset requests shall be acknowledged by a similarly coded L2RBOP connection control PDU in the reverse direction. Data transfer between L2Rs is not allowed until the connection control acknowledge PDU is received.

In the case of requests crossing they shall each be treated as acknowledgements of the other.

A.3.4 LAPB exchange identification

The L2RBOP entity transfers a LAPB exchange identification request/acknowledge between L2Rs via the L2RBOP exchange identification PDUs. This allows transfer of identification information prior to link establishment and/or during the link (especially with respect to ISO 8885/DADI). A L2RBOP exchange identification request PDU shall be answered by an associated exchange identification acknowledge PDU. In case of crossing of two requests each request shall be answered individually. A LAPB exchange identification request with identification information will be acknowledged by the LAPB entity from L2R only when the acknowledge from the remote LAPB connection is indicated by an exchange identification acknowledge PDU sent by the remote L2RBOP entity.

A.3.5 Data Transfer

The L2RBOP entity assembles and disassembles L2RBOP-PDUs by segmenting and reassembling the LAPB user information fields.

A.3.6 Flow control

Flow control information is transferred between L2Rs in two ways, these are:

- back pressure caused by L2R buffer conditions
- use of the X-bit in the status octet,

  X = 1 flow control active

  X = 0 flow control inactive

Annex B:
Change history

Change history						
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Apr 1999	GSM 07.03	6.0.0				Transferred to 3GPP CN1
CN#03	27.003				3.0.0	Approved at CN#03
CN#04	27.003	3.0.0	001	R99	3.1.0	Introduction of EDGE

History

Document history		
V3.0.0	May 1999	Approved at TSGN #3. Under TSG TSG CN Change Control.
V3.1.0	September 1999	Approved by E-mail for TSGN#4

3GPP N3/SMG3 WPD Meeting #7
Sophia Antipolis, France, 29 Oct – 3 Nov 1999

***Document* N3-99355**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

29.007	CR	006	Current Version:	3.2.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	CN#6	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]
(at least one should be marked with an X)

Source: TSG_N3 **Date:** 01.11.1999

Subject: R99 service clean up (correction)

Work item: Technical Enhancements and Improvements

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Due to the deletion of services in GSM R99 this specification has to be updated. In addition to the already approved CR 002 against 29.007 this CR completes the changes necessary for the service clean up.

Clauses affected: See attached pages

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	29.007 CR 002
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:


help.doc

<--------- double-click here for help and instructions on how to create a CR.

1 Scope

This TS 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 this TS, the requirements for voice and non-voice (data) calls are considered separately.

From GSM R99 onwards the following services are no more required to be provided by a GSM 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)

If a PLMN network still provides these services it shall fulfil the specification of GSM R98.

***** Next modified section *****

4 Introduction

General Network Interworking Scenarios are described in GSM 09.01. Since the numbering plan for the ISDN era (E.164) includes the numbering plan for the telephone network (E.163), it is not possible to distinguish by the number whether a given subscriber is a PSTN or ISDN subscriber. Further, in some countries both PSTN and ISDN subscribers will be connected to the same exchange, so the only difference for this type of combined network will be in the nature of the customer access. In this document a PSTN is considered to support only an analogue interface towards the subscriber. An ISDN shall be considered to support digital interface towards the subscriber. In addition, the ISDN is considered to support a standardized outband signalling protocol both between the subscriber and the network and within the network, i.e. DSS1 and ISUP, thus enabling the generation and transport of Compatibility Information for compatibility checking and terminal/function/service selection at the user-network interface as well as for MSC/IWF selection.

There now exist networks which do not fall into either of these categories in that they provide for digital connectivity from subscriber to subscriber through the network. The subscribers have access to a wide range of services by a limited set of standard multi-purpose user network interfaces. However, these networks do not support the standardized inter-exchange signalling protocol throughout, in that they are e.g. using TUP or National User Part (NUP). These types of network support 64 kbit/s connections, so in service support are comparable to ISDN, however, the signalling system provided may not support transport of all Compatibility Information allowed for in the standardized ISDN signalling. This document will therefore identify interworking to PSTN and ISDN on the principle of the network characteristics as identified in the previous paragraph. The aforementioned existing networks then constitute one particular case in the ISDN interworking scenarios. These cases will be itemized when the implication of the various degrees of exhaustiveness of the Compatibility Information - delivered via the ISDN - used for deducting a GSM Basic Service needs to be set forth.

When two dissimilar networks are required to interwork in order to support a communication between two subscribers, one on each network, a number of Interworking Functions (MSC/IWFs) are required to support the communication. Some of these are related to the differences in signalling and are dealt with in GSM 09.03.

Examples of other aspects of interworking are:

a) the need or otherwise of echo control devices;

b) the need or otherwise of modem pools and network-based rate adaptation.

For the purposes of determining the required MSC/IWFs, it is necessary, however, to consider separately each type of interworking (i.e. PLMN-ISDN and PLMN-PSTN) since, in the worst case, "PSTN" could refer to an essentially analogue network with electromechanical switching not controlled by software and without common-channel signalling.

Some facilities associated with alternate speech and facsimile group 3 may not be available with version 1 of the MAP (GSM 09.02). Version 1 of the Mobile Application Part (MAP) does not support in-call modification and channel mode modification following an inter-MSC handover.

~~From GSM R99 onwards the following services are no more required to be provided by a GSM PLMN:~~

~~- the dual Bearer Services "alternate speech/data" and "speech followed by data"~~
~~- the dedicated services for PAD and Packet access~~

~~If a PLMN network still provides these services it has to fulfil the specification of GSM R98.~~

***** Next modified section *****

9.2.2.1 Multi-numbering Scheme

In this scheme, the HPLMN will allocate a number of MSISDNs to a subscriber and associate with each of these numbers a Bearer Capability to identify a Bearer or a Teleservice. This Bearer Capability comprises a complete GSM Bearer Capability (GSM BC) information element with contents according to GSM 07.01 and coded as per GSM 04.08. In either case, when the HLR receives an interrogation relating to an incoming call (i.e. the MAP "Send Routing Information" procedure), it requests a roaming number (MSRN) from the VLR. This request will contain the GSM BC~~(s)~~ reflecting the service associated with the called MSISDN, i.e. the GSM BC~~(s)~~ ~~are~~ is passed to the VLR within the MAP parameter "GSM Bearer Capability" of the message "Provide Roaming Number".

At the VMSC, when the incoming call arrives, the GSM BC associated with the MSRN are retrieved from the VLR and sent to the MS at call set-up.

Where the PLMN specific parameters "connection element" and "radio channel" requirements contained in the retrieved GSM BC-IE, indicate dual capabilities then the VMSC shall set them according to its capabilities/preferences. Additionally the parameters correlated to those mentioned above may have to be modified in accordance with GSM 07.01.

The same applies to the parameter modem type if "autobauding type 1" is indicated but the IWF does not support this feature. The parameter "data compression" may also be modified according to the capabilities of the IWF.

Where single capabilities are indicated then the VMSC shall use the requested values if it is able to support the service requested. If it is unable to support the requested service then it shall set them according to its capabilities/preferences.

Where the Compatibility Information is provided in a degree exhaustive to deduce a GSM Basic Service (see application rules in subclause 10.2.2), then the VMSC in providing the GSM BC IE in the setup message shall set the PLMN specific parameters to its capabilities/preferences.

On receipt of a Set-up message containing the compatibility information, the MS will analyse the contents to decide whether the service can be supported (with or without modification, see GSM 07.01) and the call will be accepted or rejected as appropriate.

These negotiable parameters in the GSM BC-IE are: Connection Element (Transparent\non-transparent), Data Compression, number of data bits, number of stop bits and parity as well as the correlated parameters Structure, Intermediate Rate, Modem Type and User Information Layer 2 Protocol. For multislot, 14.4kbit/s or EDGE--operations additionally the parameters Fixed Network User Rate, Other Modem Type and User Initiated Modification Indicator can be negotiated, see GSM 07.01. This negotiation takes place by means of the MS reflecting back to the MSC a complete bearer capability information element in the call confirm message, with the relevant parameters changed. If this does not take place (i.e. if there is no GSM BC present in the call confirmed message), than the MSC will assume that the values originally transmitted to the MS are accepted.

In case the GSM-BC sent with the set-up message contained the "fixed network user rate", "other modem type" and "user initiated modification parameter" parameters and no multislot, 14.4kbit/s, and/or EDGE--related parameters (refer to GSM 07.01) are received in the GSM-BC of the call confirmed message or no GSM-BC is received, the MSC shall discard the "fixed network user rate", "other modem type" and "user initiated modification parameter" parameters - the MSC shall use the fall-back bearer service indicated by the remaining parameters of the GSM-BC on a singleslot configuration (refer to GSM 08.20 and GSM 04.21) on the MSC/IWF-BSS link.

On the other hand, if the GSM-BC received with the call confirmed message contain(s) multislot, 14.4kbit/s or EDGE--related parameters the MSC shall apply a singleslot configuration when the “maximum number of traffic channels” indicates ‘1 TCH’ and the “user initiated modification indicator” indicates either ‘user initiated modification not requested’ or ‘user initiated modification upto 1 TCH/F requested’, otherwise a multislot configuration (refer to GSM 08.20 and GSM 04.21) shall be used on the MSC/IWF-BSS link. In case the MS signals an ACC containing TCH/F4.8 only and the network does not support TCH/F4.8 channel coding, then the MSC may act as if TCH/F9.6 were included in the ACC.

In addition the MS may propose to the network to modify the User Rate as well as the correlated parameters Modem Type and Intermediate Rate in the CALL CONFIRMED message. The network may accept or release the call. For multislot, 14.4kbit/s or EDGE--operations, the MS may also propose to the network to modify the Fixed Network User Rate and Other Modem Type parameters (see GSM 07.01).

***** Next modified section *****

10.2.2.3 Functions in HLR

According to the contents of the Compatibility Information, i.e. the ISDN BC, LLC and HLC received, the HLR applies one of the following alternatives:

1) No ISDN BC is received, or one from which a GSM Basic Service cannot be deduced with the information Transfer Capability field set to "3,1 kHz audio" but without any associated modem type[1] in the ISDN BC and LLC, or without HLC indication of group 3 facsimile. Two cases have to be considered:

   a) The called MSISDN has ~~one or two~~a corresponding GSM BC-IE~~(s)~~ stored in the HLR (see option a) of 9.2.2); then the service attached to this number in the HLR tables is applicable and the corresponding GSM BC-IE~~(s)~~ is passed to the VLR in "provide roaming number". See figure 6.

   ~~If two GSM BC IE have to be sent to the VLR they are preceded by a repeat indicator information element according to 04.08. These three information elements shall be included within the MAP parameter "GSM Bearer Capability" of the message "Provide Roaming Number".~~

~~NOTE: For the case of two GSM BC IEs see subclause 10.3.~~

   b) The called MSISDN has no corresponding GSM BC-IE~~(s)~~ stored in the HLR (see option b in 9.2.2). In this case no GSM BC is passed to the VLR in the "provide roaming number" message.

2) Compatibility Information is received from which a GSM Basic Service can be deduced, i.e. the ITC field in the ISDN BC received is "unrestricted digital" and the fields for the applicable user layer 1 protocol and user rate are available (either in the ISDN BC or LLC), or the ITC field is "3,1 kHz audio", and a modem type, user rate, etc. is indicated but the HLC does not indicate "facsimile group 3". The received ISDN BC (and possibly LLC plus HLC) is then considered applicable regardless of the kind of MSISDN received (GSM BC associated or not) and either the equivalent GSM BC or the original ISDN BC/LLC is sent to the VLR. Additionally in both cases the originally received HLC may also be sent to the VLR, see figure 7.

   When the HLR interworks with a phase 1 VPLMN (VLR/VMSC), then the HLR shall convert the ISDN BC to the equivalent GSM BC, and forward to the VLR. In this case however no LLC can be forwarded.

3) Compatibility Information is received from which the GSM Teleservice category Facsimile transmission can be deduced i.e. the ITC field in the ISDN BC received is "3,1kHz audio" and the HLC indicates "facsimile group 3" (see figure 7), the following two cases have to be considered:

   a) The called MSISDN has a corresponding GSM BC stored in the HLR (either stating TS 61 or TS 62). In this case the service attached to the MSISDN in the HLR tables is applicable and the corresponding GSM BC is passed to the VLR in the "provide roaming number" message, see also subclause 10.3.1.3.

   b) The called MSISDN has no corresponding GSM BC stored in the HLR. In this case the HLR shall forward the appropriate GSM BC to the VLR in line with the subscribers subscription to teleservice 61 or 62.

      For TS 61 the value of the GSM BC-IE parameter "Information Transfer Capability" shall be set to "alternate speech/facsimile group 3, starting with speech"

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[1] "Modem type" in connection with the ITC value "3.1 kHz audio" means hereafter that either an ISDN BC modem type value is present or the autobauding modem function is indicated (see note 16 of table 7B)

In both cases the HLC IE should be passed to the VLR in the "provide roaming number" message.

Alternatively the HLR may forward the originally received ISDN/LLC/HLC, when interworking with a phase 2 VLR.

4) In the case where Compatibility Information received does not allow for deducing a GSM Bearer Service but an ISDN BC is received with the ITC field indicating "unrestricted digital", but without the fields indicating applicable "user layer 1 protocol", user rate, etc., neither in the ISDN BC or the ISDN LLC then the following shall apply. The call is managed as for an udi call according to subclause 9.2.2, i.e. either the "multi numbering" or "single numbering" scenario is applied depending on which capability is provided by home PLMN/HLR.

***** Next modified section *****

Table 7A (continued): Comparable setting of parameters in GSM 04.08 and ETS 300 102-1 (ETSI ISDN user to network signalling) Mobile Originated

Octet	GSM 04.08 parameter value as in GSM 07.01	Octet	ETS 300 102-1 parameter value
5 #5..4	**Rate adaptation** no rate adaptation (note 2) V.110/X.30 rate adaptation CCITT X.31 flag stuffing No comparable value (note 11) No comparable value (note 11) No comparable value (note 11) other rate adaptation (see octet 5a)	5 #5..1	**User information layer 1 protocol** no comparable value CCITT standardized rate adaption V.110/X.30 CCITT standardized rate adaption X.31 flag stuffing Recommendation G.711 µ-law Recommendation G.711 A-law (note 3) Recommendation G.721 32 kbit/s ADPCM and I.460 No comparable value
5a #5..4	**Other rate adaptation** V.120 (note 17)		No comparable value
5 #3..1	**Signalling access protocol** I.440/I.450 X.21 X.28, ded.PAD, indiv.NUI (note 24) X.28, ded PAD, univ.NUI (note 24) X.28, non-ded PAD ~~(note 24)~~ X.32		No comparable field
6 #1	**Synchronous/asynchronous** synchronous asynchronous	5a #7	**Synchronous/asynchronous** synchronous asynchronous
6 #5..2	**User info. layer 1 protocol** default layer 1 protocol	5 #5..1	**User info. layer 1 protocol** see section under rate adaptation for GSM 04.08 above
6a #7	**Number of stop bits** 1 bit 2 bits	5c #7..6	**Number of stop bits** 1 bit 2 bits
6a #6	**Negotiation** In band neg. not possible no comparable value	5a #6	**Negotiation** In band neg. not possible In band neg. possible (note 10)
6a #5	**Number of data bits** 7 bits 8 bits	5c #5..4	**Number of data bits excluding parity if present** 7 bits 8 bits
6a #4..1	**User rate** 0.3 kbit/s 1.2 kbit/s 2.4 kbit/s 4.8 kbit/s 9.6 kbit/s 12 kbit/s (note 7) 1.2 kbit/s / 75 bit/s (note 24) any value no comparable value	5a #5..1	**User rate** 0.3 kbit/s 1.2 kbit/s 2.4 kbit/s 4.8 kbit/s 9.6 kbit/s 12 kbit/s 75 bit/s / 1.2 kbit/s 19.2 kbit/s (note 14) Ebits or inband negotiation (note 10)

(continued)

***** Next modified section *****

Table 7B (continued): Comparability and Mapping of bearer capability parameter values according to ETS 300 102-1 and GSM 04.08 within the HLR for a mobile terminated Call

Octet	ETS 300 102-1 parameter value	Octet	GSM 04.08 parameter value
5 #5..1	**User information layer 1 protocol** no comparable value CCITT V.110 / X.30 CCITT G.711 A-law CCITT X.31 flag stuffing no comparable value	5 #5..4	**Rate adaption** no rate adaption (note 11) V.110/X.30 rate adaption no comparable value CCITT X.31 flag stuffing other rate adaption (see octet 5a)
	No comparable value	5a #5..4	**Other rate adaptation** V.120 (note 24)
	no comparable field	5 #3..1	**Signalling access protocol** I.440/I.450 X.21 X.28, ded.PAD, indiv.NUI (note 26) X.28, ded.PAD, univ.NUI (note 26) X.28, non-ded.PAD ~~(note 26)~~ X.32
	see above	6 #5..2	**User information layer 1 protocol** default layer 1 protocol
5a #7	**Synchronous / asynchronous** synchronous asynchronous	6 #1	**Synchronous/asynchronous** synchronous asynchronous
5a #6	**Negotiation** not possible inband neg, possible (note 16)	6a #6	**Negotiation** not possible no comparable value

(continued)

***** Next modified section *****

10.2.4.12.2 V.120 Protocol parameters

The following restrictions apply for the parameters relevant for V.120:

- BS ~~2x~~ 20 NT will use the protocol sensitive asynchronous mode~~,~~. BS ~~3x~~ 30 NT will use the protocol sensitive synchronous mode. As a consequence, the rate adaption header shall always be present.
- Only the default logical link will be established, i.e. the LLI negotiation value is "Default, LLI=256 only".
- V.120 recommends the use of the multiple frame acknowledged information transfer procedure for the protocol sensitive mode of operation.
- The IWF shall use the default value for the V.120 window size and the default value for the maximum transmit information field size. It shall be able to receive frames with the default maximum size.

Note. V.120 does not specify the values for these and other HDLC-related parameters directly. They are specified in Q.922 (1992) section 5.9. The information field includes the V.120 terminal adaption data field, the rate adaption header and the header extension (Control State octet), if present.