3GPP TSG_CN#6 **NP-99439**
ETSI SMG3 Plenary Meeting #6,
Nice, France
13th – 15th December 1999

Agenda item: **5.3.3**

Source: **TSG_N WG3**

Title: **CRs to 3G Work Item CS Data Services in UMTS**

Introduction:

This document contains **"3"** CRs **on Work Item CS Data Services in UMTS** agreed by **TSG_N WG3** and forwarded to **TSG_N Plenary** meeting #6 for approval.

Tdoc	Spec	CR	Rev	CAT	Rel.	Old Ver	New Ver	Subject
N3-99492	24.022	003		B	R99	3.1.0	3.2.0	INITIAL UPDATES FOR UMTS
N3-99495	27.001	005		B	R99	3.2.0	3.3.0	INITIAL UPDATES FOR UMTS
N3-99504	29.007	009		B	R99	3.2.0	3.3.0	INITIAL UPDATES FOR UMTS

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

***Document* N3-99492**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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24.022	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: CN#6 *list expected approval meeting # here ↑*	for approval [X]	strategic [ ]	*(for SMG use only)*
	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:** 01.12.1999

Subject: Updates for UMTS

Work item: CS Data Services in UMTS

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	[X]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Release:

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

Reason for change: The GSM bearer services have to be provided in UMTS. The non-transparent services require the RLP. In contradiction to GSM where RLP supports two frame formats (240 / 576 bit frames), in UMTS only 576 bit frames will be used. Also the support for DTX differs between GSM and UMTS.

Clauses affected: See attached pages

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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3G TS 24.022 V3.1.0 (1999-09

Technical Specificati

3rd Generation Partnership Proj
Technical Specification Group
Radio Link
for circuit switched Bearer and Teleserv
data and telematic servi
on the Mobile Station - Base Station System (MS - B
interface and
Base Station System - Mobile-services Switching Cen
(BSS - MSC) interf
(3G TS 24.022 version 3.

***** Next modified section *****

Foreword

This Technical Specification has been produced by the 3GPP.

This TS specifies the Radio Link Protocol (RLP) for circuit switched data transmission ~~over~~ 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 Specification specifies the Radio Link Protocol (RLP) for circuit switched data transmission ~~over~~ within the GSM and UMTS PLMN. RLP covers the Layer 2 functionality of the ISO OSI Reference Model (IS 7498). It is based on ideas contained in IS 3309, IS 4335 and IS 7809 (HDLC of ISO) as well as ~~CCITT~~ITU-T X.25 and Q.92x (LAP-B and LAP-D of ~~CCITT~~ITU, respectively.) RLP has been tailored to the special needs of digital radio transmission. RLP provides to its users the OSI Data Link Service (IS 8886).

RLP is intended for use with non-transparent data-transfer. Protocol conversion may be provided for a variety of protocol configurations. Those foreseen immediately are:

- Character-mode protocols using start-stop transmission (IA5);
- X.25 LAP-B.

For reasons of better presentation, material about protocol conversion has been placed within those Specifications concerned with the relevant Terminal Adaptors, i.e. ~~GSM 07.02~~3G TS 27.002 for the asynchronous case and ~~GSM 07.03~~3G TS 27.003 for the synchronous case. Care must be taken that that material also applies to Interworking Functions; see ~~GSM 09.04 - 09.07~~3G TS 29.006 and 29.007.

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

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

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

[5] 3GPP TS 25.410: "UTRAN I_u Interface: General Aspects and Principles".

[6] 3GPP TS 25.411: "UTRAN Iu Interface Layer 1".

[7] 3GPP TS 25.414: "UTRAN Iu Interface Data Transport and Transport Signalling".

[8] 3GPP TS 25.415: "Iu Interface CN-UTRAN User Plane Protocols".

[9] 3G TS 27.001: "3GPP; TSG CN; General on Terminal Adaptation Functions (TAF) for Mobile Stations".

[~~3~~10] ~~GSM 07.02~~3G TS 27.002: "~~Digital cellular telecommunication system (Phase 2+)~~3GPP; TSG CN; Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[~~4~~11] ~~GSM 07.03~~3G TS 27.003: "~~Digital cellular telecommunication system (Phase 2)~~3GPP; TSG CN; Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

~~[5] 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)".~~

~~[6] 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 facility (PAD) access".~~

[~~7~~12] ~~GSM 09.06~~3G TS 29.006: "~~Digital cellular telecommunication system (Phase 2+)~~3GPP; TSG CN; 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".

[~~8~~13] ~~GSM 09.07~~3G TS 29.007: "~~Digital cellular telecommunications system (Phase 2+)~~3GPP; TSG CN; General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

~~[9] CCITT Recommendation I.440 (Redbook): "ISDN user-network interface data link layer - General aspects".~~

~~[10] CCITT Recommendation I.441 (Redbook): "ISDN user-network interface, data link".~~

[~~11~~14] ~~CCITT~~ITU-T Recommendation Q.920 ~~(Redbook)~~: "ISDN user-network interface data link layer - General aspects".

[~~12~~15] ~~CCITT~~ITU-T Recommendation Q.921 ~~(Redbook)~~: "ISDN user-network interface - data link".

[~~13~~16] ~~CCITT~~ITU-T Recommendation Q.921bis: "Abstract test suites for LAPD conformance tests".

[~~14~~17] ~~CCITT~~ITU-T Recommendation Q.922: "ISDN data link layer specification for frame mode bearer services".

[~~15~~18] ~~CCITT~~ITU-T Recommendation V.42bis: "Data Compression for Data Circuit Terminating Equipment (DCE) using Error Correction Procedures".

[~~16~~19] ~~CCITT~~ITU-T Recommendation X.25 ~~(Redbook)~~: "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".

[~~17~~20] ISO/IEC Recommendation 4335: "Information technology - Telecommunications and information exchange between systems - High level data link control (HDLC) procedures - Elements of procedures".

[~~18~~21] ISO Recommendation 3309: "Information technology - Telecommunications and information exchange between systems - High level data link control (HDLC) procedures - Frame structure".

[~~19~~22] ISO Recommendation 7498: "Information processing systems - Open Systems Interconnection - Basic Reference Model".

[~~20~~23] 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".

[~~21~~24] ISO Recommendation 8886: "Information technology - Telecommunication and information exchange between systems - Data link service definitions for Open Systems interconnection".

[~~22~~25] ISO Recommendation 8509: "Information processing systems - Open Systems Interconnection - Service conventions".

[~~23~~26] ISO/IEC Recommendation 7809: "Information technology - Telecommunication and information exchange between systems - High-level data link control (HDLC) procedures - Classes of procedures".

[~~24~~27] ISO Recommendation 7776: "Information processing systems - High-level data link control procedures - Description of the X.25 LAPB-compatible DTE data link procedures".

2.1 Definitions and abbreviations

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

For the purposes of this TS, the following definitions apply:

backwards compatibility: RLP defines several backwards-compatible versions. That means that a newer version can interwork with an older one without changing the older one. This is realized by a fall back mechanism during XID exchange.

command: An instruction represented in the RLP header, causing the receiving RLP entity to execute a specific function.

frame check sequence: A field of redundant information based on a cyclic code, used for error detection.

I + S frame: An RLP frame that is used for user information transfer, carrying supervisory information piggyback.

improper frame: An RLP frame having an FCS error or having a header the contents of which is inconsistent with this Specification.

non-transparent: In PLMN data transmission, a configuration where at layer 2, protocol information of the fixed network is mapped on RLP elements, and vice versa.

piggybacking: Means by which one and the same frame can carry both user information and RLP related supervisory information.

response: A reply represented in the RLP-header, by which the sending RLP entity reports back about its status.

RLP frame: A sequence of contiguous bits, representing an RLP procedural element.

RLP header: That part of an RLP frame that encodes either a command or a response, located at the beginning of the RLP frame.

S frame: An RLP frame that contains supervisory information in the absence of user information.

transparent: In PLMN data transmission, a configuration where at layer 2 (and also at the layers above) no protocol conversion takes place.

U frame: An RLP frame that contains unnumbered protocol control information.

STM: Synchronous Transfer Mode

ATM: Asynchronous Transfer Mode

***** Next modified section *****

3 Introduction

Three versions of RLP are defined:

- RLP version 0: single-link basic version;
- RLP version 1: single-link extended version (e.g. extended by data compression);
- RLP version 2: multi-link version.

RLP uses one physical link (single-link) or from 1 up to 4 (multi-link) substreams on one or more physical links. However, the RLP multi-link version is designed to be able to support up to 8 physical links. If, in the call set-up signalling, either end indicates that it cannot support multi-link operation, neither end shall require usage of RLP-versions higher than 1. If the BC negotiation during call set-up results in a possibility for multi-link operation during the call, both ends shall require and accept RLP version 2 only.

If the BC negotiation during call set-up results in "maximum number of traffic channels" = "1 TCH" and UIMI = "not required/not allowed" or "up to 1 TCH/F allowed/may be requested", this is interpreted as if at least one end does not support multi-link operation, and neither end shall require RLP version higher than 1.

RLP makes use of an underlying FEC (Forward Error Correction) mechanism. For RLP to perform adequately it is assumed that the basic radio channel together with FEC provides for a block error rate of less than 10 %, where a block consists of 240 or 576 bits (Further study on the BLER for 576-bit blocks is needed). Furthermore, it is assumed that in case of multi-link RLP the difference of the delay between all physical links is less than timer T4.

In GSM, RLP frames are sent in strict alignment with the radio transmission. (For details, see GSM 04.21). RLP frames are of a fixed size of 240 (TCH/F4.8 and TCH/F9.6 channel codings) or 576 bits (TCH/F14.4, TCH/F28.8 and TCH/F43.2 channel codings). Whenever a frame is to be sent, the RLP entity has to provide the necessary protocol information to be contained in it. In UMTS, the RLP frame size does not depend on the channel coding, only 576 bit frames are used.

RLP entities running only in an UMTS environment need only to support the 576 bit frame length. The REMAP function is not necessary. RLP entities running in both of the systems have to support the REMAP function. In a handover from UMTS to GSM the frame either stays 576 bits long or changes from 576 bits to 240 bits incurring a REMAP. In a handover from GSM to UMTS the frame either stays 576 bits long or changes from 240 bits to 576 bits incurring a REMAP.

Provision is made for discontinuous transmission (DTX).

RLP spans from the Mobile Station (MS) to the interworking function (IWF), located at the nearest Mobile Switching Centre (MSC), or beyond. Depending on the exact location of the IWF, handover of the MS may result in link-reset or even total loss of the connection.

The MS shall initiate the RLP link. In addition the MSC/IWF may initiate the RLP link.

In the terminology of HDLC, RLP is used in a balanced configuration, employing asynchronous operation, i.e. either station has the right to set-up, reset, or disconnect a link at any time. Procedural means are provided for to deal with contentious situations, should they ever occur.

RLP is full-duplex in the sense that it allows for information to be transferred in both directions simultaneously.

4 Frame structure

4.1 Basic frame structure

In GSM, an ~~An~~ RLP-frame has a fixed length of either 240 bits, used when the channel coding is TCH/F4.8 or TCH/F9.6, or 576 bits, used when the channel coding is TCH/F14.4, TCH/F28.8 or TCH/F43.2. In UMTS, the RLP-frame has a fixed length of 576 bits.

A frame consists of a header, an information field, and an FCS (frame check sequence) field. The size of the components depends on the radio channel type, RLP version and on the RLP frame. As a benefit of using strict alignment with underlying radio transmission there is no need for frame delimiters (like flags etc.) in RLP. In consequence, there is no "bit-stuffing" necessary in order to achieve code transparency.

a) 240 bit frame size

	Header	Information	FCS
version 0 and 1, version 2 (U frames only)	16 bit	200 bit	24 bit
version 2 (S and I+S frames only)	24 bit	192 bit	24 bit

b) 576 bit frame size

	Header	Information	FCS
version 0, 1, and version 2 (U frames only)	16 bit	536 bit	24 bit
version 2 (S and I+S frames only)	24 bit	528 bit	24 bit

Figure 1: Frame structure

***** Next modified section *****

5.2.3.9 Upgrading Proposal bit, UP bit

In version 2, the UP bit in the S and I+S frame headers may be used by the IWF to indicate to the MS that a service level upgrading will increase the throughput, and is used in accordance with ~~GSM TS 07.01~~3G TS 27.001 and ~~09.07~~29.007. The usage of the UP bit is negotiated by XID exchange.

***** Next modified section *****

5.5 List of system parameters

The system parameters are as follows:

Table 2: RLP parameter values

Name	Range of values	Default value	Recommended value
Version N°	0 – 2	0	2
k MS ⇒ IWF (for N° = 0/1)	0 – 61	61	61
k MS ⇒ IWF	0 - k_{max} (note 3)	480	240 (note 2)

(for N° = 2)			
k IWF ⇒ MS (for N° = 0/1)	0 – 61	61	61
k IWF ⇒ MS (for N° = 2)	0 - k_{max} (note 3)	480	240 (note 2)
T1 (note 1)	> 420 ms (version2) > 380 ms > 440 ms > 600 ms	520 ms (fullrate on 14.5, 29.0 or 43.5 kbit/s) 480 ms (fullrate on 12 kbit/s) 540 ms (fullrate on 6 kbit/s) 780 ms (halfrate)	520 ms (fullrate on 14.5, 29.0 or 43.5 kbit/s) 480 ms (fullrate on 12 kbit/s) 540 ms (fullrate on 6 kbit/s) 780 ms (halfrate)
T2 (note 1)		< 80 ms (fullrate on 14.5, 29.0 or 43.5 kbit/s) < 80 ms (fulrate on 12 kbit/s) < 80 ms (fullrate on 6 kbit/s) < 80 ms (halfrate)	< 80 ms (fullrate on 14.5, 29.0 or 43.5 kbit/s) < 80 ms (fullrate on 12 kbit/s) < 80 ms (fullrate on 6 kbit/s) < 80 ms (halfrate)
N2	> 0	6	6
P_T	0	0	0
P_0	0 – 3	0	3
P_1	512 – 65535	512	2048
P_2	6 – 250	6	20
T4 (note 1)	> 25 ms	30 ms 50 ms (fullrate on 14.5, 29.0 or 43.5 kbit/s)	30 ms 50 ms (fullrate on 14.5, 29.0 or 43.5 kbit/s)
Optional feature, Up signalling	0 – 1	0	1

NOTE 1: The timer values shall fulfil the formula:

T1 > T2 + T4 + (2 * transmission delay) for multi-link operation

T1 > T2 + (2 * transmission delay) for single link operation

For GSM the values apply according to indicated channel types, for UMTS the values apply according to "fullrate on 14.5".

NOTE 2: This value is recommended in the case of 4 physical links.

NOTE 3: The maximum window size shall fulfil the formula
kmax < 496 - n * (1 + T4 / 20 ms), where n denotes the number of channels.
Any value k within the given range may be chosen.
However, to avoid transmission delay the value k should be

k > n * (2 * transmission delay) / 20 ms.

***** Next modified section *****

5.5.7 Optional features

The format of the optional features parameters is an octet where each bit position represents an optional feature that can be negotiated. The optional features are:

Bit position	Optional feature name
1	Up signalling
2	(Not yet assigned)
3	(Not yet assigned)
4	(Not yet assigned)
5	(Not yet assigned)

6	(Not yet assigned)
7	(Not yet assigned)
8	(Not yet assigned)

The 'Optional Features' parameter is negotiated bitwise in the downward sense, meaning that the value of bit *i* in the XID response shall be less or equal to the value of bit *i* in the XID command.

Up signalling: If the negotiated value of the 'Up signalling' feature is 1, then the UP bit in the S and I+S frame header is used for indicating an upgrading proposal to the MS, otherwise the UP bit is ignored (don't care). This optional feature is only applicable for GSM.

***** Next modified section *****

5.6 Support for discontinuous transmission (DTX)

In both ADM and ABM, whenever the RLP entity has no numbered or unnumbered supervisory commands/responses and no information transfer frames pending transmission, the RLP entity shall indicate to the lower layer that the DTX function may be invoked.

5.6.1 In case of GSM

Protocol of lower layer conforms to GSM 08.04, 08.20 and 04.21. GSM specification assumes STM for lower layer protocol. Even if there is no data to be sent, some transmission is needed on STM. RLP acts as follows in case of DTX.

~~NOTE:~~ In case DTX is invoked, in ADM a NULL-frame will be sent, and in ABM a~~n~~ RR or RNR S-frame will be sent.

5.6.2 In case of UMTS

Protocol of lower layer conforms to 3GPP TS 25.410, 25.411, 25.414 and 25.415. UMTS specification assumes ATM for lower layer protocol. When there is no data to be sent, no transmission is available on ATM. In consideration of transmission efficiency, no transmission is suitable. RLP acts as follows in case of DTX.

In case DTX is invoked, in ADM and ABM no frame will be sent.

6 Service definitions

6.1 Introduction

This chapter defines the service provided by the RLP-sublayer to the L2R-sublayer at the boundary between the RLP-sublayer and the L2R-sublayer.

The relationships between RLP-sublayer, L2R-sublayer and RLP-protocol are shown in figure ~~3~~4.

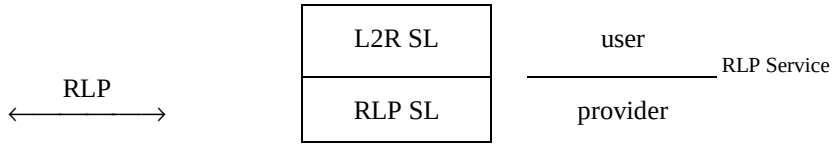

Figure 4: Basic relationship between RLP and L2R

The RLP service is defined in terms of:

- the primitive actions and events of the service;

- the parameters associated with each primitive action and event;
- the inter-relationship between, and the valid sequence of, these actions and events.

***** Next modified section *****

Annex A (informative): RLP SDL Diagrams

This annex describes a model implementation of an RLP entity for RLP version "0".

The description should help to clarify ~~GSM~~ this Specification ~~04.22~~, the RLP service and protocol definition.

However, it is not intended to restrict any implementation of an RLP entity in any way, on condition the implementation shows the correct behaviour at the RLP protocol level.

The model implementation consists of three processes. Process "SEND_PDU" adds the CRC to a given PDU and hands it to the lower layer entity for transmission. Process "RECEIVE_PDU" gets a received PDU block, checks the value of the CRC and the bits of the PDU header. If the CRC has the right value and if the header is syntactically correct, the receipt event is signalled to the "RLP_KERNEL" process, which is the protocol handling automaton.

Each process is described as an extended finite state machine (using SDL-Diagrams).

Each state of the automaton is described by a (main-)state number and a corresponding (main-)state name. The state may further be distinguished by the value of other state variables. This scheme is used because not every state variable needs to be defined in every state. The states are defined in chapter A.1.

The RLP machine reacts on events, which may be classified as:

- lower layer interface events;
- upper layer interface events; and
- station management or internal events.

The events of the RLP-Kernel are described in section A.2.

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

***Document* N3-99495**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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27.001	CR	005	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:** 25-11-1999

Subject: Introduction of UMTS

Work item: CS data bearer services

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	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Necessary updates for UMTS

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:

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;
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- 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 is based on the principles of terminal adaptor functions presented in the ~~CCITT~~ITU-T 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 ~~E~~TS is to outline the functions needed for the terminal adaptation.

In the ~~GSM 02.02 (ETS 300 904)~~3G TS 22.002 the bearer services are described. The general network configuration is described in ~~GSM 03.02~~TS 23.002 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 ~~E~~TS is presented in GSM 01.04 (ETR 350), 3G 21.905 and 3G TS 29.990. For support of data services between ~~GSM~~ a PLMN and other networks see ~~GSM 09 series~~TS 29.007 ~~of Specifications~~.

This TS is valid for a 2nd generation PLMN (GSM) as well as for a 3rd generation PLMN (UMTS). If text applies only for one of these systems it is explicitly mentioned by using the terms "GSM" and "UMTS". If text applies to both of the systems, but a distinction between the ISDN/PSTN and the PLMN is necessary, the term "PLMN" is used.

2 Normative references

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

[2] ~~GSM 02.02~~3G TS 22.002: "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~~TS 23.002: "~~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~~3G TS 24.008: "~~Digital cellular telecommunication system (Phase 2+);~~ Mobile radio interface layer 3 specification; Core Network Protocols -Stage 3".

[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~~3G TS 24.022: "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~~3G TS 27.002: "Digital cellular telecommunication system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[12] ~~GSM 07.03~~3G TS 27.003: "Digital cellular telecommunication system (Phase 2+); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[13] ~~GSM 07.05~~3G TS 27.005: "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~~3G TS 27.007: "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~~3G TS 29.002: "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~~3G TS 29.006: "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~~3G TS 29.007: "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~~3G TS 29.010: "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~~3G TS 29.011: "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~~ ITU-T Series V Recommendations: "Data communication over the Telephone network".

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

[28] ~~CCITT~~ ITU-T Series X Recommendations: "Data Communication networks".

[29] ~~CCITT~~ ITU-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".

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

[31] ~~CCITT~~ ITU-T 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~~ ITU-T Recommendation V.54: "Loop Test Devices for Modems".

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

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

[36] ITU-T Recommendation Q.931 (05/98): "DSS 1 - ISDN user network interface layer 3 specification for basic call control"~~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~~ITU-T 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".

[44] 3G TS 21.905 "3G Vocabulary".

[45] 3G TS 25.990 "Vocabulary for UTRAN".

[46] 3G TS 25.322 "Radio Link Control (RLC) Protocol Specification".

[47] 3G TS 25.415 "UTRAN Iu interface user plane protocols".

3 Abbreviations and Definitions

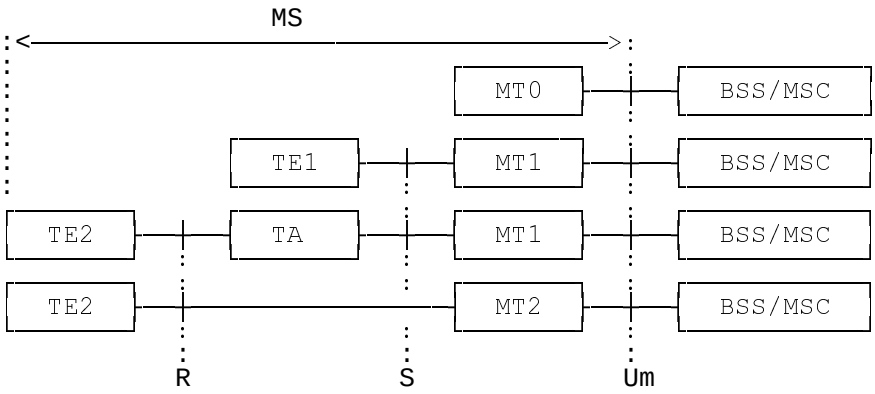
In addition to those below, abbreviations used in this TS are listed in GSM 01.04, 3G TS 21.905 or 3G TS 25.990.

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 ~~E~~TS 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~~ITU-T V- or X-series terminal adaptation functions among other MT functions.

Figure 2 presents the access reference configuration for UMTS. There is no reference point identified for the TAF. The TAF is considered as a part of the Mobile Termination.

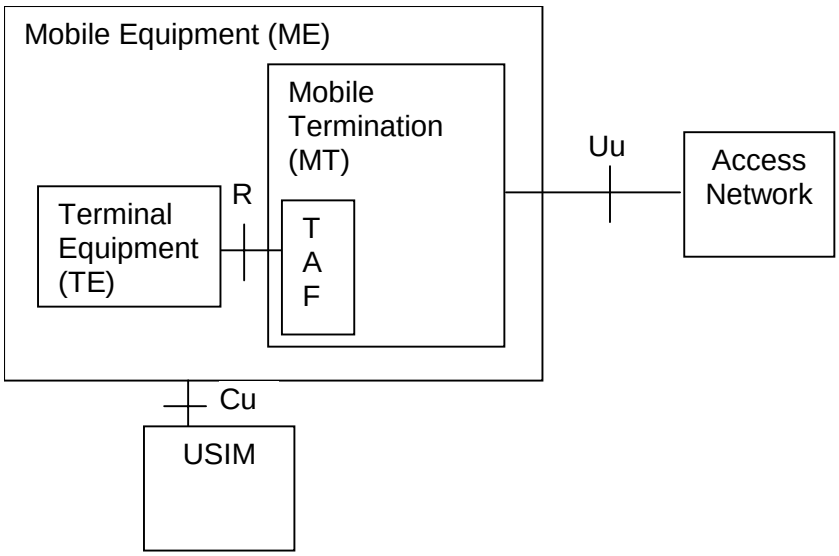


Figure 1 Reference Configuration for access to a UMTS PLMN

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) and data formatting for the transmission SAP (3G TS 25.322);
- 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~~ITU-T Rec. V.25 bis or with ITU-T Rec~~e~~ommendation. 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~~TS 24.008 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.

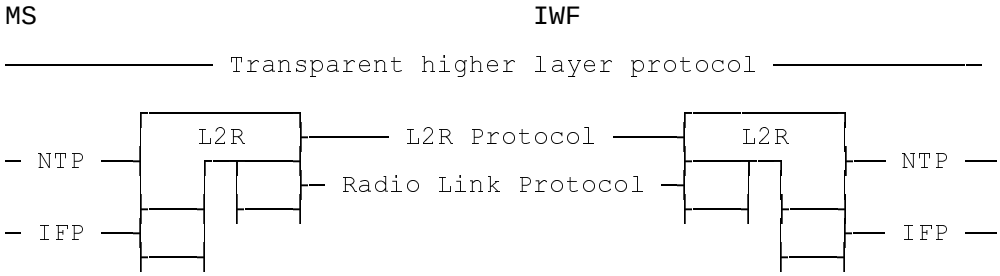
6 Support of non transparent Bearer Services

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~~3G 27-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.

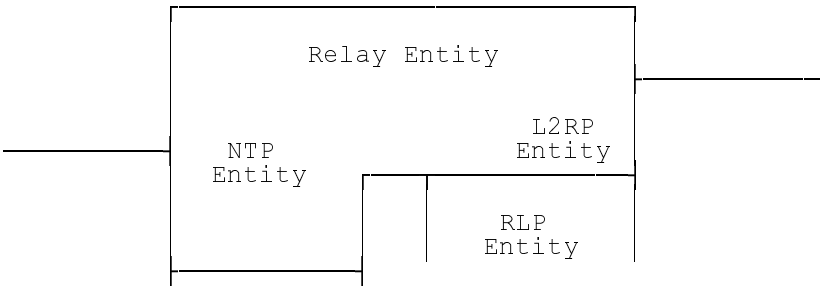


Figure 3

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~~ITU-T 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 (applies to GSM only)

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 (applies to GSM only)

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~~TS 27.001 General on Terminal Adaptation Functions for Mobile Stations

~~07.02~~TS 27.002 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~~TS 27.003 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~~MO calls, on reception of the message CONNACK in case of ~~MTC~~ MT calls 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~~MO) or CONNACK (~~MTC~~MT) 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~~TS 27.003, "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.

8.1.1.4 Procedures for RLC

With respect to the TAF for T bearer support, the procedure is as follows:

- no access stratum SDUs are transmitted until an access stratum SDU is received.

8.1.1.4.1 V-series interface

Until the first access stratum SDU is received at the transmission SAP, CT 106, 107 and 109 remain in the OFF condition. At the reception of the first SDU, CT 106, CT 107 and CT 109 are changed from OFF to ON at the DCE/DTE (TE/TAF) interface. The data received in each SDU are mapped to CT 104 and data on CT 103 are mapped to SDUs sent toward the RNC.

8.1.2 Non-transparent services

With respect to the TAF for non-transparent bearer capability support the synchronization procedure in GSM 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.

In UMTS, the TAF shall initiate the RLP after the physical connection has been established.

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~~3G TS 27.002, 27.003 "L2R functionality").

8.1.2.2 X.-series interface

The procedure is described in 3G TS 27.003~~GSM 07.03~~, "X.21 procedures mapping".

8.1.2.3 S interface (I.420) (does not apply to UMTS)

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

In GSM, ~~If~~ 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.

In UMTS, no action shall be taken

8.1.3.2 Loss at the TAF-terminal interface (applies to GSM only)

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~~ITU-T 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 (GSM transparent mode only)

8.2.1 General

The DTEs used at the MS side of the PLMN conform to ~~CCITT~~ITU-T'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~~24.008 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~~TS 24.008). 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. The radio channel requirement is ignored in UMTS, see Table B.5a in Annex B .

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, see B.1.1.2.

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~~MT 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) if in GSM, 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 GSM 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~~TS 24.008).

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 and in UMTS 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 or in UMTS 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~~values. ~~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, in GSM, 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).

8.3.3.3 Differences in validity of BC parameter values in GSM and UMTS

The validity of a BC parameter value, either in the SETUP or CALL CONFIRM message, may differ from GSM to UMTS. Certain parameters are irrelevant in UMTS and any value given is valid and ignored. These ~~paramaters~~parameters may be available in the BC IE. For those parameters that are relevant in UMTS and GSM, certain values may be invalid in one of the systems. Invalid parameter values may cause rejection of the BC and subsequent release of the call.

Parameters that are ignored in UMTS may be set to default values, or to specific values in vue of an eventual handover to GSM. Parameter values that are invalid in one system may result in unsuccessful handover from the other system.

Table B.5a in Annex B, lists parameters that are ignored in UMTS and parameter values which validity is different in GSM and UMTS

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~~ITU-T V.54/X.150). A comprehensive solution of such test loops in a ~~GSM~~ PLMN 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~~ PLMN 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 alternate services 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 or 3G TS 23.046. The ensuing data phase shall follow all the operational procedures as described in ~~07~~3G 27-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~~3G TS 24.022).

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~~ PLMN Bearer Capability Elements which need to be provided ~~on the Dm channel~~ to support Terminal adaptation function to Interworking control procedures. Some parameters are ignored in UMTS altough present in the BC-IE. The validity of parameter values may also differ fron GSM to UMTS. The ignored parameters and the difference of parameter value vality in GSM and UMTS are listed in Table B.5a in Annex B.

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~~3G TS 29.007 (Table ~~6A~~7A, ~~6B~~7B) 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~~3G TS 24.008.

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, or between the MT and the RNC (Uu interface).

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 1)

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~~PLMN Bearer Services and ~~GSM~~PLMN TeleServices

B.0 Scope

This annex describes the relationship between the various parameters of the ~~GSM~~PLMN Bearer Capability Information Element (BC-IE), their validity and the possible settings with reference to each ~~GSM~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN BC-IE during the call set-up phase. For the use during the established connection refer to ~~GSM~~ 3G TS ~~04.08~~24.008.

With respect to the individual parameter settings at the MS the following cases may be distinguished (ref. ~~GSM 07.0~~3G TS 27.002 and ~~GSM 07.0~~3G TS 27.003):

- 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~PLMN 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~~MO or a ~~MTC~~MT CALL 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	4)

	Acceptable channel codings	
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~~PLMN 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~~MO call or a ~~MTC~~MT CALL 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~~MO call or a ~~MTC~~MT CALL 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	euqal 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		X	
	6kbit/s..6kbit/s radio interface rate requested			
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		
	- none..No channel coding (defined by selecting none of the above		
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.5a: Differences in parameter value validity in GSM and UMTS

Parameter / *value*	GSM	UMTS
Radio Channel Requirements / *any*	valid	ignored
User rate / *any*	valid	ignored
Intermediate Rate / *any*	valid	ignored
NIC on transmission / *any*	valid	ignored
NIC on reception / *any*	valid	ignored
Negotiation of IR requested / *any*	valid	ignored
Acceptable Channel Codings / *any*	valid	ignored
Maximum number of traffic channels / *any*	valid	ignored
User initiated modfication indication / *any*	valid	ignored
Modem type /		
V.21, V.22, V.22bis, V.26ter	valid	invalid
V.32	valid	invalid for CE=T
Fixed Network User Rate /		
32, 33.6 kbit/s	invalid	valid
9.6, 19.2, 38.4	valid	invalid for CE=T
48.0	valid	invalid
Other Rate adaptation /		
H.223 and H.245	valid (note 1)	valid
PIAFS	invalid	valid

Note: Although a parameter value is marked as "valid", the validity may be restricted by rules given elsewhere in this specification.

NOTE 1: This parameter is interpreted as "No rate adaptation" in GSM.

Table B.6: Channel combinations

Single Bearer and Teleservices

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

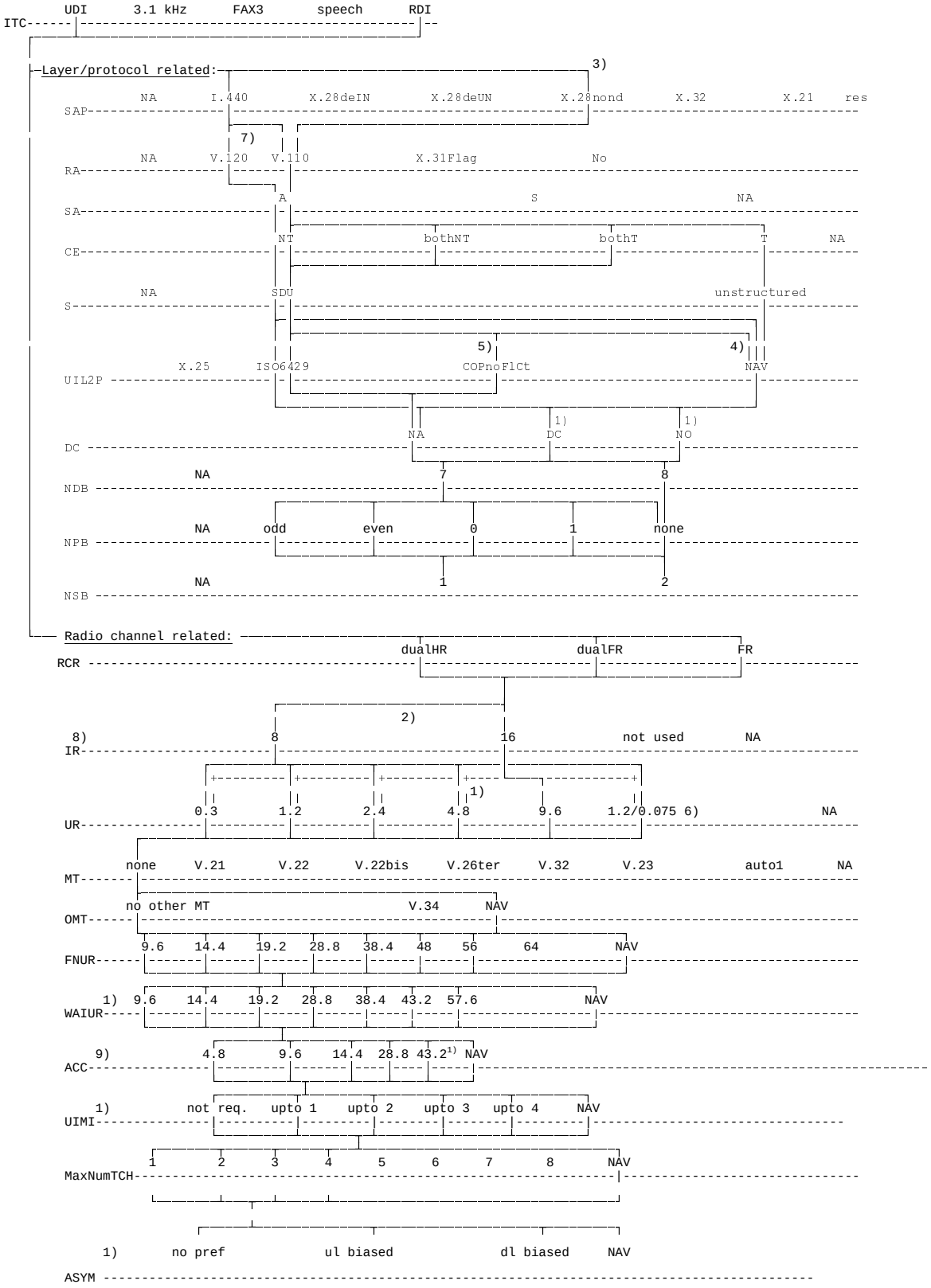
Subscription	**SETUP**	**CALL CONFIRMED**
TS61	TS61 s/f	TS61 s/f or TS61 f/s or TS62
	TS61 f/s	TS61 s/f or TS61 f/s or TS62
	TS62	TS62
	no BC	TS61 s/f or TS61 f/s or TS62
TS62	TS62	TS62
	no BC	TS62 (Note1)

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~~3G TS 29.007).

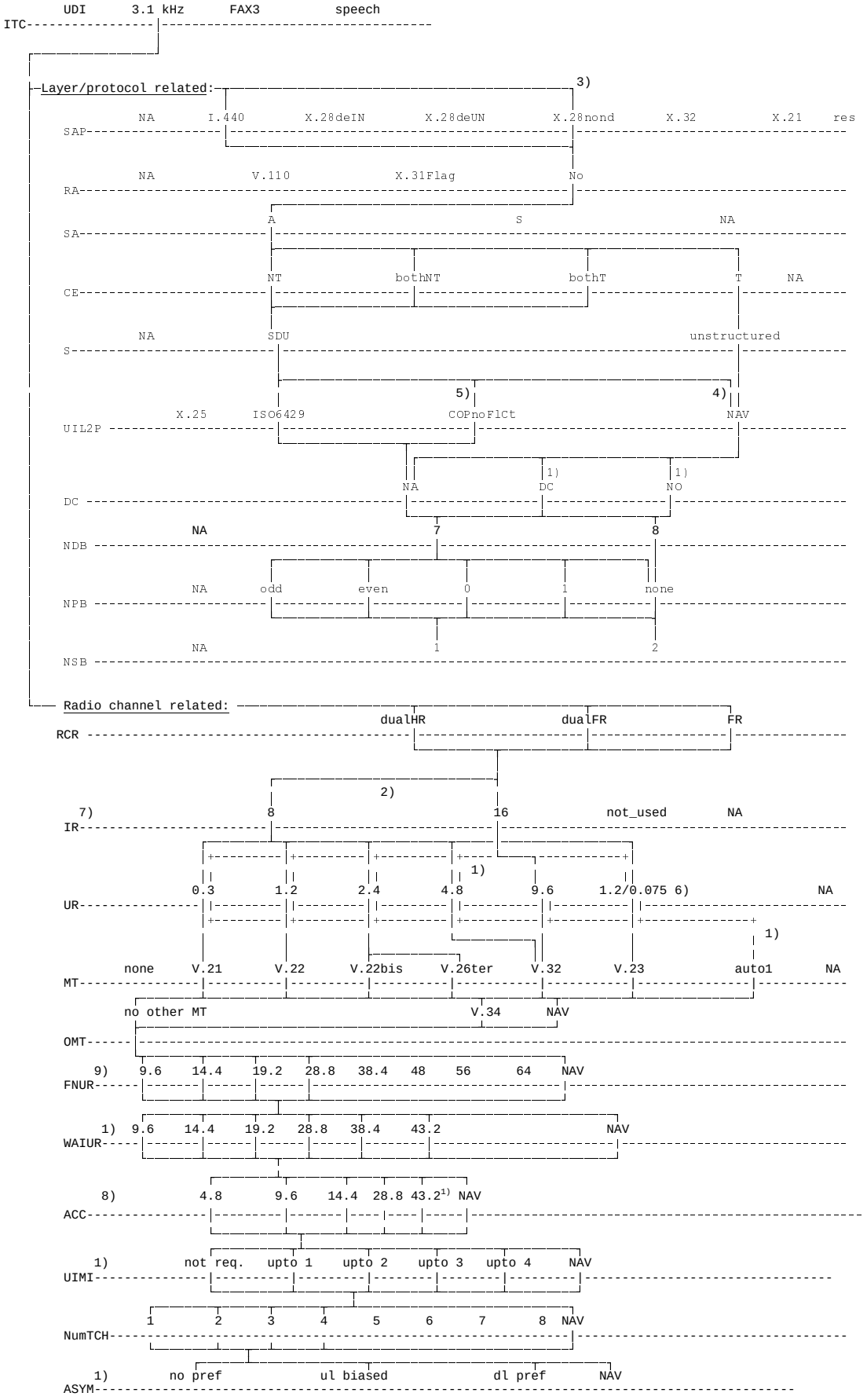
B.1.2 Bearer Service 20 ... 26, Data Circuit Duplex Asynchronous

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~~MO calls only;
4) for ~~MTC~~MT calls in the SETUP message or ~~MOC~~MO/~~MTC~~MT calls with "out-band" flow control requested
5) for ~~MOC~~MO/~~MTC~~MT calls with no flow control requested;
6) ~~MOC~~MO calls 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

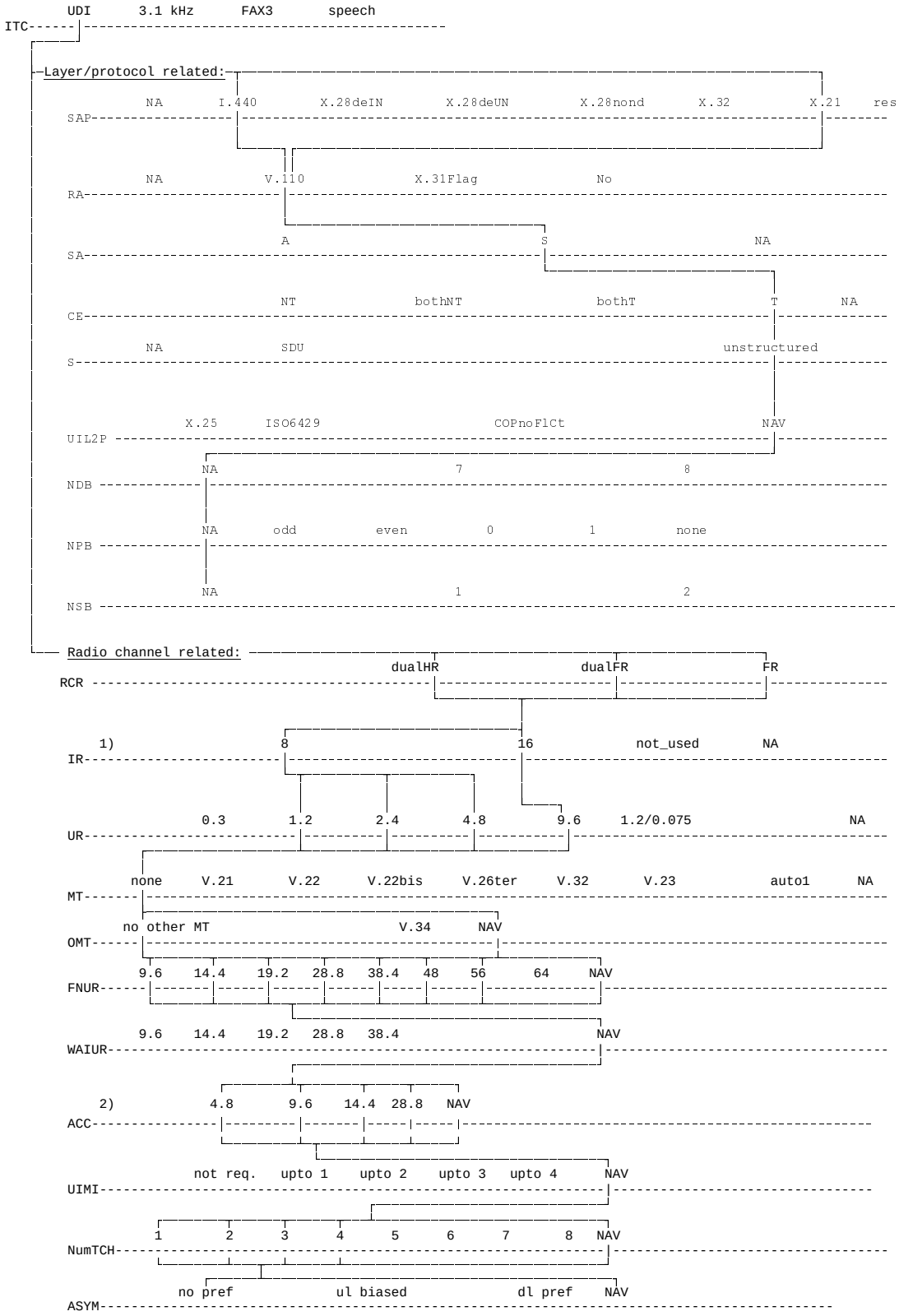


1) for CE:NT or "both";
2) for CE:T only or CE:NT and NIRR:6kb/s (not for the SETUP message);
3) for ~~MOC~~MO calls only;
4) for ~~MTC~~MT call in the SETUP message or ~~MOC~~MO/~~MTC~~MT call with "out-band" flow control requested
(not for V.21 and V.23 modem types);
5) for ~~MOC~~MO/~~MTC~~MT call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

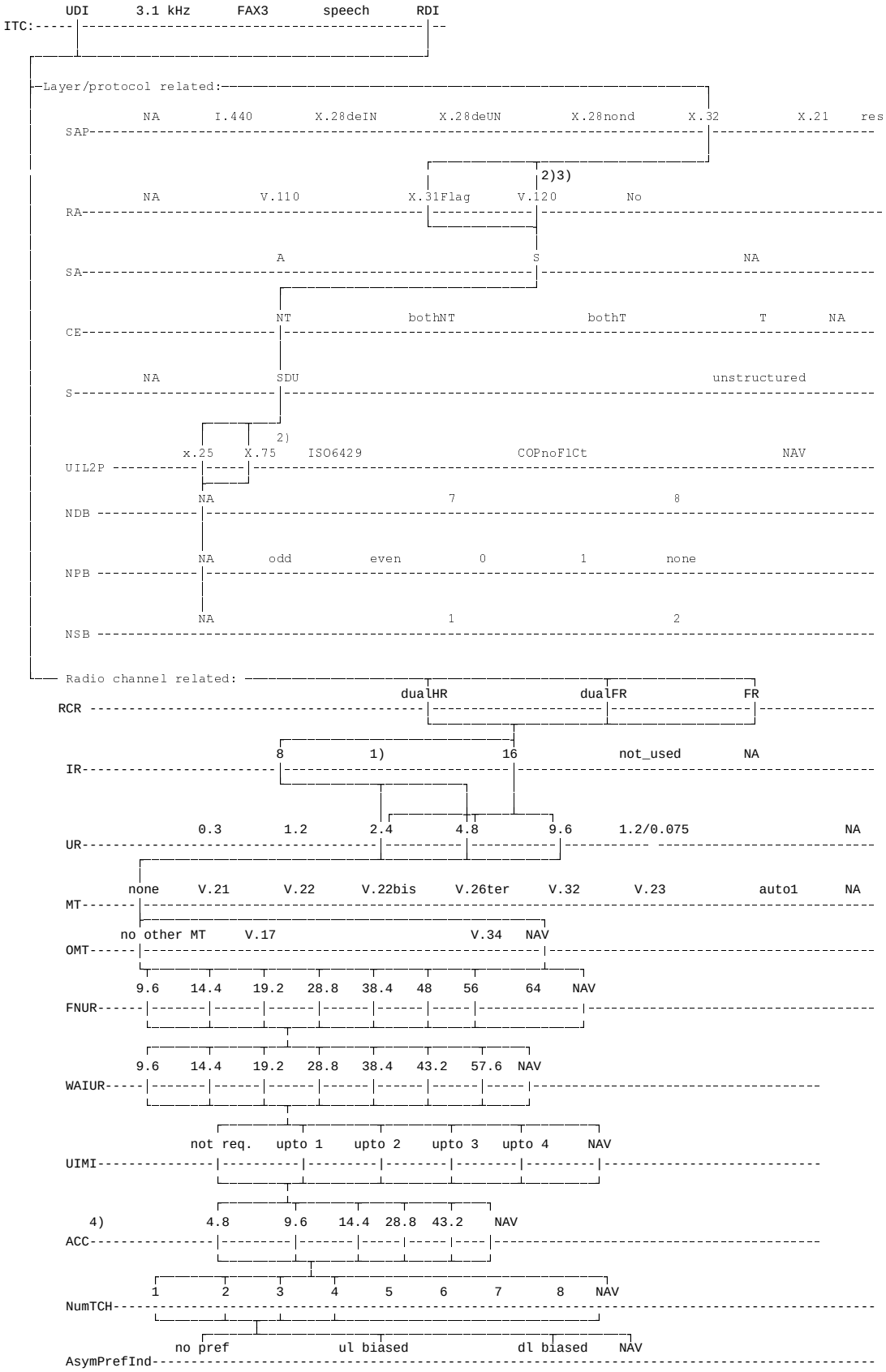
B.1.3.1 Unrestricted digital information transfer capability

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)



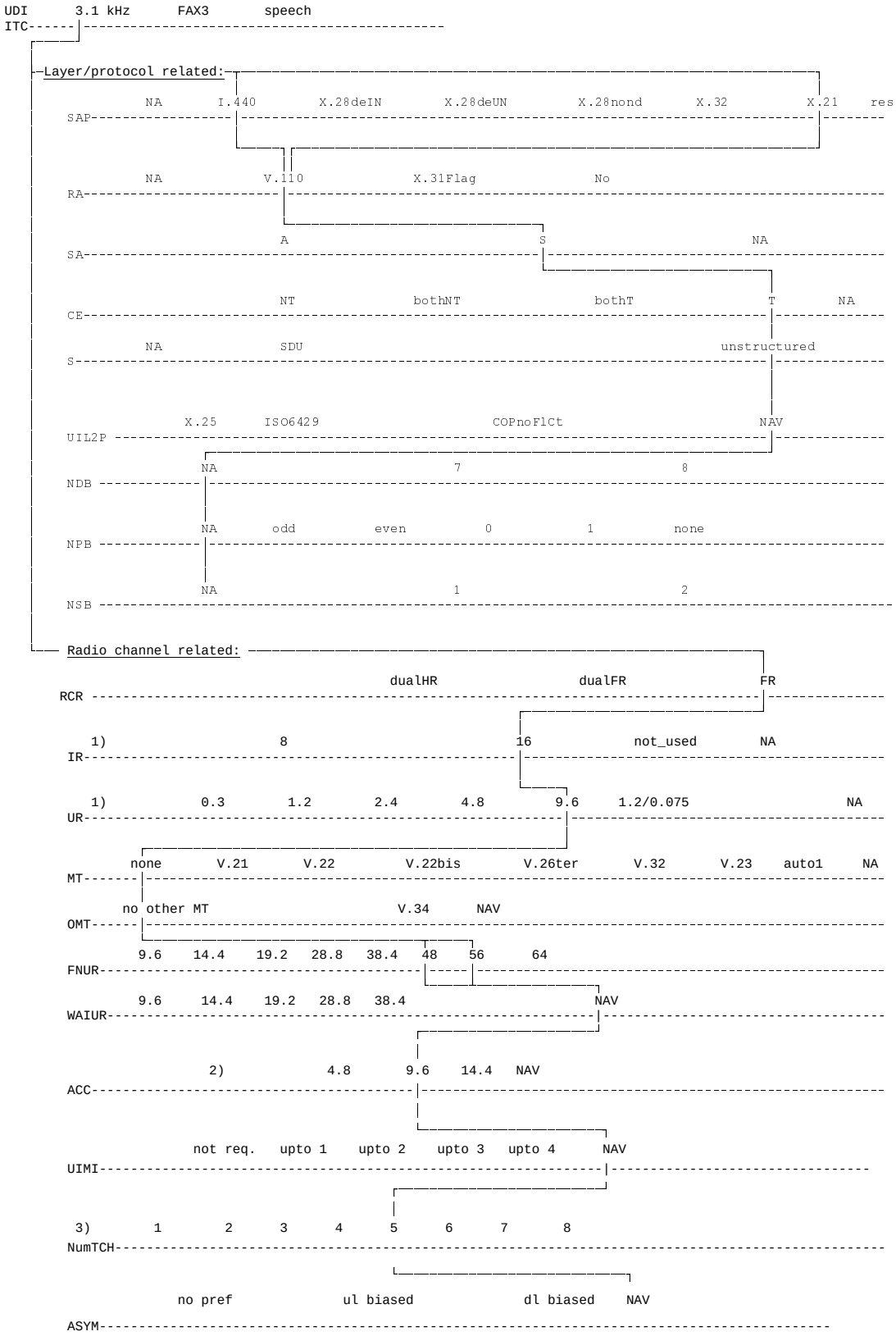
1) for NIRR:6kb/s (not for the SETUP message)

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)



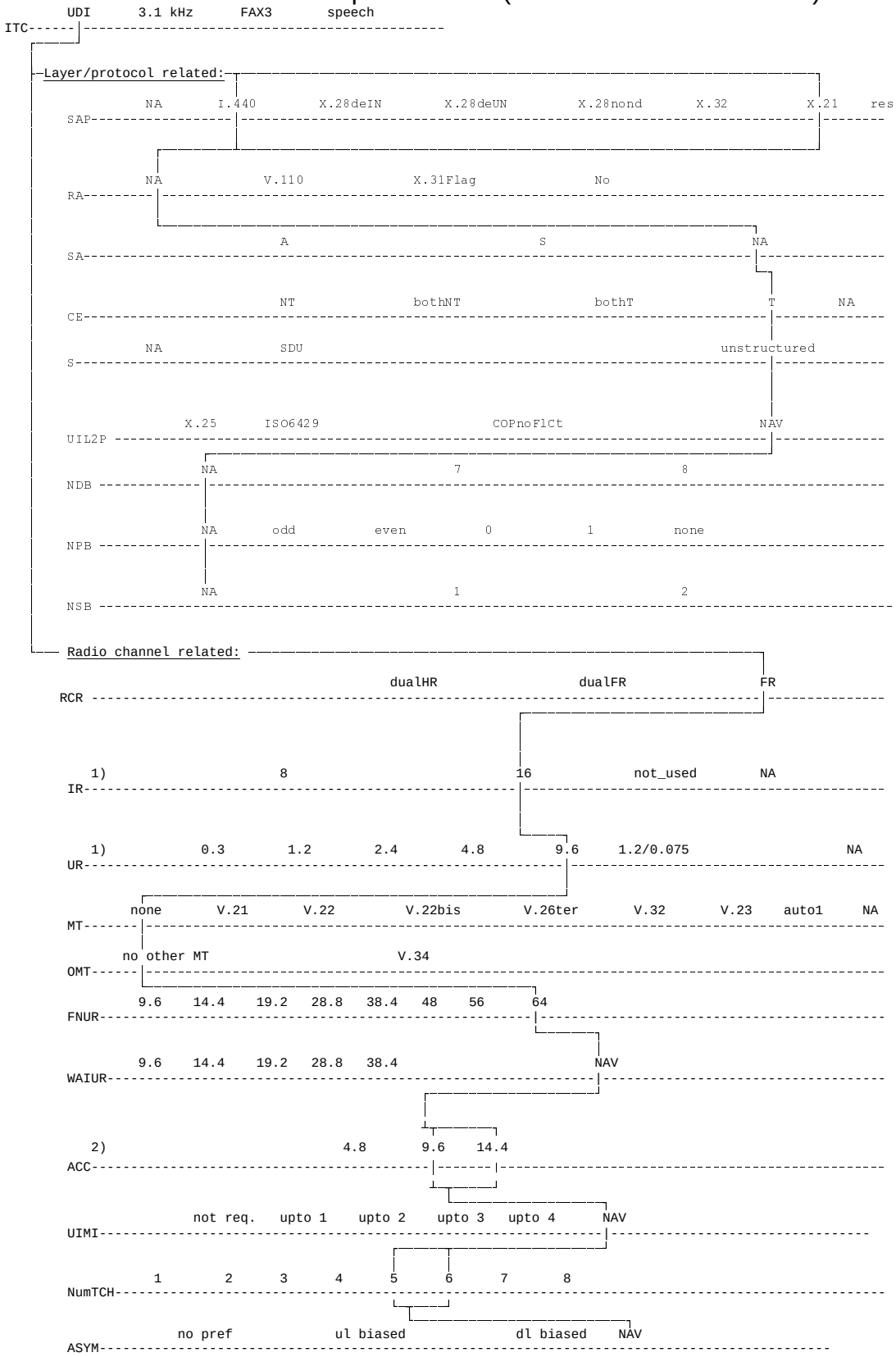
1) IR and UR are overridden by FNUR, ACC and MaxNumTCH are available

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)

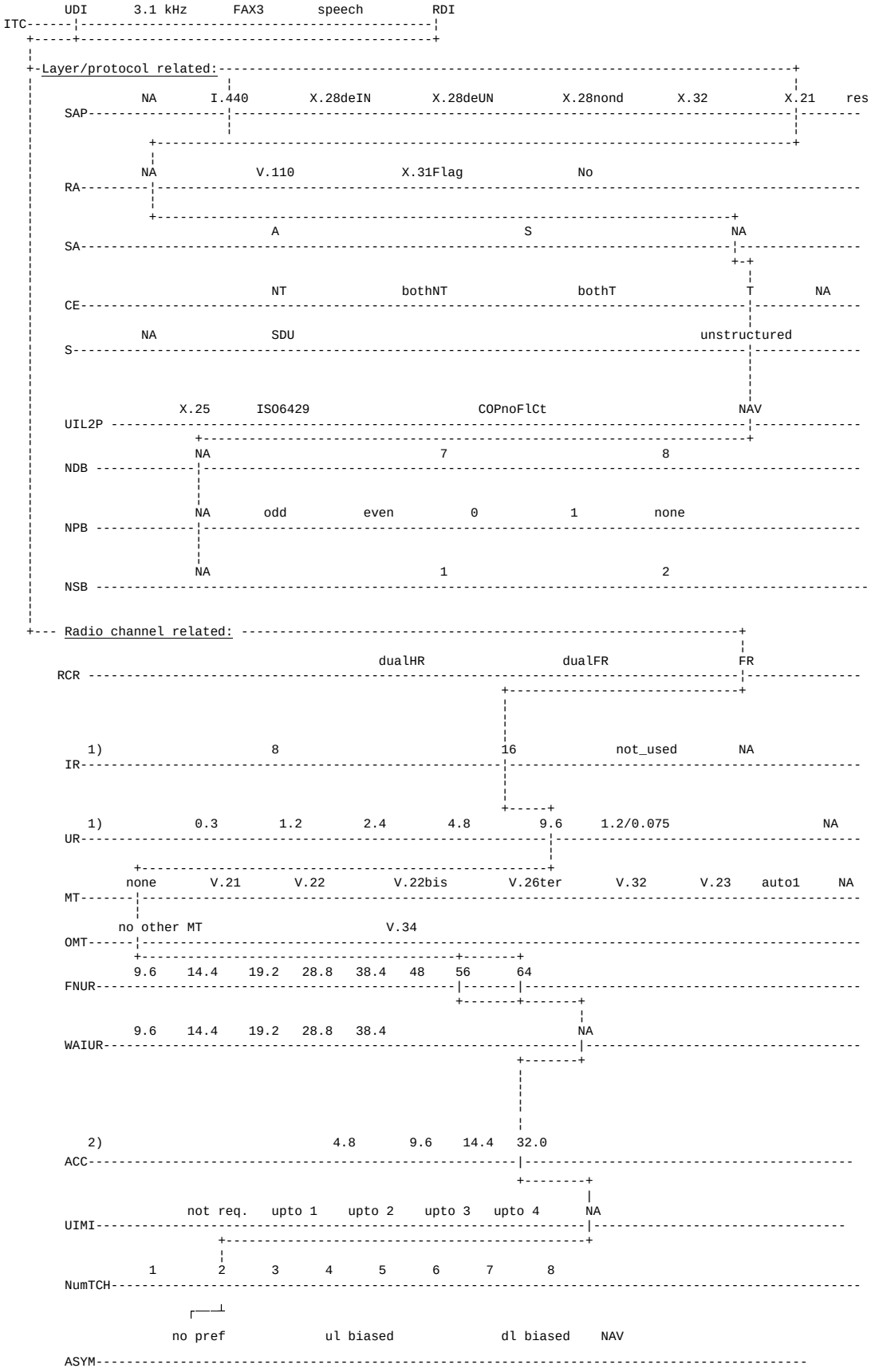


1) IR and UR are overridden by FNUR, ACC and MaxNumTCH are available

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)



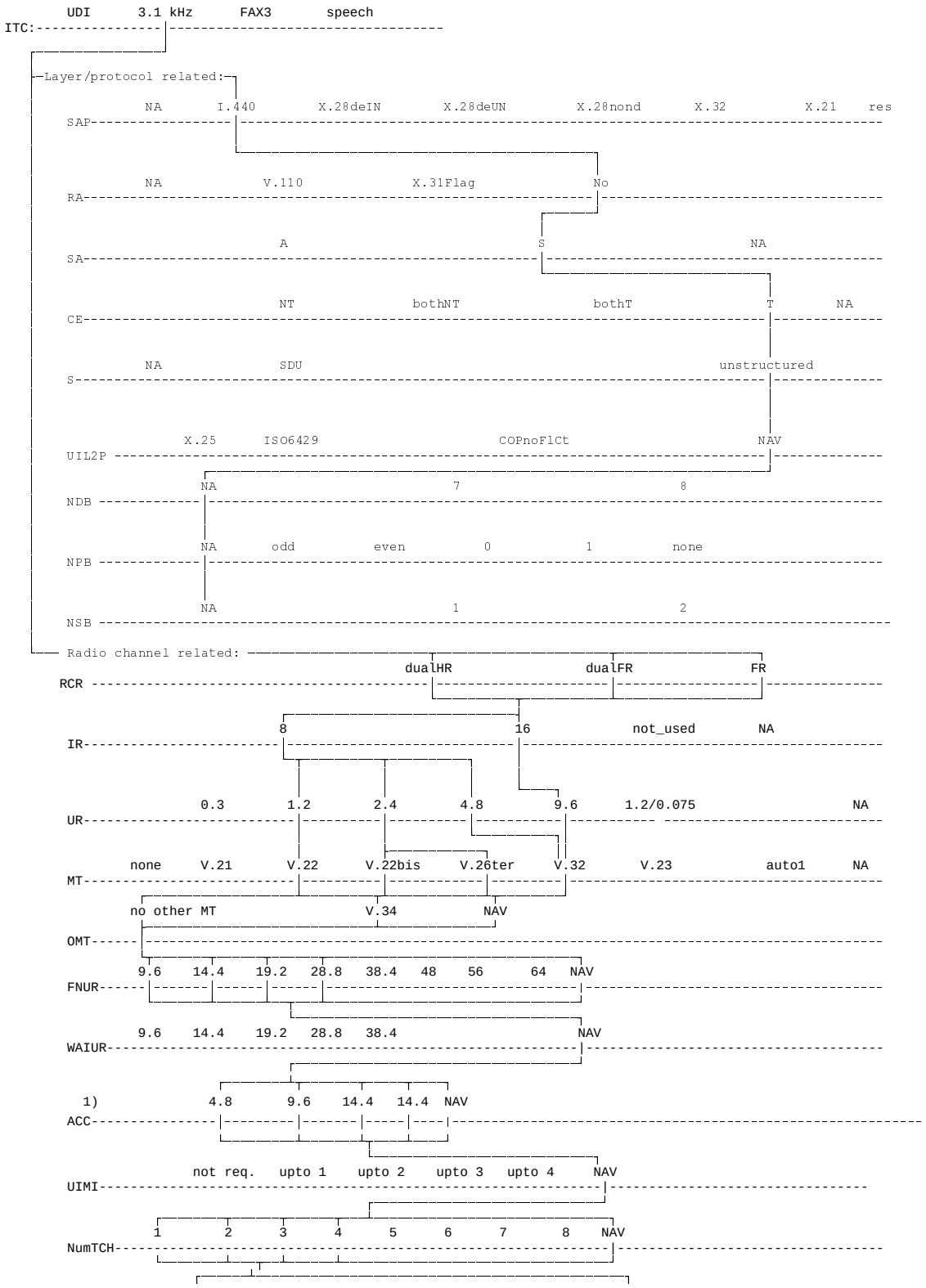
1) IR and UR are overridden by FNUR, ACC and MaxNumTCH are available

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

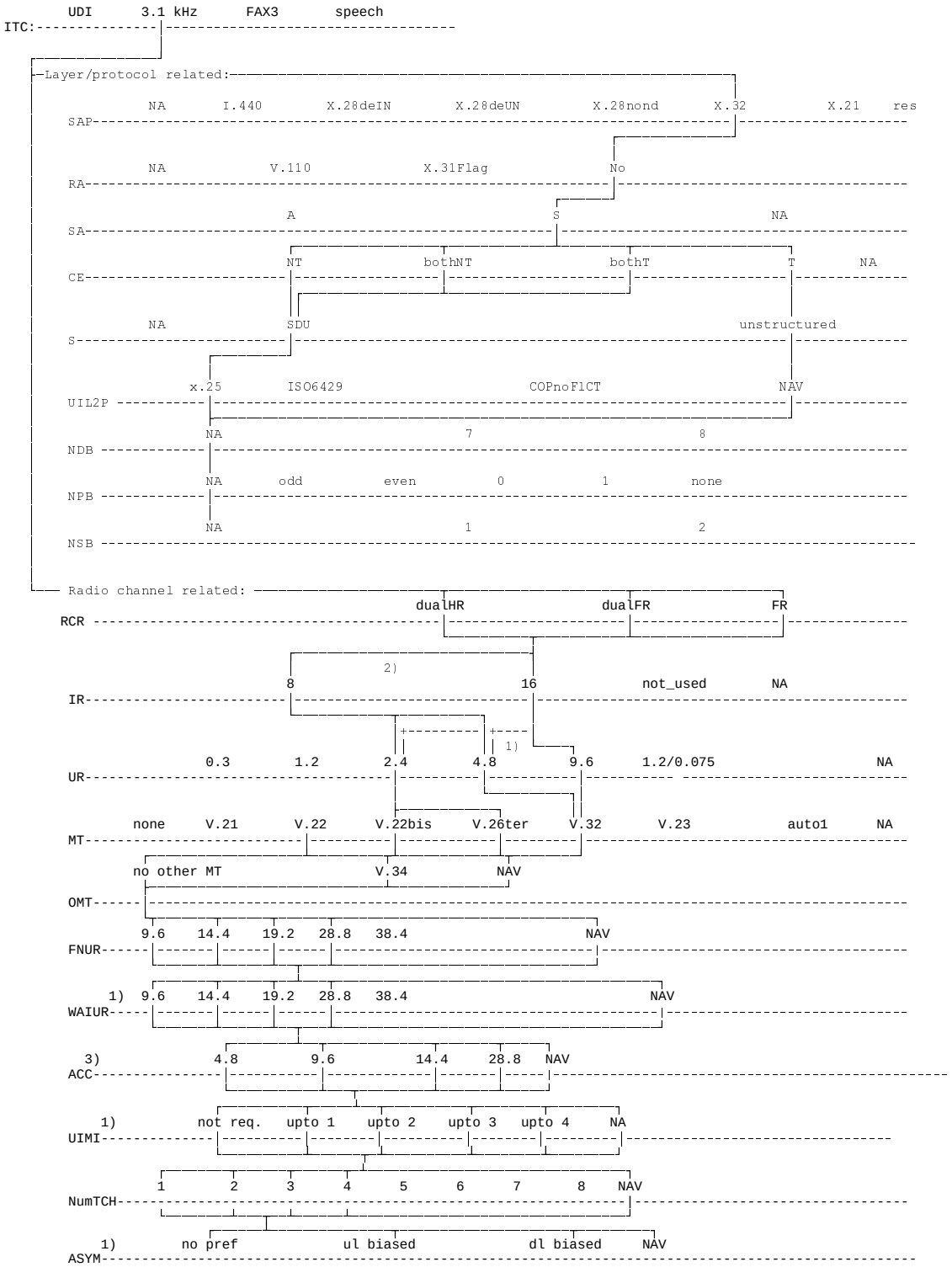
B.1.3.2.1 Non-X.32 Cases



```
              no pref            ul biased             dl biased    NAV
ASYM-------------------------------------------------------------------------------------------
```

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

B.1.3.2.2 X.32 Case (Packet Service)

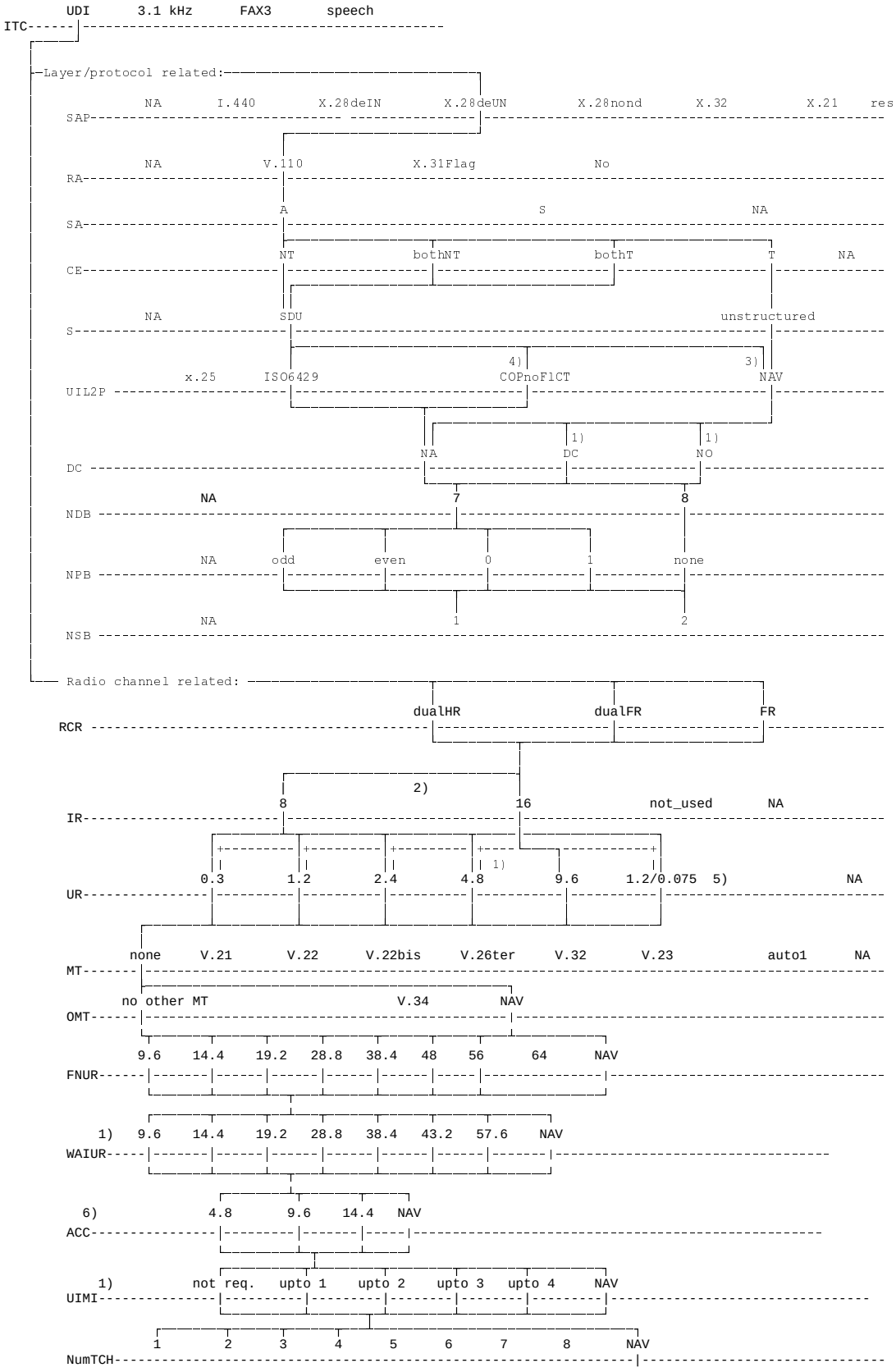


1) for CE:NT or "both"

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

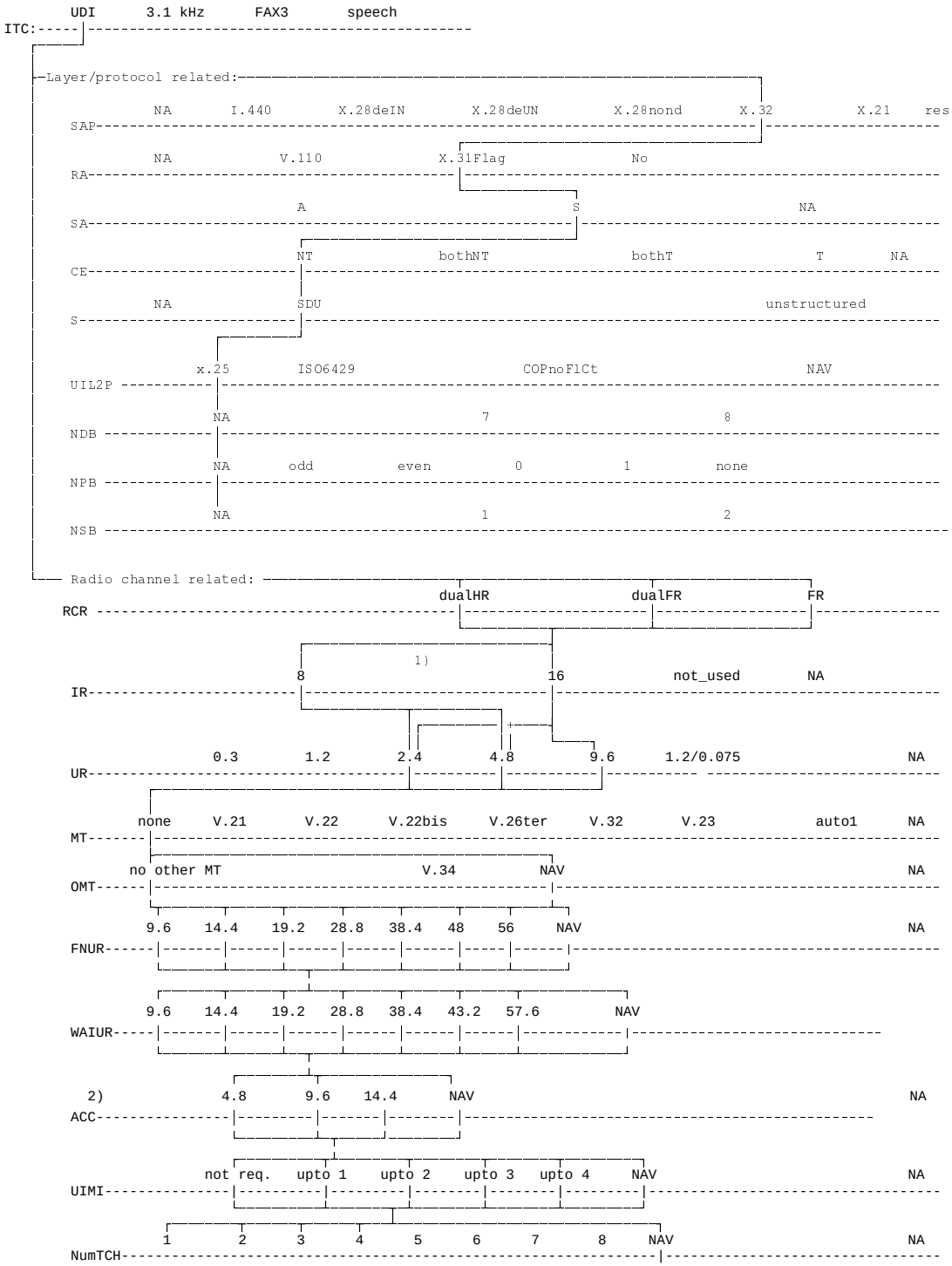
3) ACC may have several values simultaneously (bit map coding).

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~~MO calls with "outband" flow control requested;
4) for ~~MOC~~MO calls with no flow control requested;
5) ~~MOC~~MO calls 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

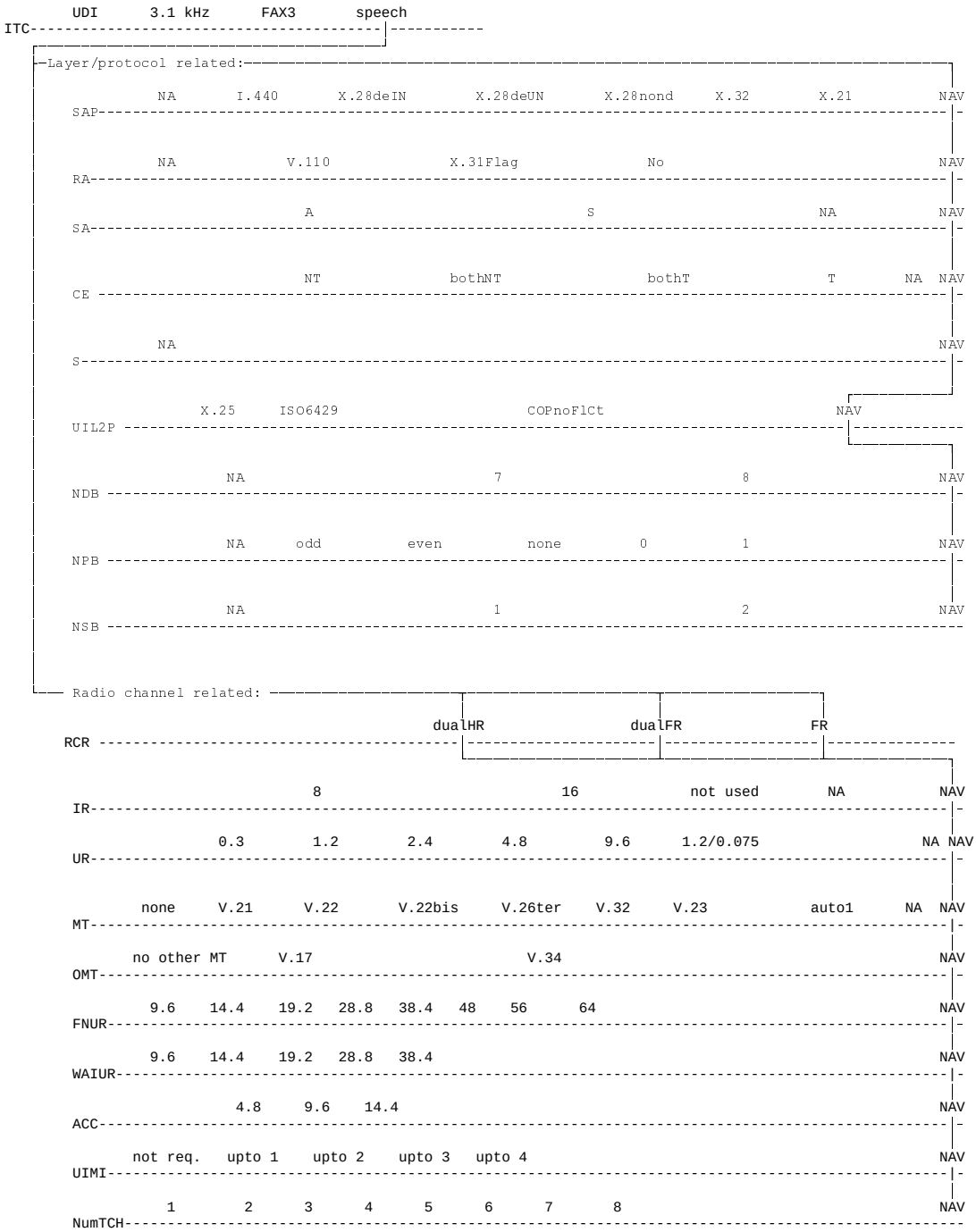


1) for NIRR:6kb/s (not for the SETUP message)
2) ACC may have several values simultaneously (bit map coding).

B.1.6 Bearer Service 61, Alternate Speech/Data

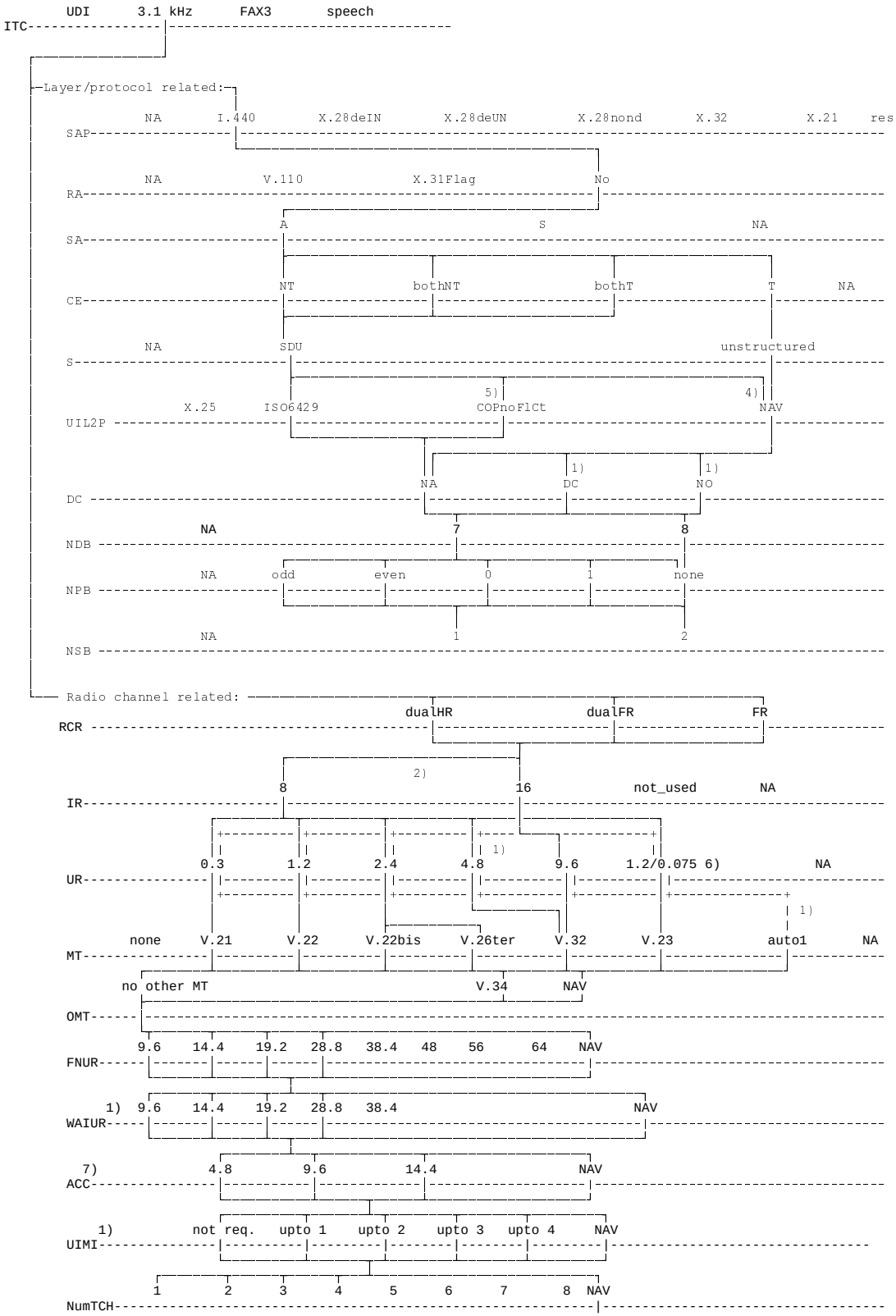
The information element of the "repeat indicator" is set to the value "circular for successive selection (alternate)".

B.1.6.1 Bearer Service 61,Speech



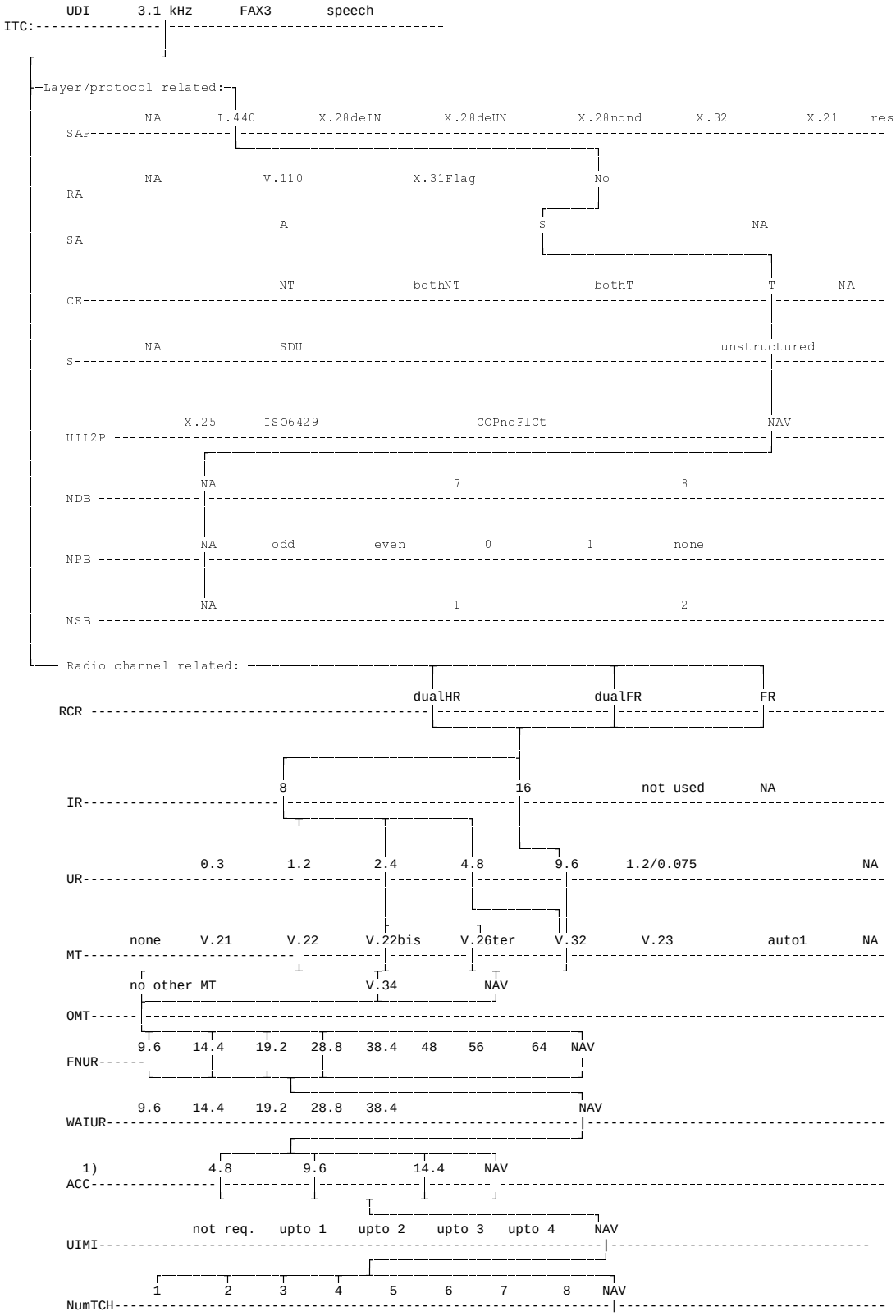
B.1.6.2 Bearer Service 61, 3.1 kHz audio ex-PLMN information transfer capability

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~~MO calls only
4) for ~~MTC~~MT call in the SETUP message or ~~MOC~~MO/~~MTC~~MT call with "out-band" flow control requested
(not for V.21 and V.23 modem types)
5) for ~~MOC~~MO/~~MTC~~MT call with no flow control requested
6) ~~MOC~~MO calls 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.

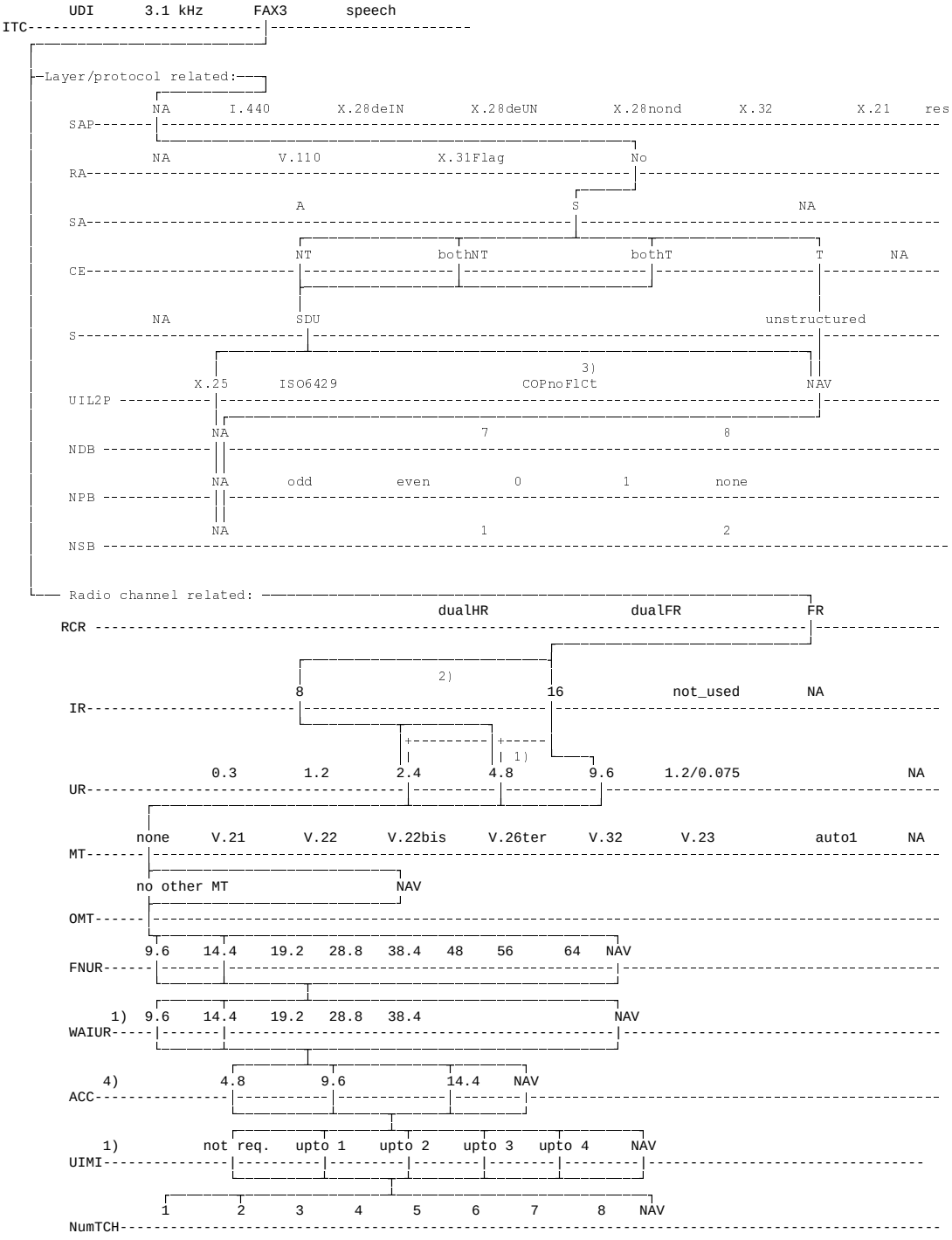
B.1.10 Teleservice 61, Alternate Speech and Facsimile group 3

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.

B.1.10.2 Teleservice 61, Facsimile group 3



1) for CE:NT or "both";
2) for CE:T only;
3) for ~~MTC~~MT call 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~~3G TS 22.034).

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~~3G TS 22.034).

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.1.13 Assignment of radio access bearer parameters depending on FNUR and WAIUR

B.1.13.1 Transparent Services

Depending on the FNUR signalled by the MS, the network is allowed to assign any radio resources with a radio access bearer parameter indicating a Quality of Service specifying

QoS Parameter	Value	Comments
Traffic Class	Conversational	
Maximum bit rate	= guaranteed bit rate	
Guaranteed bit rate	FNUR = 64 .. 28.8 kbit/s	GBR for FNUR=56 kbit/s is 64 kbit/s
Delivery Order	Yes	
Maximum SDU size	640 .. 288 bits (depending on the FNUR)	
Transfer Delay	< 200 ms	Subject to operator tuning
Traffic Handling Priority	-	Not applicable
Source statistics descriptor	Unknown	
SDU Parameters		
SDU error ratio	-	Not applicable
Residual bit error ratio	10^{-4}	Subject to operator tuning.
Delivery of erroneous SDUs	-	No error detection in the core network
Subflow SDU size parameters		
Rate Control Allowed	No	
Subflow SDU size	Maximum SDU size	

The final decision about the radio interface configuration is taken by the RNC during the Assignment procedure.

B.1.13.2 Non-transparent services

Depending on the WAIUR signalled by the MS, the network is allowed to assign any radio resources with a radio access bearer parameter indicating a Quality of Service specifying

QoS Parameter	Value	Comments
Traffic Class	Streaming	
Maximum bit rate	14.4, 28.8, 57.6 kbit/s	Maximum bit rate is set to the highest value ≤ WAIUR
Guaranteed bit rate	14.4 kbit/s	
Delivery Order	Yes	

Maximum SDU size		576 bits	
Transfer Delay		< 250 ms	Subject to operator tuning
Traffic Handling Priority		-	Not applicable
Source statistics descriptor		Unknown	
SDU Parameters			
	SDU error ratio	< 10 %	Subject to operator tuning
	Residual bit error ratio	10^{-3}	Subject to operator tuning.
	Delivery of erroneous SDUs	No	
	Subflow SDU size parameters		
		Rate Control Allowed	Yes	
		Subflow SDU size	576 bit	
	Subflow SDU size parameters		
		Rate Control Allowed	No	
		Subflow SDU size	0 bit	

The final decision about the radio interface configuration is taken by the RNC during the Assignment procedure.

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 07.0~~3G TS 27.002 and ~~GSM 07.0~~3G TS 27.003):

- 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~~ITU-T Q.931 and ETR 018). However, considering that ~~GSM~~ PLMN data transmission is based on ~~CCITT~~ITU-T 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~~PLMN 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~~ 3G TS ~~04.08~~24.008).

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

B.2.2 LLC Bearer Service 21 ... 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~~ITU-T { 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~~ITU-T 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 31 ... 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~~ITU-T { 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	á[duplex] -----
6	User information layer 2 protocol	á[X.25]
7	User information layer 3 protocol	á[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~~ITU-T 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	á[duplex] á[{ V.22 | V.22bis | V.26ter | V.32 | | V.34 }]
6	User information layer 2 protocol	á[X.25]
7	User information layer 3 protocol	á[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~~ITU-T 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~~ITU-T 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	~~CCITT~~ITU-T
	Interpretation	first high layer characteristic identification to be used in the call
	Presentation method of protocol profile	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	~~CCITT~~ITU-T
	Interpretation	first high layer characteristic identification to be used in the call
	Presentation method of protocol profile	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/SMG WPD Meeting #7
Sophia Antipolis, France, 29 Oct – 03 Nov 1999

***Document* N3-99504**
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		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: *(at least one should be marked with an X)* (U)SIM [ ] ME [ ] UTRAN / Radio [ ] Core Network [X]

Source: TSG_N3 **Date:** 01.12.1999

Subject: Updates for UMTS

Work item: CS Data Services in UMTS

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	X		Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

The requirement for the introduction of the GSM Bearer Services in UMTS needs changes of this specification. The changes are related to the following items:

- Notations are generalised because the text has to be applicable for GSM and UMTS
- Some sections were restructured to incorporate changes needed for UMTS in a proper manner
- GSM references are replaced by 3G references where applicable
- CCITT references are replaced by ITU references
- Reference to ETS 300 102-1 was replaced by Q.931 (05/98)
- Some minor editorial corrections are made.

Clauses affected: See attached pages

Other specs affected:

Other 3G core specifications	X	→ 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.

***** Next modified section *****

Foreword

This Technical Specification has been produced by the 3GPP.

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

i) PLMN and PSTN

ii) PLMN and ISDN

within the 3GPP system.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of 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 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.

This TS is valid for a 2nd generation PLMN (GSM) as well as for a 3rd generation PLMN (UMTS). If text applies only for one of these systems it is explicit mentioned by using the terms "GSM" and "UMTS". If text applies to both of the systems, but a distinction between the ISDN/PSTN and the PLMN is necessary, the term "PLMN" is used.

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] ~~CCITT~~ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

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

[3] ITU-T Recommendation I.464: "Multiplexing, rate adaption and support of existing interfaces for restricted 64 kbit/s transfer capability".

[4] ITU-T Recommendation Q.922 (1992): "DSS 1 Data link layer: ISDN data link layer specification for frame mode bearer services"

[5] ITU-T Recommendation Q.931 (05/98): "DSS 1 - ISDN user network interface layer 3 specification for basic call control"

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

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

[~~3~~8] ~~CCITT~~ITU-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".

[9] ITU-T Recommendation V.32: "A family of 2-wire, duplex modems operating at data signalling rates of up to 9600 bit/s for use on the general switched telephone network and on leased telephone-type circuits"

[10] ITU-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"

[11] ITU-T Recommendation V.34: "A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits"

[12] ITU-T Recommendation V.42: "Error-correcting procedures for DCEs using asynchronous-to-synchronous conversion"

[~~4~~13] ~~CCITT~~ITU-T Recommendation V.42bis: "Data Compression for Data Circuit Terminating Equipment (DCE) using Error Correction Procedures"

[14] 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"

[15~~5~~] ~~CCITT~~ITU-T Recommendation V.110: "Support of data terminal equipments (DTEs) with V-Series interfaces by an integrated services digital network".

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

[17] ETR 018: "Integrated Services Digital Network (ISDN); Application of the Bearer Capability (BC), High Layer Compatibility (HLC) and Low Layer Compatibility (LLC) information elements by terminals supporting ISDN services".

[18~~6~~] ETS 300 102-1 Edition 1 (1990): "Integrated Services Digital Network (ISDN); User-network interface layer 3 Specifications for basic call control".

[19] EN 300 403-1 V1.2.2 (1998-04): "Integrated Services Digital Network (ISDN); Digital Sunscriber Signalling System No. One (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification".

~~[7] ETS 300 121: "Integrated Services Digital Network (ISDN); Application of the ISDN User Part (ISUP) of CCITT Signalling System No.7 for international ISDN interconnections (ISUP version 1)".~~

[20] GSM 01.01: "Digital cellular telecommunication system (Phase 2+); GSM Release 1999 Specifications".

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

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

~~[10] GSM 02.02: "Digital cellular telecommunications system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".~~

[2311] GSM 02.03: "Digital cellular telecommunications system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

~~[12] GSM 02.04: "Digital cellular telecommunications system (Phase 2+); General on supplementary services".~~

~~[13] GSM 02.81: "Digital cellular telecommunication system (Phase 2+); Line identification supplementary services - Stage 1".~~

~~[14] GSM 02.82: "Digital cellular telecommunication system (Phase 2+); Call Forwarding (CF) supplementary services - Stage 1".~~

~~[15] GSM 02.83: "Digital cellular telecommunication system (Phase 2+); Call Waiting (CW) and Call Hold (HOLD) supplementary services - Stage 1".~~

~~[16] GSM 02.84: "Digital cellular telecommunication system (Phase 2+); MultiParty (MPTY) supplementary services - Stage 1".~~

~~[17] GSM 02.85: "Digital cellular telecommunication system (Phase 2+); Closed User Group (CUG) supplementary services - Stage 1".~~

~~[18] GSM 02.86: "Digital cellular telecommunication system (Phase 2+); Advice of charge (AoC) supplementary services - Stage 1".~~

~~[19] GSM 02.88: "Digital cellular telecommunication system (Phase 2+); Call Barring (CB) supplementary services - Stage 1".~~

~~[20] GSM 03.03: "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".~~

~~[21] GSM 03.08: "Digital cellular telecommunication system (Phase 2+); Organization of subscriber data".~~

~~[22] GSM 03.11: "Digital cellular telecommunications system (Phase 2+); Technical realization of supplementary services".~~

[24] GSM 03.10: "Digital cellular telecommunications system (Phase 2+); GSM PLMN Connection types".

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

~~[24] GSM 03.46: "Digital cellular telecommunication system (Phase 2+); Technical realization of facsimile group 3 non-transparent".~~

[2625] GSM 03.50: "Digital cellular telecommunications system (Phase 2+); Transmission planning aspects of the speech service in the GSM Public Land Mobile Network (PLMN) system".

~~[26] GSM 03.54: "Digital cellular telecommunications system (Phase 2+); Description for the use of a Shared Inter Working Function in a GSM PLMN; Stage 2".~~

~~[27] GSM 04.08: "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".~~

[27~~8~~] GSM 04.21: "Digital cellular telecommunications system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

~~[29] GSM 04.22: "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".~~

~~[30] GSM 07.01: "Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".~~

~~[31] GSM 07.02: "Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".~~

~~[32] GSM 07.03: "Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".~~

~~[33] 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)".~~

[~~34~~28] GSM 08.20: "Digital cellular telecommunication system (Phase 2+); Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[29~~35~~] GSM 08.60: "Digital cellular telecommunications system (Phase 2+); Inband control of remote transcoders and rate adaptors for Enhanced Full Rate (EFR) and full rate traffic channels".

[30~~36~~] GSM 09.02 version 3.x.y: "Digital cellular telecommunications system (Phase 2+); Mobile Application Part (MAP) specification".

[31~~7~~] 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)".

~~[38] 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 facility (PAD) access".~~

~~[39] GSM 09.06: "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".~~

~~[40] CCITT Recommendation V.120: "Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing".~~

~~[41] ETR 018: "Integrated Services Digital Network (ISDN); Application of the Bearer Capability (BC), High Layer Compatibility (HLC) and Low Layer Compatibility (LLC) information elements by terminals supporting ISDN services".~~

~~[42] CCITT Recommendation I.464: "Multiplexing, rate adaption and support of existing interfaces for restricted 64 kbit/s transfer capability".~~

~~[43] CCITT Recommendation Q.922 (1992): "DSS 1 Data link layer: ISDN data link layer specification for frame mode bearer services"~~ 3G TR 23.910: "

[32] 3G TS 21.101: "3rd Generation Partnership Project; Technical Specification Group: Release 1999 Specifications".

[33] 3G TS 22.002: " Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[34] 3G TS 22.004: " General on supplementary services".

[35] 3G TS 23.003: " Numbering, addressing and identification".

[36] 3G TS 23.008: " Organization of subscriber data".

[37] 3G TS 23.011: " Technical realization of supplementary services".

[38] 3G TS 23.046: " Technical realization of facsimile group 3 non-transparent".

[39] 3G TS 23.054: " Description for the use of a Shared Inter Working Function in a GSM PLMN; Stage 2".

[40] 3G TS 24.008: " Mobile radio interface layer 3 specification".

[41] 3G TS 24.022: " 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".

[42] 3G TS 25.415: "Iu Interface CN-UTRAN User Plane Protocols"

[43] 3G TS 27.001: " General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[44] 3G TS 27.002: " Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[45] 3G TS 27.003: " Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[46] 3G TS 29.002: " Mobile Application Part (MAP) specification".

[47] 3G TS 29.006: " 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".

~~NOTE: As regards ETS 300 102-1 [6], the first edition of this ETS from 1990 shall be used, with one exception: the encoding of the field modem type in the ISDN BC IE shall be handled as specified in table 7A and 7B.~~

3 Definitions and abbreviations

Use is made of the following terms within this TS. These terms refer to information requirements necessary to support interworking functions, some of these terms will be identifiable with their use in other GSM specifications.

bearer capability information: Specific information defining the lower layer characteristics required within the network.

low layer compatibility information: Information defining the lower layer characteristics of the terminal.

high layer compatibility information: Information defining the higher layer characteristics of the terminal.

compatibility information: This term subsumes the entirety of Bearer Capability, Low Layer Compatibility, High Layer Compatibility, Progress Indicator and Address Information conveyed out-of-band prior to call establishment for the support of compatibility checking and terminal/function/service selection at the ISDN-type user-network interface.

protocol identifier: Information defining the specific protocols utilized for the support of data transfer by a terminal.

progress indicator: Information supplied to indicate to the terminal that network interworking has taken place.

out-of-band parameter exchange: Information exchanged via an associated or non-associated signalling link e.g. SS No 7.

PSTN: Subscriber to network interface supports only analogue terminals.

ISDN: Subscriber to network interface supports digital or analogue terminals, plus a standardized user to network associated signalling system and a standardized internetwork signalling system.

autobauding type 1: This information element value may be contained in the setup or call confirm messages from the MS in association with a non transparent data service. This implies that the MSC/IWF may select any speed and modem type according to what it can negotiate with the remote modem on the PSTN/ISDN. The parameters User Rate and FNUR (Fixed Network User Rate), if present, has no meaning when Modem Type is autobauding type 1.

multi self selecting speed modem: This term applies to V series modems capable of handling one or more lower speeds as a fall back position. When such a modem is requested in the call setup or call confirm message from the MS in association with a non transparent service, the MSC/IWF may select any of the speeds supported according to the negotiation with the remote modem on the PSTN/ISDN. The parameters User Rate and FNUR (Fixed Network User Rate), if present, has no meaning when Modem Type is autobauding type 1.

unrestricted 64 kbit/s network: A digital network which has 64 kbit/s octet-structured Information Transfer Capability (ITC) with no restrictions on the contents of each octet.

restricted 64 kbit/s network: ~~CCITT~~ITU-T I.464 defines "'restricted 64 kbit/s transfer capability" as "64 kbit/s octet-structured capability with the exception that an all-zero octet is not permitted". In this specification, the term "restricted 64 kbit/s network" refers not only to networks with the I.464 restriction but also to those in which the 8th bit of each octet is unusable for data transmission.

directly connected restricted 64 kbit/s network: A restricted 64 kbit/s network which is connected directly to the MSC/IWF.

indirectly connected restricted 64 kbit/s network: A restricted 64 kbit/s network which is connected to the MSC/IWF via an unrestricted 64 kbit/s network.

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

In addition to the following, abbreviations used in this TS are listed in GSM 01.04 [8].

ADPCM	Adaptive Differential Pulse Coded Modulation
DP	Dial Pulse
DSS1	Digital Subscriber Signalling 1
ITC	Information Transfer Capability
LE	Local Exchange
NT	Network Termination
PABX	Private Automatic Branch Exchange
SPC	Stored Program Control
SS No.7	Signalling System No.7
TE	Terminal Equipment
TA	Terminal Adaptor
TUP	Telephone User Part (of Signalling System No.7)
UNI	User Network Interface

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.

5 Not used

6 Network Characteristics

6.1 Key Characteristics of Networks Concerned

Table 1: Key Characteristics of Networks Concerned

~~Characteristic~~	~~GSM PLMN~~	~~ISDN~~	~~PSTN~~
Subscriber Interface	Digital	Digital	Analogue
User-network signalling	~~GSM 04.08~~3G TS 24.008	DSS1, other UNIs	loop-disconnect and DTMF
User-terminal equipment supported	~~MT0, MT1 or MT2 functions (~~for GSM see GSM 04.02~~)~~ for UMTS see 3G TS 27.001	Digital TE (ISDN NT, TE1 or TE2+TA) see e.g. I.411	Analogue TE (e.g. dial pulse telephones PABXs modem equipped DTEs)
Inter-exchange signalling	SS No.7 ISUP TUP+, MAP	SS No.7 ISUP TUP+, TUP, NUP	Channel associated (e.g. R2, No.4, No.5) or common channel (e.g. No.6)
Transmission facilities	Digital	Digital	Analogue
Exchange types	Digital	Digital	Analogue/digital
Information transfer mode	Circuit/Packet	Circuit/Packet	Circuit
Information transfer capability	Speech, digital unrestricted, alternate speech/ group 3 fax etc.	Speech, digital unrestricted, 3,1 kHz audio, video etc.	3,1 kHz audio (voice/voice- band data)

6.1.1 Characteristics of PLMNs

The ~~GSM~~ PLMN is fully defined in the ~~GSM~~ Technical Specifications summarised in GSM 01.01 for a 2nd generation PLMN (GSM) or in 3G TS 21.101for a 3rd generation PLMN (UMTS).

6.1.2 Characteristics of PSTNs

Because of the efforts at an early stage to standardize ISDNs in different countries, the differences between any two ISDNs will be small compared with the differences between PSTNs, which have evolved in different ways in different countries. In some cases the evolution has occurred over many decades, and therefore each PSTN is distinct, and for a recommendation on interworking, it is necessary to make certain assumptions about a generalized PSTN.

Whilst the key characteristics of PSTNs are given in table 1 above, the specific MSC/IWFs needed to allow interworking between a PLMN and a PSTN will depend on the nature of the PSTN concerned.

Table 2 below gives a number of categories that can be used to classify PSTNs and a number of possibilities within each category.

Table 2: Characteristics of PSTNs

Category	Possibilities within Category
Type of subscriber signalling	a) PSTN with loop disconnect subscriber signalling (10 pps)
	b) PSTN with DTMF subscriber signalling
Type of interexchange signalling	a) PSTN with channel-associated signalling
	b) PSTN with common-channel signalling
Type of interexchange transmission	a) Analogue
	b) Digital
Type of exchange switching	a) PSTN with electro-mechanical switching
	b) PSTN with electronic (non-digital) switching
	c) PSTN with electronic digital switching
Type of exchange control	a) Non-SPC
	b) SPC
NOTE: Under each category, it is possible that a PSTN will have a combination of the possibilities rather than only one.	

6.1.3 Characteristics of ISDN

For the "standardized ISDN" in principle taken into account here, these are defined in the ETS/ITU-T-series.

7 Interworking classifications

7.1 Service interworking

Service interworking is required when the Teleservices at the calling and called terminals are different. No service interworking, except for facsimile group 3 (GSM Teleservice 61 or 62 interworking with standard facsimile group 3 service), has been identified as a requirement of the GSM system for PSTN/ISDN network based services.

7.2 Network interworking

Network interworking is required whenever a PLMN and a non-PLMN together are involved to provide an end to end connection and may be required in instances of PLMN to PLMN connections.

The concept of Bearer Services was developed for the ISDN and has been extended to the PLMN. A bearer service is defined (in GSM 02.01) as:

A type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces.

Bearer services are described by a number of attributes, where an attribute is defined as a specified characteristic of an object or element whose values distinguish that object or element from others.

For the purpose of this TS, a PSTN is assumed to provide a bearer service which equates to an ISDN 3,1 kHz audio bearer service.

Refer to ~~GSM 02.02~~3G TS 22.002 for complete list of bearer services. Refer to ~~GSM 04.08~~3G TS 24.008 for coding of Bearer Capabilities. Refer to 3G TS 27.001 for the allowed combinations of parameter value settings.

Table 3: Bearer Service Interworking

Bearer service category in ~~GSM~~ PLMN	**Bearer Service in ~~GSM~~PLMN**	**Bearer service in ISDN**	**Service in PSTN**
Circuit mode unstructured with unrestricted digital capability Transparent and Non transparent	Asynchronous Data general	Cct mode structured 64 kbit/s unrestricted	Not Applicable
Circuit mode unstructured with unrestricted digital capability Transparent	Synchronous Data general		
Circuit mode unstructured with unrestricted digital capability. Non-transparent	Packet Services see ~~GSM 09.06~~3G TS 29.006	Packet Services see ~~GSM 09.06~~3G TS 29.006	
3,1 kHz Audio Ex PLMN Transparent and Non-transparent	Asynchronous Data general	Cct Mode 3,1 kHz Audio	Cct Mode 3,1 kHz Audio
3,1 kHz Audio Ex PLMN Transparent	Synchronous Data general		
3,1 kHz Audio Ex PLMN Non Transparent	See ~~GSM 09.06~~3G TS 29.006	See ~~GSM 09.06~~3G TS 29.006	

Table 4: Network interworking of ~~GSM~~ Teleservices

Teleservice in ~~GSM~~ PLMN	Lower layer capabilities addressed in the ~~GSM~~ PLMN Bearer Capabilities IE	Bearer service in ISDN	Service in PSTN
Telephony	Unstructured with speech capability	Speech or Cct mode 3,1 kHz audio	Cct Mode 3,1 kHz audio
Emergency calls	Unstructured with speech capability		
Alternate speech/ facsimile group 3	Data Cct duplex synchronous access alternate speech group 3 fax	Cct mode 3,1 kHz audio	Cct mode 3,1 kHz audio
Automatic Facsimile group 3	Data Cct duplex synchronous access group 3 fax	Cct mode 3,1 kHz audio	

This table does not identify any relationship between Teleservices in the ~~GSM~~ PLMN with those in the ISDN/PSTN, it is merely to identify the interworking of the lower network layers of that teleservice with the network layers i.e. bearer service in the ISDN/PSTN.

7.3 Signalling interworking

See GSM 09.03.

7.4 Numbering

See ~~GSM 03.03~~3G TS 23.003.

7.5 Supplementary service interworking

For general aspects of supplementary services refer to ~~GSM 03.11~~3G TS 22.004 and 23.011~~, GSM 03.8x and 03.9x series~~.

Not every supplementary service may be used in combination with each basic service. The applicability of each supplementary service for a basic service is defined in 3G TS 22.004.~~GSM 02.8x and 02.9x series. Certain application rules are also set out in GSM 02.03 and 09.06.~~

~~This subclause only deals with data service specific aspects of supplementary services, i.e. MSC/IWF functions concerned in combination with supplementary services. This interworking is described in GSM 02.04, GSM 02.8x, and 02.9x series, GSM 03.11, GSM 03.8x and GSM 03.9x series, if applicable.~~

8 Compatibility and subscription checking

Compatibility checking is carried out on the following items:

a) Low layer compatibility - utilizing low layer compatibility and bearer capability information elements.

b) High layer compatibility - utilizing high layer compatibility information element.

The use of the progress indicator for compatibility checking is outside the scope of this ~~E~~TS.

Indication of compatibility requirements is carried out as described in subclauses 9.2.2 and 10.2.2.

For subscription checking, relevant for the interworking described in clauses 9 and 10 of this TS, refer to GSM 02.01.

9 Interworking to PSTN

9.1 Speech Calls

9.1.1 Interworking indications to PLMN terminal

An indication to inform the PLMN terminal that:

i) instead of receiving out-of-band indications for certain types of failure conditions, a tone or announcement will be received in-band from the PSTN.

ii) the available compatibility information will be not exhaustive for deducing a ~~GSM~~ PLMN Basic Service and there will be a limitation on address - the terminal may be required to accept the call on the basis of indicating its compatibility requirements.

iii) (if a DTE) in-band handshaking signals should be anticipated.

9.1.2 Transmission aspects

Includes control of Speech Processing and Echo Control Devices, see GSM 03.50.

9.1.3 Generation of In-band Tones and Announcements (PLMN-PSTN)

In-band tones and announcements shall be provided for all speech and 3,1 kHz audio bearer services between a PLMN and a PSTN.

9.2 Data Calls

Low Layer Compatibility Checking on the received ~~GSM~~ PLMN bearer capability information element will be carried out by the MSC/IWF to check if the call setup is compatible to the bearer service (3,1 kHz audio) provided by a PSTN and to the IWFs provided by the PLMN.

In case the call setup does not conform to these requirements (e.g. an information transfer capability value "unrestricted digital information" is requested), the call shall fail with an error cause indicating that the network is unable to support the service requested.

As well as compatibility checking subscription checking shall be performed. If the subscription check fails the call setup shall be rejected.

For the case where the MS offers negotiable values in the ~~GSM~~ PLMN bearer capability information element (e.g. both transparent and non-transparent connection element) refer to the definitions specified in ~~GSM 07.01~~3G TS 27.001.

For interworking of data calls between a PLMN and a PSTN a modem will be utilized to provide the interworking function.

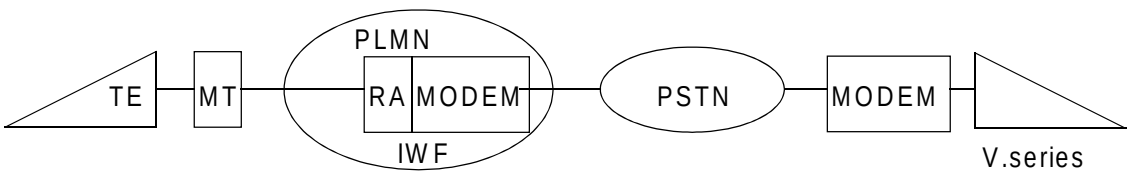


Figure 1: PLMN PSTN interworking for circuit switched calls

9.2.1 Network interworking mobile originated

9.2.1.1 Selection of interworking function

The interworking function will need to negotiate with the user to establish the appropriate modem selection e.g. data rate, modulation scheme, etc. In addition, it will also be required to convert the signalling format, from a combination of out of band and in band, to that suitable for controlling the modem and the autocalling line procedure function where applicable. In the following modem selection procedures it is assumed that the interworking function and modems will be associated with each MSC. As an alternative, a centralized interworking function is possible as a network provider option. This is specified in ~~GSM TS 03.54~~3G TS 23.054.

For a data call originated by a circuit mode data terminal on the PLMN, the modem selection is done by using the element "modem type" in the call set-up message (bearer capability).

In addition, other elements of the call setup will indicate the user rate, etc. to be used via that modem. The use of this information however means that the network is only able to select a modem from the modem pool which conforms to the speed which the terminal is utilizing at the DTE/DCE interface at the MS (e.g. V.22 for 1 200 bps). The exception to this is where the user has selected the non transparent service in which case either an autobauding or multi self selecting speed modem (e.g. V.32) may be used.

In case the ~~GSM~~PLMN-BC(s) received with the set-up message indicated a multislot, 14.4kbit/s, and EDGE-operation (refer to ~~GSM 07.01~~3G TS 27.001) and the network does not support any of the required such services, the ~~GSM~~PLMN-BC(s) sent with the call proceeding message shall not contain the “fixed network user rate”, “other modem type” and “user initiated modification indicator” parameters - the MSC shall discard the multislot or 14.4kbit/s and/or EDGE-related parameters and use the fall-back bearer service indicated by the remaining parameters of the ~~GSM~~PLMN-BS(s) on a singleslot configuration (refer to GSM 08.20 and GSM 04.21) on the MSC/IWF-BSS link. The MSC/IWF shall modify the relevant parameters in a possibly present LLC accordingly.

If the MSC supports the multislot, 14.4kbit/s and/or EDGE-operation, the ~~GSM~~PLMN-BC(s) shall include the “fixed network user rate”, “other modem type” and if applicable the “user initiated modification indicator” 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 up to 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 case the ~~GSM~~PLMN-BC(s) received with the set-up message did not indicate a multislot, 14.4kbit/s or EDGE-operation, the MSC shall not include the “fixed network user rate”, “other modem type” and “user initiated modification indicator” parameters in the ~~GSM~~PLMN-BC(s) of the call proceeding message - the MSC shall use a singleslot configuration on the MSC/IWF-BSS link.

The MSC may negotiate parameters with the MS according to the rules defined in ~~GSM 07.01~~3G TS 27.001. For multislot, 14,4 kbit/s, and EDGE-operations the MSC/IWF shall modify the relevant parameters in a possibly present LLC accordingly.

9.2.1.2 Modem Selection

In general terms the indication of the bearer capability parameter "Information Transfer Capability" will be utilized in the call set-up message to determine when the modem should be selected in the call.

In case of single calls, the modem function shall operate in the calling mode in case of mobile originated calls and in the answering mode in case of mobile terminated calls.

In case of dual data calls (alternate speech/facsimile group 3) the operation mode of the modem (working in calling or answering mode) depend on the initial call setup direction and on the optional parameter "Reverse Call Setup Direction" information element of the MODIFY message. If this information element is omitted the direction is derived from the initial call setup direction, i.e. the mode is the same as in case of single calls.

For the attribute value "3,1 kHz audio Ex PLMN" and "facsimile group 3", the modem will be selected immediately. The line procedure according to V.25 will then be carried out using the appropriate modem functions.

For the Teleservice 61 "Alternate speech/facsimile group 3", (if speech is selected as the first service), the modem is made available but not selected until the subscriber indicates the change of service request (see subclause 9.3).

For "alternate speech/facsimile group 3" calls refer to GSM 03.45 (GSM) and ~~03.46~~3G TS 23.046 (GSM and UMTS).

9.2.1.3 Mapping of BC-IE from ~~GSM 04.08~~PLMN to ISUP (or other)

As it cannot be determined from the called address whether the distant network is a PSTN or an ISDN the same mapping takes place as for ISDN calls (see table ~~7a~~7A), if ISDN signalling is used between different MSCs (e.g. on the link VMSC - GMSC).

9.2.2 Network Interworking Mobile terminated PSTN Originated

This subclause describes the interworking of calls where the calling subscriber cannot generate or communicate Compatibility Information exhaustive for deducing a ~~GSM~~ PLMN Basic Service to a PLMN (gateway MSC/interrogating node) because of lack of ISDN signalling capability. Thus the HLR is relieved from any compatibility checking for such calls.

Two methods of allocating MS International ISDN Numbers (MSISDNs) are allowed: Firstly, a separate MSISDN may be allocated for each service, or service option, which a subscriber uses for incoming calls; or, alternatively, a single number, applicable for all incoming calls is used.

It should be noted that it is possible for both schemes to co-exist within the PLMN and that they are not mutually exclusive.

a) Multiple MSISDNs are used ("The Multi-numbering Scheme"). See figure 2.

b) A single MSISDN is used ("The Single-numbering Scheme"). See figure 3.

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~~ PLMN Bearer Capability (~~GSM~~ PLMN BC) information element with contents according to ~~GSM 07.01~~3G TS 27.001 and coded as per ~~GSM 04.08~~3G TS 24.008. 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~~ PLMN BC(s) reflecting the service associated with the called MSISDN, i.e. the ~~GSM~~ PLMN BC(s) are 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~~ PLMN 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~~ PLMN 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~~shall be modified in accordance with ~~GSM 07.01~~3G TS 27.001.

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~~ PLMN Basic Service (see application rules in subclause 10.2.2), then the VMSC in providing the ~~GSM~~ PLMN 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~~3G TS 27.001) and the call will be accepted or rejected as appropriate.

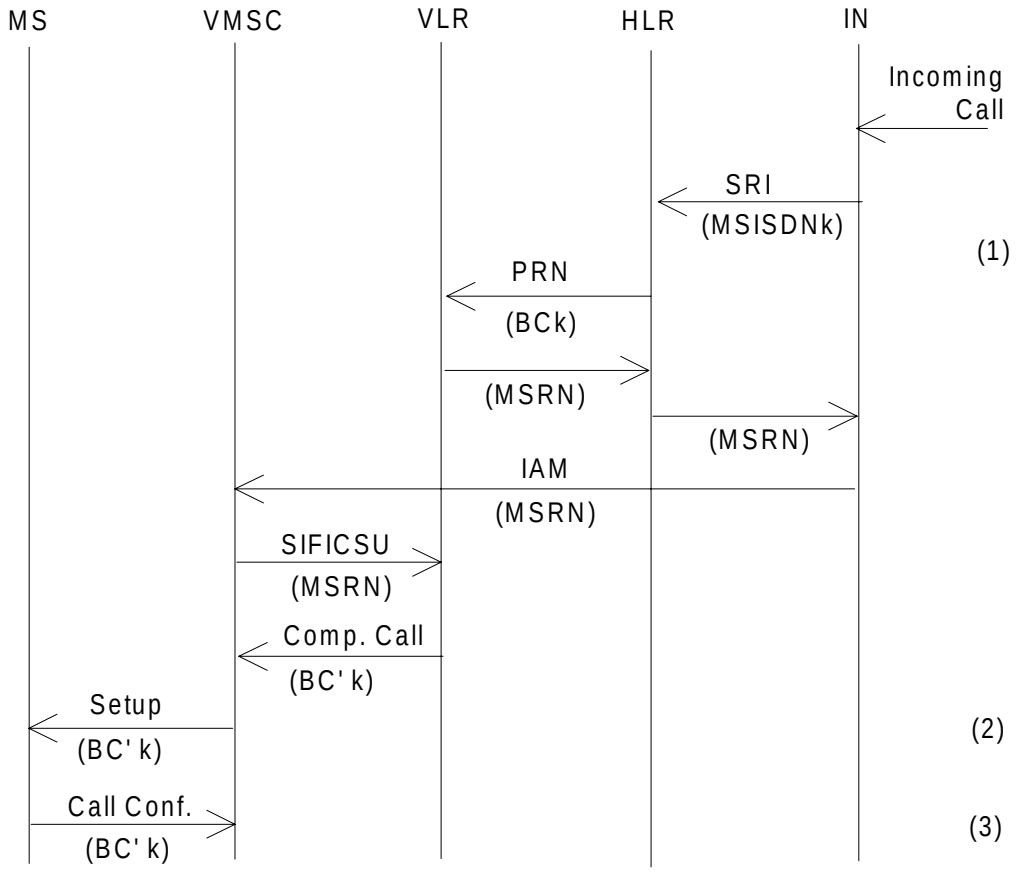
These negotiable parameters in the ~~GSM~~ PLMN BC-IE are: Connection Element (Transparent \ non-transparent), Data Compression, number of data bits, number of stop bits and parity as well as the correlated parameters Structure, Intermediate Rate, Modem Type and User Information Layer 2 Protocol. For 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~~3G TS 27.001. 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~~ PLMN 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~~PLMN-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~~3G TS 27.001) are received in the ~~GSM~~PLMN-BC of the call confirmed message or no ~~GSM~~PLMN-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~~PLMN-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~~PLMN-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~~3G TS 27.001).



NOTES: (1) The HLR translates the received MSISDN_ called address (MSISDNk) into the relevant bearer capability information (BCk).
(2) Some parameters of BCk may be provided/modified according to the MSC's capabilities/preferences. See subclause 9.2.2.
(3) In the "Call Confirm" message, the MS may modify some parameters of the BC. See subclause 9.2.2.

Abbr.: SRI - Send Routing Information
PRN - Provide Roaming Number
MSRN - Mobile Station Roaming Number
IAM - Initial Address Message
SIFICSU - Send Information For Incoming Call Set Up

Figure 2: Call Flow for a mobile terminated, PSTN originated call where the compatibility information provided are not exhaustive for deducing a ~~GSM~~ PLMN Bearer Service; HLR uses multiple MSISDN numbers with corresponding BCs.

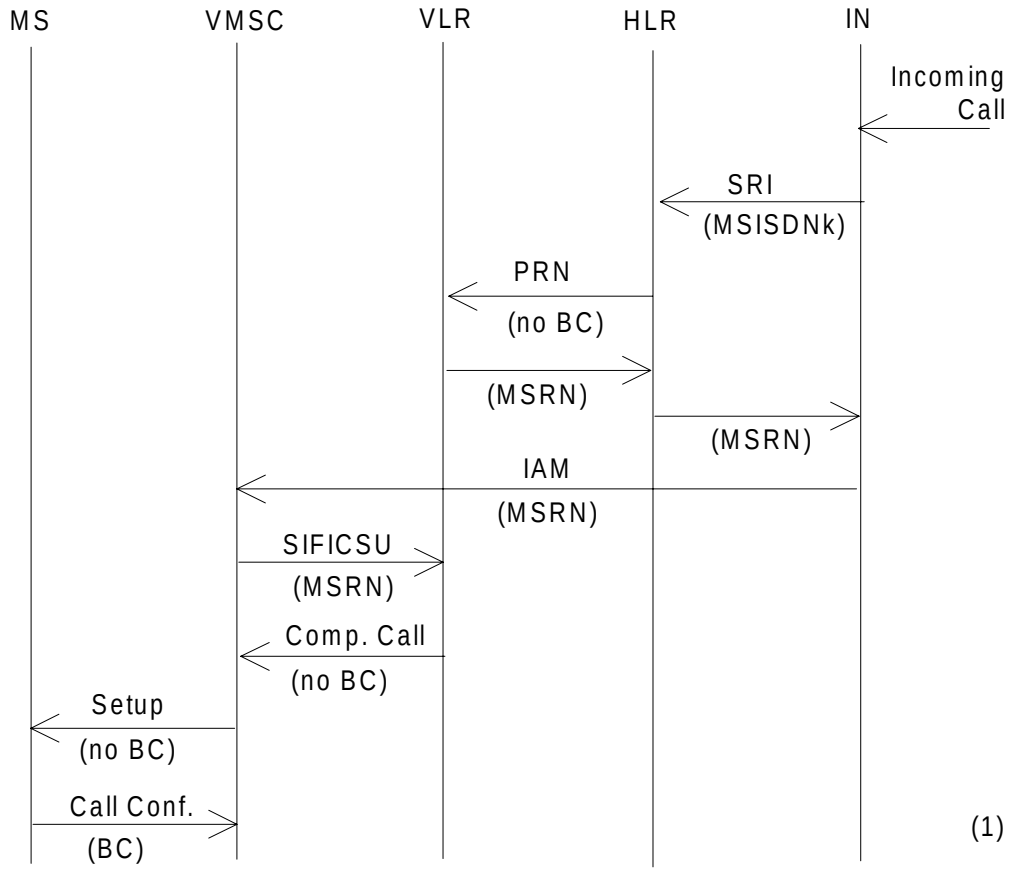
9.2.2.2 Single-numbering Scheme

In the single-numbering scheme, the HPLMN will allocate one MSISDN to a subscriber, applicable to all services.

In this case, when the HLR receives an interrogation relating to an incoming call without compatibility information exhaustive for deducing a ~~GSM~~ PLMN Basic Service (i.e. the MAP "Send Routing Information" procedure), the request to the VLR for a roaming number will not contain compatibility information i.e. a ~~GSM~~ PLMN BC.

At the VLR, when the incoming call arrives, there is no ~~GSM~~ PLMN BC associated with the MSRN and so the call set-up to the mobile will not contain the ~~GSM~~ PLMN BC element.

In this case, the MS will return a complete single or dual ~~GSM~~ PLMN BC in the Call Confirmed message, indicating the service required by the mobile subscriber. The VMSC will analyse this ~~GSM~~ PLMN BC and optionally perform subscription checking (see GSM 02.01). If the requested ~~GSM~~ PLMN BC can be supported the call is established, otherwise the call will be released.



NOTE: (1) This BC is derived from information stored in the MS, according to its configuration.
Abbreviations: see figure 2.

Figure 3: Call Flow for a mobile terminated, PSTN originated call where the compatibility information provided are not exhaustive for deducing a ~~GSM~~ PLMN Bearer Service; HLR uses single MSISDN numbers (no corresponding BC stored). Per call MSRN allocation.

9.2.3 Transparent service support

~~NOTE: See GSM 03.10.~~

The protocol stacks for transparent services are specified in GSM 03.10 (GSM) and in 3G TR 23.910 (UMTS).

In UMTS, the transparent services are based in the Iu User Plane protocol specified in 3G TS 25.415.

In GSM, ~~08.20 identifies~~ the rate adaptation scheme ~~to~~shall be utilized on the BSS to MSC link as identified in GSM 08.20. The transcoding function will generate the 64 kbit/s rate adapted format utilizing the 8 and 16 kbit/s intermediate data rates. The MSC to MSC/IWF link (e.g. in the case of handover) will utilize the same 64 kbit/s rate adaptation scheme as that indicated in GSM 08.20.

For the transparent service support the MSC/IWF will select the modem and speed based on the Compatibility information contained in either the call set-up or call confirmed message reference subclause 9.2.1 and 9.2.2. Where the modem type indicated is one of the multi-speed versions, e.g. V.32, then the MSC/IWF will restrict the modem to the speed indicated in the call set-up and call confirmed message, respectively, i.e. will inhibit the modem from changing speed, irrespective of the conditions, error rate, encountered on the PSTN link. This scenario is also applicable for the use of "autobauding" modems, in that only the specifically requested modem type and speed will be selected at the MSC/IWF (however Facsimile Group 3 can use channel mode modify).

9.2.3.1 ~~9.2.3.1 Not used~~Structure of the MSC/IWF for UMTS

The transmission towards the RNC is based on AAL2. The Iu UP is used in the transparent mode.

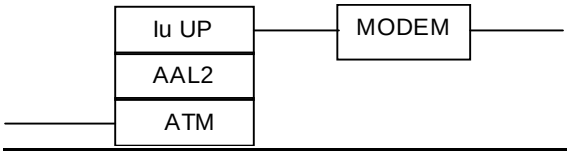


Figure 4: Structure of MSC/IWF

9.2.3.2 ~~Rate adaptation process in~~Structure of the MSC/IWF for GSM

~~This~~ The rate adaptation process is a reverse of that provided in the Terminal Adaptation function of the MS. The rate adaptation RA1 is based on the ~~CCITT~~ITU-T V.110 80 bit frame for TCH/F2.4, TCH/F4.8 and TCH/F9.6 and on A-TRAU frame for TCH/F14.4. GSM 04.21 and 08.20, respectively, refer to the rate adaptation mechanisms to be provided. For multislot configurations refer to GSM 03.10. NOTE: From MSC/IWF's perspective a TCH/F28.8 EDGE configuration is identical to a multislot 2×TCH/F14.4 configuration.

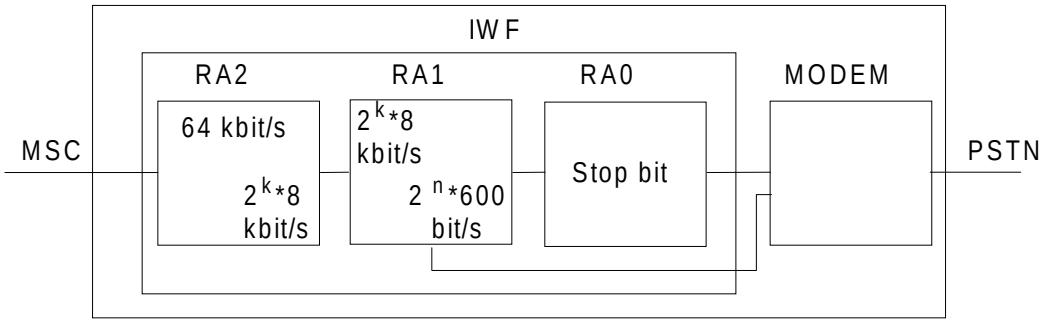


Figure 45: Rate adaptation schematic

In case of asynchronous bearer services and the facsimile teleservices in the transparent mode, the IWF shall disregard the value of bits E4, E5, E6 and E7 in the data transmission phase.

9.2.3.3 Mapping of signalling MS/MSC/IWF to modem interface requirements

This process also is a reverse of the function provided in the Terminal Adaptation function of the MS for the mapping of DTE/DCE signalling information to Dm channel and in band signalling information. ~~GSM 07.02~~3G TS 27.002~~,~~ and ~~07.03~~3G TS 27.003 refer.

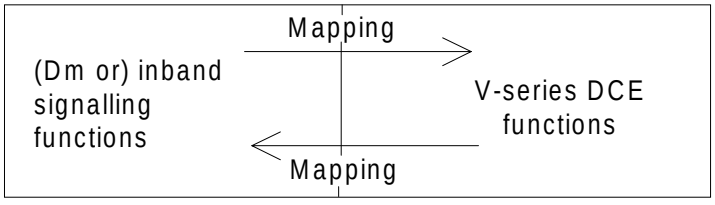


Figure ~~5~~6: Signalling mapping schematic

Status bits SA, SB and X can be used to convey channel control information associated with the data bits in the data transfer state. Table 5 shows the mapping scheme between the V.24 circuit numbers corresponding to the V-series DCE functions 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 B. 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 GSM 04.21 and 08.20 for GSM. For UMTS refer to 3G TR 23.910.

NOTE. Although the interface to the modem is described in terms of V.24 interchange circuit functions, this does not imply that such circuits need to be physically realised.

Table 5: Mapping scheme at the IWF for the transparent mode

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

NOTE 1. The SB bit towards the IWF, according to the General Mapping (annex B), could be used to carry CT 105 from the mobile DTE to the modem in the IWF. However, CT 105 should always be ON at the DTE interface 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. Therefore, CT 105 shall always be set to ON at the IWF modem during 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 since there is no flow control in transparent mode.

NOTE 5. CT 107 is not used by the IWF.

NOTE 6. CT 108 is used in the call setup and answering processes.

In general it is not required for the modem in the MSC/IWF to support a "remote looping" request from a modem in the PSTN. In addition the invocation of a "remote looping" request from the mobile subscriber to a modem in the PSTN need not be supported (see also ~~GSM 07.01~~3G TS 27.001). Specific test loops for mobile subscribers to contact may be provided at the network operators discretion.

9.2.3.4 Establishment of end-to-end terminal synchronizations

Prior to exposing the traffic channel of a PLMN connection to transmission of user data, the controlling entities of the connection ~~have to~~shall assure of the availability of the traffic channel. This is done by a so called synchronizations process:

- starting on the indication of "physical connection established" resulting from the PLMN-inherent outband signalling procedure. This indication is given on sending the message CONNECT in case of MOC, CONNECT ACKNOWLEDGEMENT in case of MTC and MODIFY COMPLETE (which is sent after reception of the ASSIGN COMPLETE message) 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).

Network interworking within an MSC/IWF is concerned with the terminating side (to the MS / UE) and the transit side (to the fixed network) of a connection. Both sides ~~have to~~shall be treated individually related to the synchronizations process.

9.2.3.4.1 Terminating side (towards the MS / UE)

9.2.3.4.1.1 GSM Traffic channel types TCH/F4.8 and TCH/F9.6

With respect to the terminating side the procedure is as follows:

- sending of synchronizations pattern 1/OFF (all data bits"1"/all status bits "OFF") to the MS using the RA1/RA2 rate adaptation function. 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 synchronizations pattern from the MS within valid V.110 frames, 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. This implies that the E1, E2 and E3 bit of the V.110 frame shall be checked for the appropriate user rate in order to distinguish the synchronization pattern from the BSS idle data frame.

- Timer T (= 500 ms) is started for each of the allocated traffic channel(s) of the call on receipt of the synchronizations pattern from the MS.

- When the frame alignment pattern and, in case of multislot operation, the multiframe alignment pattern have been recognized as a steady state, the MSC/IWF continues sending the synchronizations patterns to the MS until a timer T expires.

9.2.3.4.1.2 GSM Traffic channel type TCH/F14.4

With respect to the terminating side the procedure is as follows:

- Sending A-TRAU frames with the data rate set in the bits C1-C4 (TS 08.20) and data bits set to one, sending the multiframe structure with the alignment pattern (bit M1) and with the status bits OFF (bit M2) and, in a multislot case, sending substream numbers (bit M2).

- Searching for the detection of the multiframe alignment pattern „0000 1001 0110 0111 1100 0110 1110 101“ (TS 04.21) in the bit M1 and, in a multislot 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 recognition of five successive M1 bits.)

- Timer T (= 500 ms) is started for each of the allocated traffic channel(s) of the call on receipt of the synchronizations pattern from the MS.

- When the frame alignment pattern and the multiframe alignment pattern have been recognized as a steady state, the MSC/IWF continues sending the synchronizations patterns to the MS until a timer T expires.

9.2.3.4.1.3 UMTS User Plane

The IWF does not send any frame down link until the modem connection has been established and the modems have synchronised. Thereafter the IWF through connects, mapping data from the fixed network side onto frames that are sent toward the MS, and mapping data in the received frames to the fixed network side.

9.2.3.4.2 Transit side (towards the fixed network)

With respect to the transit side the procedure is as follows:

- At the start of timer T for each of the allocated traffic channel(s) of the call, circuit 108 to the selected modem associated with the connection will be switched from the "OFF" to "ON" condition, thus initiating the establishment of the modem connection. In the case of mobile originated calls, this initiates the auto calling sequence and after signalling, calling tone according to V.25 shall be generated by the modem in the IWF.

- The interchange circuits towards the modem (with the exception of CT108) are held in the OFF condition until timer T ~~(see below)~~ expires, when they are switched to ON.

- ~~When the frame alignment pattern and, in case of multislot operation or TCH/F14,4, the multiframe alignment pattern have been recognized as a steady state, the MSC/IWF continues sending the synchronizations patterns to the MS until a timer T (= 500 ms) expires.~~ From this time, after the expiration of the timer T of every allocated traffic channel, the information on CT106 and CT109 from the IWF Modem are directly mapped to the SB and X bits toward the MS. For TCH/F14.4 the SB and X bits are mapped to the M2 multiframe bits according to GSM 04.21. The IWF is allowed to map CT 104 to the data bits sent towards the MS and to map data bits received from the MS to CT 103.

~~Mobile Originated~~

~~At the start of timer T for each of the allocated traffic channel(s) of the call, i.e. on receipt of the synchronizations pattern from the MS, circuit 108 to the selected modem associated with the connection will be switched from the "OFF" to "ON" condition, thus initiating the auto calling sequence. After signalling, calling tone according to V.25 shall be generated by the modem in the IWF.~~

~~Mobile Terminated~~

~~At the start of timer T for each of the allocated traffic channel(s) of the call, i.e. on receipt of the synchronizations pattern from the MS, circuit 108 to the selected modem associated with the connection will be switched from the "OFF" to "ON" condition, thus initiating the establishment of the modem connection.~~

9.2.3.5 Network Independent Clocking (NIC)

The network independent clocking function applies only for GSM. It is invoked by the VMSC/IWF when the service requested (MO or MT) is 3,1 kHz Ex PLMN and synchronous. The above rule applies irrespective of the information contained in the ~~GSM 04.08~~3G TS 24.008 setup message regarding NIC. For all other services NIC is not used.

Within the GSM network the coding of the values for bits associated with NIC is specified in GSM 04.21/08.20. In the forward (transmitting) direction the multiframes shall be coded in exact accordance with that specified in those GSM 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~~synchronization, or any other purpose, is not specified and is left to the discretion of the implementer.

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~~shall 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 GSM 04.21 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 compensation within a contiguous period of time corresponding to 10 000 user data bits minus the maximum NIC code framing delay (e.g. in the case of TCH/F2.4, TCH/F4.8 or TCH/F9.6, the number of user data bits necessary to make up an even number of V.110 frames between compensation). NIC compensation is coded in two V.110 frames in the case of TCH/F2.4, TCH/F4.8 or TCH/F9.6 and in one multiframe in the case of TCH/F14.4. This results from the requirements to compensate for maximum clock differences of ±100 parts per million. If the receiving function receives NIC compensations in the average more often than a contiguous period of time corresponding to 10000 user data bits, there is no guarantee that data will not be lost.

The NIC receiving function ~~has to~~shall 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~~shall be capable of managing clock tolerances of ±100 parts per million.

Action on loss of synchronization

If five consecutive NIC multiframes in the V.110 frame have incorrect framing bit values in E7 or if the A-TRAU multiframe synchronisation is lost, the receiver shall stop applying clocking compensation to the received data. Resynchronization will be attempted and compensation will resume when synchronization is achieved.

9.2.4 Non-transparent service support

~~NOTE: See GSM 03.10.~~

The protocol stacks for non-transparent services are specified in GSM 03.10 (GSM) and in 3G TR 23.910 (UMTS). Both of the systems use the Radio Link Protocol (RLP) specified in 3G TS 24.022.

In UMTS, the non-transparent services are based in the Iu User Plane protocol specified in 3G TS 25.415.

In GSM ~~08.20 identifies~~ the corresponding necessary support concerning the rate adaptation scheme ~~to~~shall be utilized on the BSS-MSC link as identified in GSM 08.20.

For the non-transparent service support the MSC/IWF will select the modem and speed based on the Compatibility information contained in either the call set-up or call confirmed message, reference subclause 9.2.1 and 9.2.2. Where the Modem Type indicated is autobauding type 1, the MSC/IWF may select any speed and modem type according to what it can negotiate with the remote modem. In this case User Rate and Fixed Network User Rate, if present, has no meaning.

9.2.4.1 Structure of the MSC/IWF for UMTS

The transmission towards the RNC is based on AAL2. The Iu UP is used in the support mode. The RLP/L2R extends to the MS.

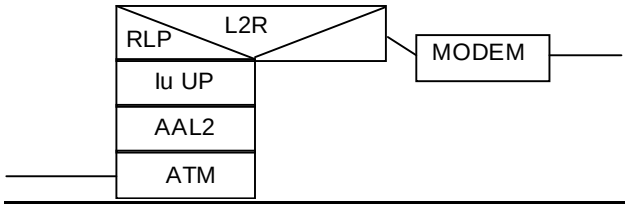
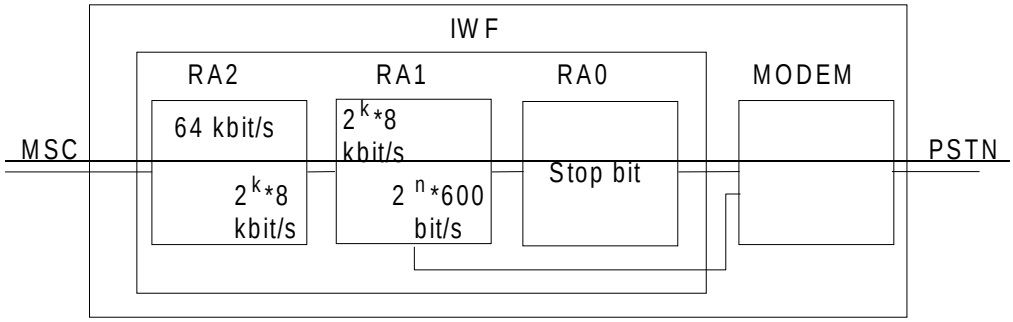


Figure 7: Structure of MSC/IWF

9.2.4.2 Structure of the MSC/IWF for GSM

~~9.2.4.1 MSC-IWF Rate adaptation scheme~~

~~This~~ The rate adaptation process will be the same as for the transparent case (see figure 5), except that a TCH/F43.2 channel coding is also supported. From MSC/IWF's perspective a TCH/F43.2 EDGE configuration is identical to a multislot 3×TCH/F14.4 configuration.



~~9.2.4.2 Protocol layer structure in the MSC/IWF~~

GSM 03.10 identifies the protocol layer structures for the non-transparent case, the physical layer to the PSTN is provided by means of a modem.

9.2.4.3 Re-constitution of user data

~~GSM 04.22~~3G TS 24.022 refers to the frame of user data in the radio link protocol. The layer 2 relay functions in the MS and the MSC/IWF (identified in GSM 03.10) contain the mechanism for packing and unpacking the user data into the L2R protocol data units.

9.2.4.4 Layer 2 relay functionality

Specific functionality is required of the L2R dependant upon the service which is being requested to be supported. The selection of the appropriate L2R function will be determined by the MSC/IWF on the basis of the bearer capability information signalled in either the call set-up request, or call confirmation messages. The prime information element being transparent or non transparent service indication. In addition the particular L2R function will be selected on the basis of the users layer 2 indication - type of protocol to be terminated and mode of flow control to be applied (see appropriate clauses of the ~~07~~ 3G TS 27 series).

The specific interaction between the L2R function and the RLP function and the L2R frame structure will be the same as that detailed in the annex to the appropriate ~~GSM 07~~3G TS 27 series.

9.2.4.5 In band signalling mapping flow control

This entails the L2R function providing the means of controlling and responding to flow control functions of the modem plus any synchronization requirements related to flow control. For synchronous services flow control is covered by the protocol indicated, whereas for asynchronous services a specific rule applies for flow control (see ~~GSM 07.01~~3G TS 27.001).

The flow control function chosen will be dependent upon the information contained or not contained in the "user information layer 2" information element of the ~~GSM~~ PLMN BC received from the MS.

If flow control is provided, irrespective of the type used the L2R function ~~must~~shall:

(a) provide immediate indication of flow control to the fixed network on receipt of flow control request from the MS.

and/or

(b) provide immediate indication of flow control to the MS on receipt of flow control request from the fixed network i.e. in the next available L2R status octet to be transmitted.

Where in-band (X-on/X-off) flow control is in use, then the X-on/X-off characters will not be passed across the radio interface.

For outband flow control refer to subclause 9.2.4.9.

If no flow control is provided, the involved end systems are responsible for performing in-band flow control on their own by taking into account the buffer capacity of the MSC/IWF stated below.

9.2.4.5.1 Conditions requiring flow control towards the fixed network

The L2R function will initiate flow control - if flow control is present - in the following circumstances:

1) The transmit buffer reaches a preset threshold (BACK PRESSURE).

2) The L2R function receives an explicit "flow control active" indication.

No flow control initiation/removal will take place at the L2R function and loss of data may occur if no flow control is provided.

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

9.2.4.5.2 Conditions requiring flow control towards the MS

The L2R function will transmit to the MS an explicit "flow control active indication" if flow control is provided in the following circumstances:

1) If the receive buffer from the radio side reaches a preset threshold (BACK PRESSURE).

2) If a flow control indication is received from the fixed network customer. On receipt of this flow control indication, transmission of data from the receive buffers towards the fixed network terminal is halted.

On removal of the buffer congestion or fixed network flow control indication, the L2R function will send a "flow control inactive" indication towards the MS. In addition, for the fixed network indication, transmission of data from the receive buffers will be restarted.

If no flow control is provided at the L2R function, no flow control initiation/removal will take place by the MSC/IWF. Data might be lost without any indication by the MSC/IWF to the end systems involved.

9.2.4.6 Data buffers

9.2.4.6.1 Transmit buffers (towards MS)

Incoming data from the fixed network customer shall be buffered such that if the MSC/IWF is unable to transfer data over the radio path the 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 flow control towards the fixed network shall be initiated if flow control is provided as per subclause 9.2.4.5.1.

9.2.4.6.2 Receive buffers (from MS)

Incoming data from the MS is buffered such that if the fixed network terminal is unable to accept the data then it is not lost.

The buffer shall be capable of holding the data. Its size is up to the implementers. When the buffer becomes half full, the L2R function will send a "flow control active" indication towards the MS if flow control is provided at the L2R function, as per subclause 9.2.4.5.2.

9.2.4.7 Transportation of the Break condition

The "BREAK" condition ~~must~~shall be recognized by the L2R function and passed immediately to the MS. The L2R will generate a "BREAK" condition towards the fixed network on receipt of a break indication from the MS. The action of the "BREAK" on the L2R transmit and receive and the length of the "BREAK" signal to be generated towards the fixed network is described in ~~GSM 07.02~~3G TS 27.002.

9.2.4.8 In band signalling mapping modem status information

Status information is carried between the modem in the IWF and the terminal adaptation function in the MS by the L2R function. The L2RCOP entity transfers interface status information between L2Rs via the status octets SA, SB and X in L2RCOP-PDUs (~~07.02~~3G TS 27.002). Table 6 shows the mapping scheme between the V.24 circuit numbers corresponding to the V-series DCE functions 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 B. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

NOTE. Although the interface to the modem is described in terms of V.24 interchange circuit functions, this does not imply that such circuits need to be physically realised.

Table 6: Mapping scheme at the IWF for the non-transparent mode

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

NOTE 1. The SB bit towards the IWF, according to the General Mapping (annex B), could be used to carry CT 105 from the mobile DTE to the modem in the IWF. However, CT 105 should always be ON at the DTE interface 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. Therefore, CT 105 shall always be set to ON at the IWF modem during the data transfer state.

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

NOTE 3. The condition of CT 133 (or other flow control mechanism) may also be affected by the state of the L2R transmit buffer (towards the MS) in the IWF and the state of RLP (RR/RNR).

NOTE 4. The condition of status bit X towards the MS may also be affected by the state of the L2R receive buffer (from the MS) in the IWF.

NOTE 5. CT 107 is not used by the IWF.

NOTE 6. CT 108 is used in the call setup and answering processes.

NOTE 7. For inband flow control, CT 106 is not mapped and the status bit X towards the MS is controlled by the reception of XON and XOFF characters from the modem.

NOTE 8. For inband flow control, changes in the condition of the status bit X from the MS result in the sending of XON or XOFF to the modem. CT 133 is always set to ON.

9.2.4.9 Support of out-band flow control

Out-band flow control in case of the asynchronous bearer service requires V.42 functionality in the modems in the MSC/IWF and the fixed network.

If this functionality is requested by the MS but cannot be provided by the MSC/IWF or the remote (fixed network) modem for any reason, the call shall be supported without V.42 functionality (fall back to the non-error correction mode according to V.42).

This implies that no flow control initiation/removal (refer to subclause 9.2.4.5.1) is possible towards the fixed network. In this case the L2R transmit buffers in the IWF (towards the MS, refer to subclause 9.2.4.6.1) shall overbridge temporary throughput problems on the radio interface and the case where the MS initiates flow control. The IWF however shall release the connection if an overflow of these buffers occurs.

9.2.4.10 Establishment of end-to-end terminal synchronizations

Prior to exposing the traffic channel of a PLMN connection to transmission of user data, the controlling entities of the connection ~~have to~~shall assure of the availability of the traffic channel. This is done by a 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 sending the message CONNECT in case of MOC, CONNECT ACKNOWLEDGEMENT in case of MTC and MODIFY COMPLETE (which is sent after reception of the ASSIGN COMPLETE message) 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 in-band information (data, status).

Network interworking within an MSC/IWF is concerned with the terminating side (to the MS) and the transit side (to the fixed network) of a connection. Both sides ~~have to~~shall be treated individually related to the synchronization process.

9.2.4.10.1 Terminating side (towards the MS / UE)

With respect to the terminating side the procedure is in GSM as follows:

- reception of V.110 or A-TRAU frames on all allocated traffic channels for the call is required before the MSC/IWF shall reply with an RLP-UA frame to the MT's RLP link establishment request (if the MSC/IWF initiates the RLP link establishment, reception of V.110 frames or A-TRAU on all allocated traffic channels for the call ~~must~~ shall be detected first).

- waiting for the RLP link establishment by the MT (in addition the MSC/IWF may initiate the RLP establishment).

In UMTS at the IWF, the synchronisation of modems on the transit network is performed after establishment of the physical connection. The RLP establishment may be initiated by the IWF, but is normally initiated by the MS. If the modems synchronise before the RLP has been established, the IWF stores the information received from the other modem in the L2R buffers.

9.2.4.10.2 Transit side (towards the fixed network)

Depending upon implementation - CT108 will be turned ON to enable the autocalling/autoanswering function of the selected modem either when the RLP has been established or in parallel to RLP establishment. If CT 108 is turned ON in parallel to the RLP establishment, the modem connection may be established before the RLP is established. In this case, data received from the transit side during RLP establishment shall be stored within the L2R buffers until the RLP establishment at the terminating side has been finished. When the RLP has been established, the information from/to the RLP including status changes will be mapped by the L2R entity applicable to the particular bearer capability. After signalling, for MO calls, calling tone according to V.25 shall be generated by the modem in the IWF.

9.2.4.11 Data compression

When data compression is invoked within a non-transparent bearer service, interworking to the fixed network is realized as follows:

The ~~GSM~~ PLMN BC is used to indicate the interworking modem type and user rate. The modems ~~must~~shall try to negotiate data compression and flow control. If negotiation of data compression fails in the fixed network, the call continues with data compression between MS and IWF only.

9.2.4.12 Service level up and down grading

Service level up and down grading is only applicable for GSM. If the value of the RLP parameter “UP signalling” is negotiated to 1, the IWF shall send a suggestion to the MS to initiate an upgrading whenever 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.

When the above condition does not hold, the IWF sets the value of the UP bit continuously to 0. When the condition above does hold, the IWF indicates the number of traffic channels to upgrade by, by sending that number of 1s between two consecutive 0s in the UP bit sequence. This indication is not repeated since the FCS protects it. For instance, if the current number of traffic channels is two and an upgrading to four traffic channels is suggested, the UP bit sequence shall be ..01100... How the IWF detects the condition and additional details for setting and resetting of the UP bit, e.g., hysteresis levels, may depend on implementation. 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. In this case, rather than suggesting the number of channels to add, the IWF suggests a number of 14.4 substreams to add and therefor a factor of 1/2 or 1/3 ~~has to~~shall be applied to the suggested increase when the assigned up link channel is TCH/F28.8 or TCH/F43.2 respectively.

9.2.5 DTE/DCE interface (Filtering)

The DTEs taken into account for the PLMN at the MS side conform to ~~CCITT~~ITU-T'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 DTE's in the PLMN environment leads to the exposure of these "interconnections" - which may, in the ISDN case, lead to the ISDN Rate Adaptation rather than to a Modem in the MSC/IWF - to the PLMN Radio Channel. To assure proper operation even under these conditions appropriate measures ~~have to~~shall 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~~shall be dealt with end-to-end between the users, while
- status line aspects are of concern to the network which are dealt with in the following.

The use of the channel control information for the remote control of the DTE/DCE control interchange-circuits between the MS and the MSC/IWF (the conveyance of which is supported by the rate adaptation scheme adopted for PLMN application) requires alignment to the particular transmission occurrences in the traffic channel to be taken into account within the PLMN. In principle this can be best achieved by:

- relying only on the PLMN outband signalling as far as connection control is concerned;
- eliminating the dependence upon the transmission of channel control information via the radio link.

Support for this strategy is given to a certain extent by the confinement of PLMN data connections to:

- full duplex operation (no turning round of the connection is required);
- switched service (demand access);

- mapping of connection-control relevant conditions of the DTE/DCE control interchange-circuits to/from outband PLMN signalling according to ~~GSM 04.08~~3G TS 24.008 after successful traffic channel synchronization;

- flow control by a network entity supported only in non-transparent mode;

- support of connections with the same user data rate only (no TA to TA end-to-end flow control in case of transparent mode).

The only DTE/DCE control interchange-circuit conditions, which actually are not covered by the above confinements, are the indications of readiness for data transmission, i.e. CT106/109 in case of V.-series interface and I-circuit of X.-series interface. As the effect of a condition change of the afore-mentioned DTE/DCE interchange-circuits depends on the:

- phase within the course of the connection;

- direction of change (ON-OFF or OFF-ON).

The required precaution to be applied (Filtering) ~~must~~shall be determined individually in view of:

- function deduced from the change;

- resilience of the connection needed;

- error condition possibly invoked due to a delay in performing the condition change of the control interchange circuit;

- potential loss of performance in connection usage.

The details of the filtering function are laid down in ~~GSM 07~~3G TS 27- series. Filtering of channel control information is only relevant at the MS side in the transparent mode of operation.

9.3 Interworking Alternate Speech / Facsimile Group 3 Calls

9.3.1 General

The procedure for the alternate speech/facsimile group 3 services is invoked at MS-MSC link during the call set-up phase. This service is invoked by indication of repeated bearer capability information elements in the setup message and/or call confirmed message respectively (preceded by a repeat indicator "circular"), one indicating speech and the other indicating facsimile group 3. The facsimile service requested will be indicated by the information transfer capability "facsimile group 3", as for a normal single call. The bearer capability first indicated i.e. speech or facsimile group 3 determines the first selection required of the network by the subscriber. Depending on the type of service requested and direction of call establishment (M0/MT, see relevant clauses of ~~GSM 07~~3G TS 27 series) low layer and high layer capabilities may also be included. The MSC/IWF will perform both compatibility checking and subscription checking on both sets of capabilities as for normal data calls. If either the subscription check or the compatibility check fails then the call will be rejected. The only exception to this is when TS61/TS62 negotiation takes place, see ~~GSM 07.01~~3G TS 27.001.

The applicable rules for provision of supplementary services are laid down in ~~GSM 02.04~~3G TS 22.004.

The "speech" phase of the call, when invoked is handled by the transcoder and will utilize normal telephony teleservice interworking requirements and mobile network capabilities. This includes any requirements for echo cancellers etc. as indicated in subclause 9.1. The "facsimile group 3" phase of the call, when invoked, will utilize the appropriate data interworking capability (IWF including modem) and may use either the transparent or non-transparent mobile network capability in the case of GSM. In UMTS only the non-transparent service is applicable.

The network shall provide, for service and operational reasons, a rapid and reliable changeover of capability upon request from the mobile user. This changeover may involve the disabling, by-passing or introduction of particular network functions (e.g. speech coder, modem etc.) and change of the channel configuration on the radio interface. This changeover is initiated on the receipt of the "MODIFY" message (see ~~GSM 04.08~~3G TS 24.008) from the MS. The network itself will not initiate a changeover.

9.3.2 Mobile originated PSTN terminated calls

The call is set up in the normal manner (but with repeated bearer capability information elements as described in subclause 9.3.1~~.1~~ and handled by the MSC/IWF as indicated in the general clause.

9.3.3 PSTN originated mobile terminated calls

The call set up request for this particular service is performed in a similar manner to that indicated in subclause 9.2 for normal PSTN originated calls.

When multiple MSISDNs are used by the HLR ("Multi-numbering scheme"), one ~~GSM~~ PLMN BC-IE with the ITC value set to "alternate speech/facsimile group 3, starting with speech" is passed to the VLR in the MAP operation "provide roaming number". The VLR stores this information against the MSRN.

When the call arrives at the visited MSC this information is retrieved from the VLR and sent to the MS in the setup message as defined in ~~GSM 07.01~~3G TS 27.001.

If the ITC of the ~~GSM~~ PLMN BC-IE retrieved from the VLR has the value "alternate speech/facsimile group 3, starting with speech" this ~~GSM~~ PLMN BC-IE ~~has to~~shall be mapped to two ~~GSM~~ PLMN BC-IEs (preceded by a repeat indicator "circular"), one representing speech, the other representing facsimile group 3. The order in which these two ~~GSM~~ PLMN BC-IEs are sent towards the MS, in the setup message, is a network option.

In order to allow auto answering mode for the facsimile phase (i.e. the call starts automatically with the facsimile phase), the MS can reflect back to MSC the dual Bearer Capability in the Call Confirm message with the BC elements interchanged to those in the original Call Set-up message (i.e. facsimile element first or negotiate to facsimile only, see subclause 9.2.2 and ~~GSM 07.01~~3G TS 27.001). In all other aspects it is handled as indicated for mobile originated.

NOTE: However, the PLMN specific parameters "connection element" and "radio channel requirements" of the retrieved ~~GSM~~ PLMN BC-IE may be modified, or added in line with the principles identified in subclause 9.2.2.

When a single MSISDN is allocated to the subscriber ("single numbering scheme"), the call is handled as described in case b) of subclause 9.2.2. In the "call confirmed" message, however, two ~~GSM~~ PLMN BC-IEs are preceded by a repeat indicator "circular", with the first ~~GSM~~ PLMN BC-IE indicating the initial phase of the connection.

10 Interworking to the ISDN

The interworking to the ISDN is specified on the principle of the network supporting standardized associated signalling protocol as outlined in clause ~~2~~6, i.e. DSS1 and ISUP. An ISDN not complying with this definition differs - for the purpose of this ~~E~~TS - in that it does not support the compatibility information to that degree necessary for deducing a ~~GSM~~ PLMN Basic Service. These networks will find their reflection in the following where those implications are to be set out.

The calling address sent in a mobile originated call to the ISDN is always the basic MSISDN even if the ISDN user ~~has to~~shall use a different MSISDN (multi numbering scheme, see 9.2.2 case a) for a mobile terminated call (call back) as only the basic MSISDN is available at the VLR (see ~~GSM 09.02~~3G TS 29.002).

The scope of this clause is to describe the handling of the content of the Information Elements where "content" is understood to be the value of the parameter fields of the Information Elements, namely BC-IE, HLC and LLC, after the length indicator. For the transport of these Information Elements within the PLMN refer to ~~GSM 09.02~~3G TS 29.002.

The handling of multislot, 14.4kbit/s, or EDGE-related parameter of the call control signalling and the applicability of single- or multislot configurations (refer to GSM 08.20 and GSM 04.21) is the same as for the PSTN interworking cases. 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~~3G TS 27.001). In case a ~~CE:T~~transparent service is used, the call shall be released. For a ~~CE:N~~non-transparent service with flow control, the MSC/IWF shall use towards the fixed network the unmodified “fixed network user rate” and shall use the “wanted air interface user rate” towards the mobile station.

10.1 Speech Calls

Since at the interworking point the transcoder provides for A-law or µ-law (PCS-1900) PCM at 64 kbit/s, no particular interworking is required. It is anticipated that the ISDN Teleservice Telephony and ISDN Bearer Service speech, respectively would be used. Transmission aspects are covered in GSM 03.50. Any further requirements are a national matter.

10.2 Data Calls

In this case it is assumed that the ISDN bearer service 3,1 kHz audio shall only be interworked by means of a modem pool in the PLMN. If a network operator provides this facility, then the MSC/IWF operation will be similar to that described for interworking to the PSTN.

Where the bearer capability information indicates that the call is a circuit switched unrestricted digital call, then the MSC/IWF shall select the appropriate rate adapted ISDN and PLMN bearer services.

The mobile network offers only Bm channel access for the packet mode service. The ISDN offers both B and D channel access for the packet mode service. The interworking of mobile packet service calls is described in ~~GSM 09.06~~3G TS 29.006.

10.2.1 Network interworking mobile originated

Low layer compatibility checking of the mobile originated call is carried out by the MSC/IWF to determine the appropriate bearer service selection in the ISDN. This will entail the MSC/IWF in mapping appropriately the ~~GSM~~ PLMN BC-IE to the ISDN BC-IE (bearer capability information element). If it is not possible for the MSC/IWF to provide a bearer service match, then the MSC/IWF shall fail the call and indicate the reason to the user.

The MS shall provide further compatibility information (LLC/HLC-IEs) if required for defining end-to-end compatibility.

As well as compatibility checking, subscription checking should be performed.

The selection of the MSC/IWF will be by means of the bearer capability information within the call set up message. The mobile subscriber shall be able to select the unrestricted digital capability, which the MSC/IWF will map to the same capability in the ISDN call set up message. If an interworking point is encountered within the ISDN which does not support this service request, then either a call release message including an appropriate error cause or progress message is returned to the PLMN, indicating that the ISDN network is unable to support the service requested. In the case of a call release message the network shall release the call. In the case of progress message the network releases the call or forwards it (see ~~GSM 04.08~~3G TS 24.008) to the mobile which will release the call.

10.2.2 Network interworking mobile terminated

10.2.2.1 General

This subclause describes the interworking of calls where the calling subscriber can communicate ISDN compatibility information with exhaustive contents for deducing a ~~GSM~~ PLMN Basic Service to a PLMN (gateway MSC/interrogating node) i.e. by means of ISDN signalling.

The GMSC ~~has to~~shall perform a mapping of the received Basic Service Information for the transport to the HLR, for details of this transport refer to ~~GSM 09.02~~3G TS 29.002.

Compatibility checking of the low layers of the ISDN originated call is carried out by the MSC/IWF to determine the appropriate bearer service selection in the PLMN. This will entail the MSC/IWF in mapping appropriately the ISDN BC/LLC-IE to the ~~GSM~~ PLMN BC-IE.

As well as compatibility checking, subscription checking should be performed. If either the subscription check or the compatibility check fails then the call will be rejected.

For ISDN originated calls it will not be possible to signal mobile specific requirements e.g. transparent/non transparent, full/half rate channel. Therefore the MSC/IWF shall select a default setting appropriate to the visited PLMN's network capabilities. In general it will be beneficial, where a network supports both full and half rate channels and transparent/non transparent capabilities, to indicate so in the appropriate ~~GSM~~ PLMN BC field of ~~GSM 04.08~~3G TS

24.008. The mobile subscriber has the option to indicate in the call confirmation message a change to this default setting according to the rules specified in ~~GSM 07.01~~3G TS 27.001. The appropriate MSC/IWF shall be selected on the basis of this requirement.

10.2.2.2 Functions in GMSC

At call Set-up, the interrogating node passes in the "send routing information" to the HLR, the ISDN BC, LLC and HLC received in the initial address message. The coding of these parameters ~~must~~shall comply with Q.931 (05/98)~~ETS 300 102-1 edition 1, with one exception: for the mapping of the parameter modem type to/from the ISDN BC IE, refer to tables 7A and 7B~~.

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~~ PLMN 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~~shall be considered:

   a) The called MSISDN has one or two corresponding ~~GSM~~ PLMN 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~~ PLMN 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~~ PLMN BC-IE(s) stored in the HLR (see option b in 9.2.2). In this case no ~~GSM~~ PLMN BC is passed to the VLR in the "provide roaming number" message.

2) Compatibility Information is received from which a ~~GSM~~ PLMN 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~~ PLMN BC associated or not) and either the equivalent ~~GSM~~ PLMN 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 GSM 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~~ PLMN 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~~shall be considered:

   a) The called MSISDN has a corresponding ~~GSM~~ PLMN 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~~ PLMN 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~~ PLMN BC stored in the HLR. In this case the HLR shall forward the appropriate ~~GSM~~ PLMN BC to the VLR in line with the subscribers subscription to T~~t~~eleservice TS 61 or 62.

      For TS 61 the value of the ~~GSM~~ PLMN BC-IE parameter "Information Transfer Capability" shall be set to "alternate speech/facsimile group 3, starting with speech"

      In both cases the HLC IE should be passed to the VLR in the "provide roaming number" message.

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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)

Alternatively the HLR may forward the originally received ISDN/LLC/HLC, when interworking with a phase 2 GSM VLR or a UMTS VLR, respectively.

4) In the case where Compatibility Information received does not allow for deducing a ~~GSM~~ PLMN 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.

10.2.2.4 Functions in VMSC

At the VMSC, when the incoming call arrives, the LLC/HLC and the ~~GSM~~ PLMN or ISDN BC associated with the MSRN is retrieved from the VLR. LLC and HLC are sent with the ~~GSM~~ PLMN BC in general to the MS at call set-up. In particular, however the following rules apply:

1) If the Initial Address Message (IAM) contains no ISDN BC and there is no ~~GSM~~ PLMN or ISDN BC/LLC/HLC retrieved from the VLR, the call is handled as subclause 9.2.2 case b.

2) If there is no ISDN BC in the IAM but a ~~GSM~~ PLMN or ISDN BC/LLC/HLC was signalled in the "provide roaming number" message, the retrieved ~~GSM~~ PLMN or ISDN BC/LLC/HLC applies.

3) If there is an ISDN BC in the IAM with the ITC field set to "3,1 kHz audio" but without any associated modem type or indication of facsimile group 3 in the HLC, the ~~GSM~~ PLMN or ISDN BC/LLC/HLC retrieved from the VLR is considered as applicable when it exists. If no ~~GSM~~ PLMN or ISDN BC is retrieved from the VLR, the call is handled as in subclause 9.2.2 case b.

4) If the ISDN BC received in the IAM has the ITC field set to the value "unrestricted digital information" and the fields for the applicable "user layer 1 protocol" and "user rate" are available (either in the ISDN BC or ISDN LLC), or if 3,1 kHz audio and a modem type is indicated, this ISDN BC is applicable regardless of what has been retrieved from the VLR. In this case the ISDN BC ~~has to~~shall be mapped to an appropriate ~~GSM~~ PLMN BC (refer to table 7B).

5) If the ISDN BC received in the IAM has the ITC field set to the value "3,1kHz audio" and a HLC "facsimile group 3" is indicated, the ~~GSM~~ PLMN BC retrieved from the VLR is applicable when it exists. If a ~~GSM~~ PLMN BC-IE with the parameter "information transfer capability" set to "alternate speech/facsimile group 3, starting with speech" (stating TS61) is retrieved from the VLR, this shall be mapped to two ~~GSM~~ PLMN BC-IE preceded by a repeat indicator, one representing speech, the other representing facsimile group 3.

   When no ~~GSM~~ PLMN BC is retrieved from the VLR, either two ~~GSM~~ PLMN BCs preceded by a repeat indicator (stating T~~t~~eleservice TS 61), or a single ~~GSM~~ PLMN BC-IE (stating TS 62), are sent in the setup message, depending whether TS 61 or TS 62 is subscribed (see also subclause 10.3.1.3).

   In case of TS 61, the order in which the two ~~GSM~~ PLMN BC-IEs are sent towards the MS, in the setup message, is a network option.

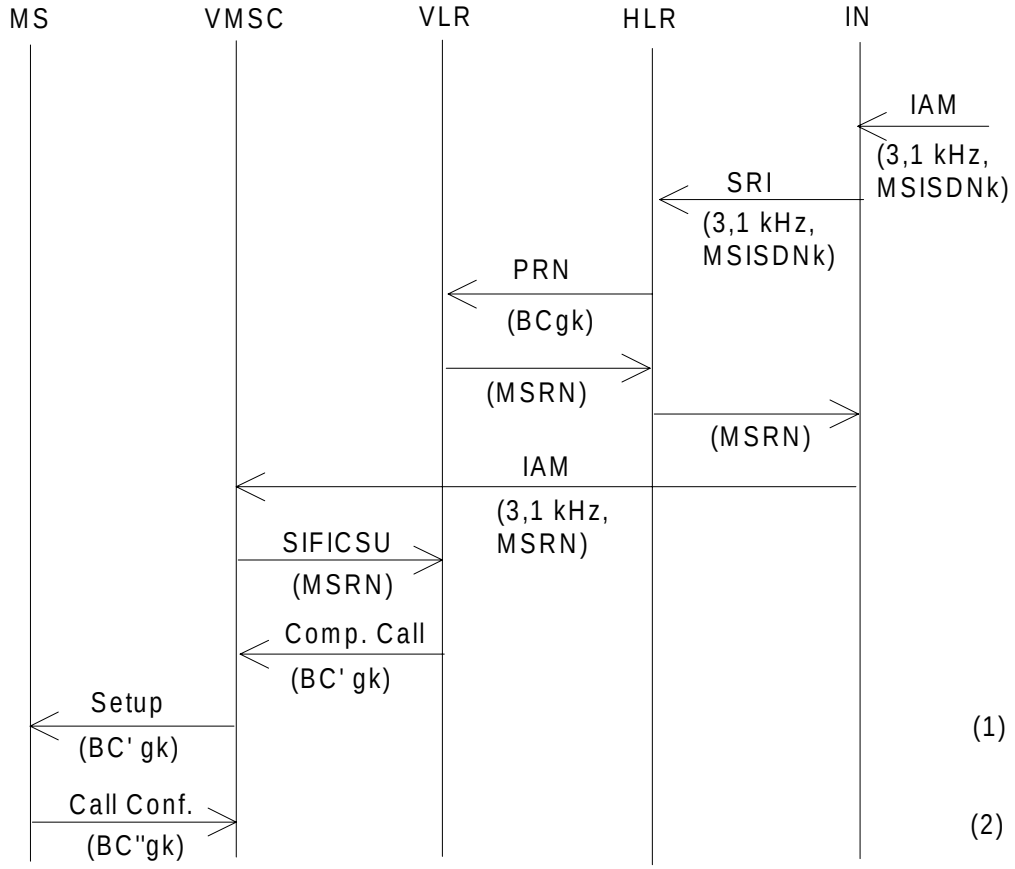
6) If the ISDN BC received in the IAM has a ITC value "unrestricted digital information" but without applicable "user layer 1 protocol" and "user rate", etc. fields, neither in the ISDN BC nor ISDN LLC, then the ~~GSM~~ PLMN or ISDN BC/LLC retrieved from the VLR is applicable, if available otherwise subclause 9.2.2 case b applies.

   In case of an ISDN BC/LLC/HLC was attached to the MSRN this ~~has to~~shall be mapped to an appropriate ~~GSM~~ PLMN BC (refer to table 7B). However in both cases (~~GSM~~ PLMN or ISDN BC attached) the PLMN specific parameters of the ~~GSM~~ PLMN BC-IEs may be added/modified in line with procedures identified in subclause 9.2.2.

In all cases when no ~~GSM~~ PLMN or ISDN BC is retrieved from the VLR and no ISDN Compatibility information allowing deduction of a ~~GSM~~ PLMN Bearer Service is available, then no ~~GSM~~ PLMN BC is inserted by the VMSC and subclause 9.2.2 case b applies.

The mapping between ~~GSM~~ PLMN and ISDN BCs is shown in table 7.

10.2.2.5 Call Flows

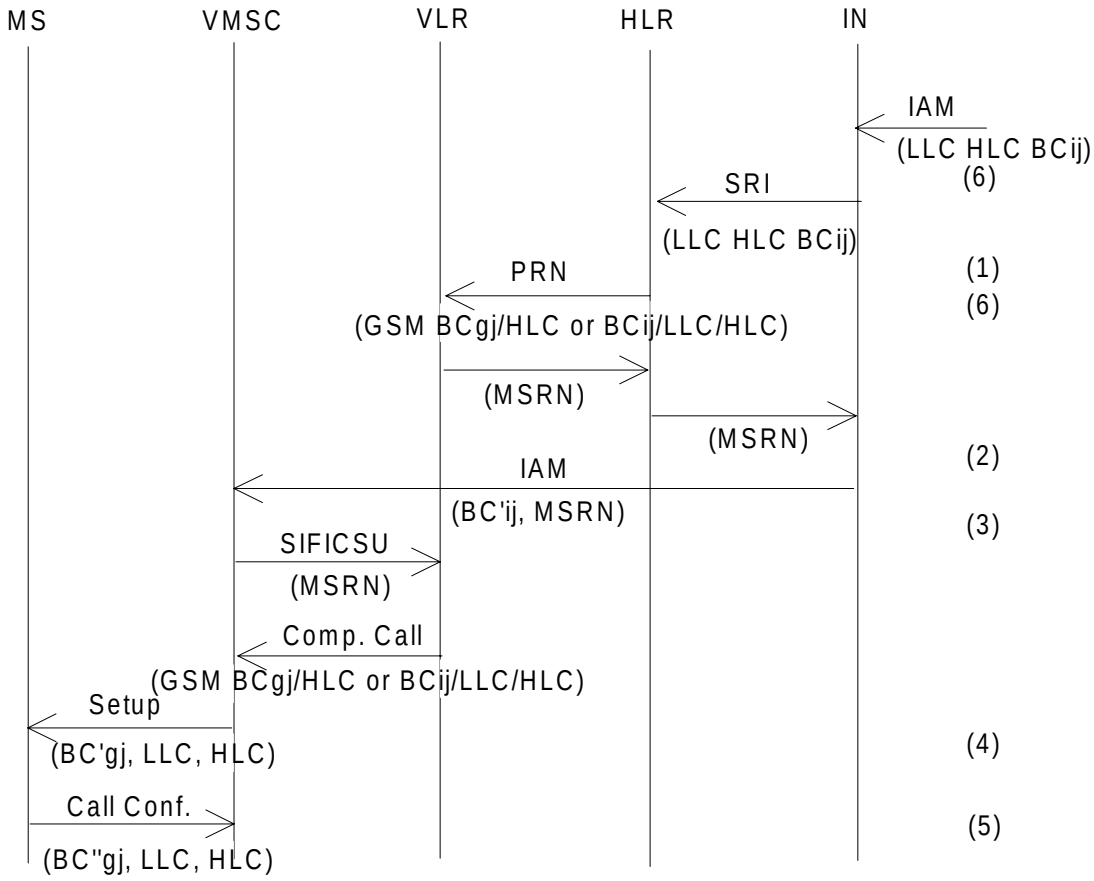


Abbreviations: see figure 2.

NOTE: (1) Some parameters of BCgk may be provided/modified according to the MSC's capabilities/preferences. See subclause 9.2.2

(2) In the "Call Confirm" message, the MS may modify some parameters of the ~~GSM~~ PLMN BC. See subclause 9.2.2.

Figure ~~6~~8: Call Flow for a mobile terminated, ISDN originated call where compatibility information provided are not exhaustive for deducing a ~~GSM~~ PLMN Bearer Service, but Information Transfer Capability = 3,1 kHz audio, no modem type and no HLC IE indicating facsimile group 3. HLR stores ~~GSM~~ PLMN BC against MSISDN number multi-numbering scheme.



NOTES: (1) BCij denotes ISDN ~~ETS 300-102-1~~ BC*; BCgj is the corresponding ~~GSM~~ PLMN BC.
(2) Assumes signalling capabilities permit the transfer of BC between IN and VMSC. If this is not the case, the VLR uses the stored BC/LLC/HLC.
(3) BC'ij denotes BCij as maybe modified by intervening networks.
(4) Some parameters of BCgk may be provided/modified according to the MSC's capabilities/preferences. See subclause 9.2.2.
(5) In the "Call Confirm" message, the MS may modify some parameters of the BC. See subclause 9.2.2.
(6) For details on how the BC, HLC, and LLC are transported, refer to ~~GSM 09.02~~3G TS 29.002.
* HLC and LLC refers to ISDN values.
Abbreviations: see figure 2.

Figure ~~7~~9: Call Flow for a mobile terminated, ISDN originated call where compatibility information provided are sufficient information to deduce a ~~GSM~~ PLMN Bearer Service or Information Transfer Capability = 3,1 kHz audio with HLC IE indicating facsimile group 3.

10.2.2.6 Mapping Functions

The following tables (7A + 7B) show that only the ISDN BC is used for mapping (exceptions are indicated).

NOTE: The ISDN/~~GSM~~ PLMN BC-IE mapping shall be performed as specified in tables 7A and 7B. This ~~must~~shall be done to allow setup of a compatible end-to-end connection between two MSs or one MS and an ISDN terminal.

~~It has been acknowledged that octets 5a, 5b, 5c and 5d or a combination of them may also be sent and received in 3,1 kHz audio calls. Follow-up versions of ETS 300-102-1 (i.e. ETS 300-403-1), confirm this interpretation. This is especially important for MOC ISDN terminating calls, where early Customer Premise Equipment (e.g. PABXs), may reject these calls.~~

In the following tables 7A and 7B the comparison is drawn between parameters in the ~~GSM~~ PLMN call set up request message and that of the ISDN call set up request message. In some cases no comparable values are available and these will be marked as such. In these cases reference will need to be made to the table of network interworking in

~~GSM 09.07~~3G TS 29.007 to identify the appropriate choice. In some cases it is not necessary to support a particular option, and in this case those parameters will be annotated appropriately.

The PLMN parameters and values are as in 3G TS 24.008 in combination as in 3G TS 27.001. The ISDN parameters and values are as in Q.931 (05/98).

Table 7A: Comparable setting of parameters in ~~GSM 04.08~~PLMN and ~~ETS 300 102-1~~ISDN: ~~(ETSI ISDN user to network signalling)~~ Mobile Originated

Octet	~~GSM 04.08~~PLMN BC parameter value ~~as in GSM 07.01~~	Octet	~~ETS 300 102-1~~ISDN BC parameter value
1	**Bearer Capability IEI**	1	**Bearer Capability IEI**
2	**Length of BC contents**	2	**Length of BC contents**
3 #7..6	**Radio channel requirement** half rate channel full rate channel dual, full, rate preferred dual, half rate preferred		No comparable field
3 #4	**Coding Standard** GSM standard coding	3 #7..6	**Coding Standard** CCITT standardized coding
3 #4	**Transfer mode** circuit mode packet mode (note7)	4 #7..6	Transfer mode circuit mode packet mode
3 #3..1	**Information transfer capability** speech unrestricted digital 3,1 kHz audio ex PLMN facsimile group 3 (note 1) other ITC (see octet 5a)	3 #5..1	**Information transfer capability** speech unrestricted digital 3,1 kHz audio see table 4 in GSM 09.07 no comparable value
5a #7..6	**Other ITC** restricted digital		(note 18)
4 #7	**Compression** (note 14) data compression allowed data compression not allowed		No comparable field
4 #6..5	**Structure** SDU integrity unstructured	4a #7..5	**Structure** (note 4)
4 #4	**Duplex mode** half duplex full duplex	5d #7	**Duplex mode** half duplex full duplex
4 #3	**Configuration** point to point	4a #4..3	**Configuration** (note 4) ~~point to point~~
4 #1	**Establishment** demand	4a #2..1	**Establishment** (note 4) ~~demand~~
4	**NIRR** (note 12) no meaning Data ≤ 4.8kbit/s, FR nt, 6kbit/s radio interface is requested		No comparable field

(continued)

Table 7A (continued): Comparable setting of parameters in ~~GSM 04.08~~PLMN and ~~ETS 300 102-1~~ISDN: ~~(ETSI ISDN user to network signalling)~~ Mobile Originated

Octet	~~GSM 04. 08~~PLMN BC parameter value ~~as in GSM 07.01~~	Octet	~~ETS 300 102-1~~ISDN BC 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 No comparable value
5a #5..4	**Other rate adaptation** V.120 (note 17)		
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~~3G TS 24.008 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)

Table 7A (continued): Comparable setting of parameters in ~~GSM 04.08~~PLMN and ~~ETS 300 102-1~~ISDN: ~~(ETSI ISDN user to network signalling)~~ Mobile Originated

Octet	~~GSM 04.08~~PLMN BC parameter value ~~as in GSM 07.01~~	Octet	~~ETS 300 102-1~~ISDN BC parameter value
6b #7..6	**Intermediate rate** 8 kbit/s 16 kbit/s any value	5b #7..6	**Intermediate rate** (note 13) 8 kbit/s or not used 16 kbit/s or not used 32 kbit/s or not used (note 14)
6b #5	**NIC on Tx** does not require requires (note7)	5b #5b	**NIC on Tx** does not require requires (note 8)
6b #4	**NIC on Rx** cannot accept can accept (note 7)	5b #4	**NIC on Rx** cannot accept can accept (note 8)
6b #3..1	**Parity information** odd even none forced to 0 forced to 1	5c #3..1	**Parity information** odd even none forced to 0 forced to 1
6c #7..6	**Connection element** transparent non-transparent (RLP) both, transp. preferred both, non-transp. preferred		No comparable field
6c #5..1	**Modem type** none V.21 V.22 V.22bis V.23 (note 24) V.26ter V.32 modem for undef. interface autobauding type 1	5d #6..1	**Modem type** ~~(note 9)~~ no comparable value (note 5) V.21 V.22 V.22bis V.23 V.26ter V.32 No comparable value (note 5) No comparable value (note 5, note 10)
7 #5..1	**User info. layer 2 protocol** X.25 link level ISO 6429, codeset 0 COPnoFlCt videotex profile 1 (note 7) X.75 layer 2 modified (CAPI)	6	**User info.layer 2 prot.** (note 6) X.25 link level no comparable value no comparable value no comparable value X.25 link level
6d #5..1	**Fixed network user rate** (note 15) FNUR not applicable (note 7) 9,6 kbit/s 12 kbit/s (note 7) 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	5a #5..1	**User rate** no comparable value 9,6 kbit/s 12 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 no comparable value (note 16)

(continued)

Table 7A (concluded): Comparable setting of parameters in ~~GSM 04.08~~PLMN and ~~ETS 300 102-1~~ISDN:
~~(ETSI ISDN user to network signalling)~~ Mobile Originated

Octet	~~GSM 04.08~~PLMN BC parameter value ~~as in GSM 07.01~~	Octet	~~ETS 300 102-1~~ISDN BC parameter value
6e #3..1	**Maximum number of traffic channels** 1 TCH 2 TCH 3 TCH 4 TCH 5 TCH 6 TCH 7 TCH (note 7) 8 TCH (note 7)		No comparable field
6f #4..1	**Wanted air interface user rate (note 23)** air interface user rate not applicable (note 7) 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 7)		No comparable field
6d #7..6	**Other modem type** (note 15) No other modem type V.34	5d #6..1	**Modem type** no comparable value V.34
6e #7..4	**Acceptable channel coding(s)** TCH/F4.8 acceptable (note 19) TCH/F9.6 acceptable TCH/F14.4 acceptable		No comparable field
6f #7..5	**User initiated modification indicator (note 23)** User initiated modification not required User initiated modification upto 1 TCH/F may be requested User initiated modification upto 2 TCH/F may be requested User initiated modification upto 3 TCH/F may be requested User initiated modification upto 4 TCH/F may be requested		No comparable field
6g #7..5	**Acceptable channel coding(s) (note 20)** TCH/F28.8 acceptable TCH/F32.0 acceptable (note 21) TCH/F43.2 acceptable (note 22)		No comparable field
6g #4..3	**Asymmetry preference indication (Note 23)** no preference up link biased asymmetry preference down link biased asymmetry preference		No comparable field

The application rules for coding the information elements ISDN-BC/LLC/HLC as set out in ETR 018 and Q.931 (05/98)~~ETS 300 102-1~~ shall apply.

Other field values in the ISDN BC-IE ~~of ETS 300 102-1~~ not supported in ~~GSM 04.08~~3G TS 24.008 are:

- Information transfer rate: In this case default 64 kbit/s is selected.

~~Symmetry: In this case default bi-directional symmetric is selected for all user data rates (note 5).~~

- Flow control on transmission: This shall be selected if outband flow control applies.

- Flow control on reception: This shall be selected if outband flow control applies.

NOTE: Outband flow control is indicated by the absence of the UIL2P parameter for non-transparent connections.

- User information layer 3 protocol:
  Octet 7 shall not be sent unless specific application rules are given for particular cases (to be defined by ~~GSM~~PLMN). End-to-end significant User Information layer 3 protocol shall be sent by LLC.

NOTE 1: In the case where ~~GSM~~ PLMN BC "Information Transfer Capability" indicates "Facsimile group 3" and only a single ~~GSM~~ PLMN BC is contained in the call set-up request then this shall be mapped to an ISDN BC with:

Coding standard:	CCITT
Information Transfer capability:	3,1 kHz audio
Transfer mode:	circuit
Information transfer rate:	64 kbit/s
User layer 1 protocol:	G711 A-law or µ-law (PCS-1900)

and

- If an HLC is not present, the network will insert a "Facsimile group 2/3" HLC.
- If an HLC element is present, the network will pass it through unmodified.

In the case where ~~GSM~~ PLMN BC "Information Transfer Capability" indicates "Facsimile group 3" and two ~~GSM~~ PLMN BCs are contained in the call set-up request, then the same ISDN BC as mentioned above is created. If the first ~~GSM~~ PLMN BC indicates "facsimile group 3" an HLC "facsimile group 2/3" will be inserted by the network (if not received from the MS). However if the first ~~GSM~~ PLMN BC indicates "speech", the network will not send a HLC, irrespective where a HLC was received from the MS or not.

NOTE 2: This value is present in combination with information transfer capability parameter value "3,1 kHz audio Ex PLMN" or "facsimile group 3" and will therefore be mapped to the value "~~CCITT~~ Recommendation G.711 A-law" or "Recommendation G.711 µ-law" (PCS-1900)~~"~~ of the ~~ETS 300 102-1~~ Q.931 (05/98) parameter user layer 1 protocol (see note 3).

NOTE 3: The value "~~CCITT~~ Recommendation G.711 A-law" or "Recommendation G.711 µ-law" (PCS-1900)~~"~~ applies only when the ~~ETS 300 102-1~~ Q.931 (05/98) parameter information transfer capability indicates "3,1 kHz audio" or "speech".

NOTE 4: When interworking with an ISDN according to ETS 300 102-1 ~~O~~octets 4a and 4b shall not be included because default values apply. In an ISDN according to Q.931 (05/98) these octets no more exist.

NOTE 5: In this case octet 5d shall not be included.

NOTE 6: Octet 6 shall not be sent unless specific application rules are given for a particular case (~~GSM~~ PLMN specified). End-to-end significant user information layer 2 protocol shall be sent by LLC.

NOTE 7: Not used for currently defined Bearer Services and Teleservices.

NOTE 8: These values will only be set if the "Information Transfer Capability" indicates "3,1 kHz audio", synchronous data transmission is used and octet 5b of the ISDN BC is present.

~~NOTE 9: The mapping of the modem type shall be according to Draft ETS 300 102-1/prA1.~~

NOTE 10: The ~~GSM~~ PLMN BC-IE parameter value "autobauding modem type 1" will be mapped to the ISDN BC-IE parameter values "inband negotiation possible" and "user rate indicated by E-bits specified in ~~CCITT~~ITU-T Rec I.460 or may be negotiated inband" (octet 5a of ISDN BC-IE). In case of data compression high speed modems, like V.32bis and/or V.34 may be used in the IWF.

NOTE 11: The ITC value of the ~~GSM~~ PLMN BC-IE "speech", "3,1 kHz audio Ex PLMN" will indicate these requirements.

NOTE 12: For the use of NIRR see ~~GSM 07.01~~3G TS 27.001.

NOTE 13: The value of the Intermediate Rate field of the ISDN Bearer Capability information element shall only depend on the values of the User Rate and the Information Transfer Capability in the same information element. The correspondence is:

Intermediate Rate = not used if User Rate > than 19.2 kbit/s

Intermediate Rate = 32 kbit/s if User Rate = 19,2 kbit/s or 14.4 kbit/s

Intermediate Rate = 16 kbit/s if User Rate = 9,6 kbit/s

Intermediate Rate = 8 kbit/s otherwise.

In case of Audio calls the value of the Intermediate Rate may be set to "not used".

NOTE 14: If compression is supported by the MSC and "data compression allowed" is indicated, then the ISDN user rate for UDI calls shall be set as follows. If the parameter “FNUR” is present the ISDN user rate shall be set to this value. Otherwise the ~~GSM~~ PLMN user rate shall be mapped to an equal or any higher ISDN user rate value (in case of V.110 the highest ISDN user rate shall be 19.2 kbit/s). The Intermediate Rate shall be set to an appropriate value.(see subclause 10.2.4.11).

In case of "3,1 kHz audio" the modem ~~must~~shall try to negotiate data compression and flow control (see subclause 9.2.4.11). In case of "autobauding type 1" high speed modems may be used (see note 10).

NOTE 15: User rate of the ~~GSM~~PLMN-BC is overridden by the fixed network user rate of the ~~GSM~~ PLMN BC-IE if available. When the MT indicates „autobauding“, „modem for undefined interface“ or „none“, the other modem type shall be set to „no other modem type“; any other value of the modem type is overridden by the other modem type value (see ~~GSM 07.01~~3G TS 27.001).

NOTE 16: The ISDN-BC will consist of the octets 1 to 4 only, coded:

Coding standard:	CCITT
Information Transfer capability:	UDI
Transfer mode:	circuit
Information transfer rate:	64 kbit/s

NOTE 17: V.120 interworking is selected.

If an LLC element is not present, the network will insert an LLC. If an LLC is present it may be modified. The ~~GSM~~PLMN-BC parameters negotiated with the MS shall be mapped to the LLC parameters. The LLC parameter Rate Adaptation will be set to "V.120".

When interworking with unrestricted 64 kbit/s networks the ISDN BC shall be coded according to note 16.

NOTE 18: When the MSC is directly connected to a restricted 64 kbit/s network, the ISDN BC-IE is coded with an ITC = RDI ~~(not applicable to ISDNs conforming to ETS 300 102-1)~~.
When indirectly interworking with a restricted 64 kbit/s network the ISDN BC-IE shall be coded according to ETR 018, as shown below:

Coding standard:	CCITT
Information Transfer capability:	UDI
Transfer mode:	circuit
Information transfer rate:	64 kbit/s
User information layer 1 protocol:	V.110/X.30
Synchronous/Asynchronous:	synchronous
Negotiation:	In-band negotiation not possible
User rate:	56 kbit/s

If an LLC element is not present, the network will insert an LLC. If an LLC is present it may be modified. The GSM-BC parameters negotiated with the MS shall be mapped to the LLC parameters according to the rules in this table. The LLC parameter Information Transfer Capability will be set to „restricted digital“

NOTE 19: 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.

NOTE 20: Extension of the 'Acceptable channel codings' field in octet 6e in case EDGE channel codings are supported.

NOTE 21: Only applicable for bit transparent 56 and 64 kbit/s services.

NOTE 22: Only applicable for non-transparent services.

NOTE 23: This parameter ~~has to~~shall be included if EDGE channel codings are indicated in ACC. 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'.

NOTE 24: This value was used by services defined for former GSM releases and does not need to be supported.

Table 7B: Comparable setting of parameters in PLMN and ISDN: Mobile Terminated ~~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~~ISDN BC parameter value	Octet	~~GSM 04.08~~PLMN BC parameter value
1	**Bearer Capability IEI**	1	**Bearer Capability IEI**
2	**Length of BC contents**	2	**Length of BC contents**
	no comparable field	3 #7..6	**Radio channel requirement** (note 1) half rate channel full rate channel both, half rate preferred both, full rate preferred
3 #7..6	**Coding standard** CCITT standardized coding	3 #5	**Coding standard** GSM standardized coding
3 #5..1	**Information transfer capability** speech unrestricted digital 3,1 kHz audio no comparable value no comparable value 7 kHz audio video (note 23)	3 #3..1	**Information transfer capability** speech unrestricted digital 3,1 kHz audio ex PLMN (note2) facsimile group 3 (note 3) other ITC (see octet 5a) not supported not supported
		5a #7..6	**Other ITC** restricted digital
4 #7..6	**Transfer mode** circuit mode packet mode	3 #4	**Transfer mode** circuit mode circuit mode
4 #5..1	**Information transfer rate** 64 kbit/s		no comparable field
	No comparable field	4 #7	**Compression** (note 18) data compression possible data compression not possible
~~4a~~ ~~#7..5~~	~~**Structure**~~ ~~default~~ ~~8 kHz integrity~~ ~~SDU integrity~~ ~~unstructured~~ No comparable field (note 4)	~~(4)~~ 4 #6..5	**Structure** (note 9) ~~no comparable value~~ ~~no comparable value~~ SDU integrity ~~(note 9)~~ unstructured ~~(note 5)~~
~~4a~~ ~~#4..3~~	~~**Configuration**~~ ~~point-to-point~~ No comparable field (note 4)	4 #3	**Configuration** point-to-point ~~(*)~~(note 5)
	No comparable field	4 #2	**NIRR** (note 17) No meaning Data ≤ 4.8 kbit/s, FR nt, 6 kbit/s radio interface requested
~~4a~~ ~~#2..1~~	~~**Establishment**~~ ~~demand~~ No comparable field (note 4)	4 #1	**Establishment** demand ~~(*)~~(note 5)
~~4b~~ ~~#7..6~~	~~**Symmetry**~~ ~~bi-directional symmetric~~		~~no comparable field~~
~~4b~~ ~~#5..1~~	~~**Information transfer rate (dest->orig.)**~~ ~~64 kbit/s~~		~~no comparable field~~

(continued)

Table 7B (continued): Comparable setting of parameters in PLMN and ISDN: Mobile Terminated~~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~~ISDN BC parameter value	Octet	~~GSM 04.08~~PLMN BC 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 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)
		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)

Table 7B (continued): Comparable setting of parameters in PLMN and ISDN: Mobile Terminated~~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~~ISDN BC parameter value	Octet	~~GSM 04.08~~PLMN BC parameter 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 rate is indicated by Ebit as specified in ~~CCITT~~ rec. I.460 0,6 kbit/s 3,6 kbit/s 7,2 kbit/s 8 kbit/s 14,4 kbit/s 16 kbit/s 19.2 kbit/s 28.8 kbit/s 32 kbit/s 38.4 kbit/s 48 kbit/s 56 kbit/s ~~64~~57,6 kbit/s 0,1345 kbit/s 0,1 kbit/s 75 bit/s / 1,2 kbit/s 1,2 kbit/s / 75 bit/s 0,110 kbit/s ~~0,115 kbit/s~~ 0,2 kbit/s	6a #4..1	**User rate (note 18)** 0,3 kbit/s 1,2 kbit/s 2,4 kbit/s 4,8 kbit/s 9,6 kbit/s 12 kbit/s (note 13) **(**note 16) not supported not supported not supported not supported (note 20) not supported (note 20) (note 20) not supported (note 20) (note 20) (note 20) not supported not supported not supported not supported not supported not supported not supported
5b #7..6	**Intermediate rate** not used (note 19) 8 kbit/s 16 kbit/s	6b #7..6	**Intermediate rate** (note 6) (note 18) 8 or 16 kbit/s 8 kbit/s 16 kbit/s
5b #5	**NIC on Tx** (note 14) does not require requires	6b #5	**NIC on Tx** does not require requires (note 13)
5b #4	**NIC on Rx** (note 14) cannot accept can accept	6b #4	**NIC on Rx** cannot accept can accept (note 13)
5b #3	**Flow control on Tx** (note 15) Not Required Required		no comparable field
5b #2	**Flow control on Rx** (note 15) Cannot Accept Accept		no comparable field
5c #7..6	**Number of stop bits** 1 bit 2 bits not used 1.5 bits	6a #7	**Number of stop bits** 1 bit 2 bits no comparable value not supported

(continued)

Table 7B (continued): Comparable setting of parameters in PLMN and ISDN: Mobile Terminated ~~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~~ISDN BC parameter value	Octet	~~GSM 04.08~~PLMN BC parameter value
5c #5..4	**Number of data bits** 7 bits 8 bits not used 5 bits	6a #5	**Number of data bits** 7 bits 8 bits no comparable value not supported
5c #3..1	**Parity information** odd even none forced to 0 forced to 1	6b #3..1	**Parity information** odd even none forced to 0 forced to 1
	no comparable field	6c #7..6	**Connection element** (note 1) transparent non-transparent (RLP) both, transp. preferred both, non-transp preferred
5d #7	**Duplex mode** half duplex full duplex	4 #4	**Duplex mode** half duplex (note 13) full duplex ~~(*)~~(note 5)
5d #6..1	**Modem type** reserved V.21 V.22 V.22bis V.23 V.26ter V.32 V.26 V.26bis V.27 V.27bis V.29 ~~V.35~~ no comparable value	6c #5..1	**Modem type** (note 12) none (note 7) V.21 V.22 V.22bis not supported V.26ter V.32 not supported not supported not supported not supported not supported autobauding type 1 (note 16)
5a #5..1	**User rate** no comparable value 9,6 kbit/s 14,4 kbit/s 19,2 kbit/s 28,8 kbit/s 38,4 kbit/s 48 kbit/s 56 kbit/s no comparable value	6d #5..1	**Fixed network user rate** (note 20) FNUR not applicable 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 22)
	Modem type no comparable value (note 21) V.34	6d #7..6	**Other modem type** No other modem type V.34

(continued)

Table 7B (concluded): Comparable setting of parameters in PLMN and ISDN: Mobile Terminated~~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~~ISDN BC parameter value	Octet	~~GSM 04.08~~PLMN BC parameter value
	No comparable field	6f #7..5	**User initiated modification indicator (note 1) (note 25)** User initiated modification not required User initiated modification upto 1 TCH/F may be requested User initiated modification upto 2 TCH/F may be requested User initiated modification upto 3 TCH/F may be requested User initiated modification upto 4 TCH/F may be requested
6 #5..1	**User information layer 2 protocol (note 10)** Q.921 (I.441) X.25, link level no comparable value	7	**User information layer 2 protocol (note 8)** no comparable value X.25, link level ISO 6429, codeset 0
7	**User information layer 3 protocol (note 10)** Q.931 (I.451) X.25, packet level		 not supported not supported

General notes:

1) Other ~~ETS 300 102-1~~ISDN BC parameter values than those listed in the table, if indicated in the BC-IE, will be rejected by clearing the call, exception see mapping note 4.

2) Only the ~~GSM 04.08~~PLMN BC parameter values listed in the table may be generated (comparable values) during a mobile-terminated call by mapping the ~~ETS 300 102-1~~ISDN BC parameter values, exception see (10).

3) According to ~~ETS 300 102-1~~ Q.931 (05/98) and ~~GSM 04.08~~3G TS 24.008, respectively, the octets are counted from 1 to n onwards; the bit position in a particular octet is indicated by #x..y, with {x,y} = 1..8 (bit 1 is the least and bit 8 the most significant bit).

4) If octets 5 to 5d of the ISDN BC are absent but present in the LLC, the LLC octets should apply for the mapping as indicated above. In the case of V.120 interworking (see note 24) these LLC octets shall apply.

5) If within the ISDN BC the parameters information transfer capability indicates "3,1 kHz audio" and user layer 1 protocol indicates "G.711 A-law" or "G.711 µ-law~~ (PCS-1900)~~" (PCS 1900) but no modem type is available and the HLC does not indicate "facsimile group 3", octets 5 to 5d of the LLC, if available, apply for the above mapping procedure.

6) The number of octets which shall be encoded for the ~~GSM~~ PLMN BC-IE ~~must~~shall comply to encoding rules in ~~GSM 04.08~~3G TS 24.008 and the combination of the different parameter values shall be in accordance to ~~GSM 07.01~~3G TS 27.001.

NOTES regarding the mapping:

~~(*) This GSM 04.08 parameter value is inserted, if the comparable ETS 300 102-1 parameter value is missing.~~

1) This ~~GSM 04.08~~PLMN parameter value is inserted according to user rate requirements and network capabilities / preferences.

2) This ~~GSM 04.08~~PLMN parameter value is inserted, if the information transfer capability in ISDN BC is "3,1kHz audio" and a comparable modem type is specified.

3) This ~~GSM 04.08~~PLMN parameter value is inserted, if the information transfer capability is "3,1 kHz audio" and the content of the HLC-IE, if any, indicates "facsimile group 2/3", (for details refer to subclause 10.2.2 case 3 for HLR action and case 5 for VMSC action). Note that via MAP the value "alternate speech/facsimile group 3 - starting with speech" shall be used, when TS 61 applies.

4) When interworking with an ISDN according to ETS 300 102-1, octets 4a and 4b may be present. The values are ignored and PLMN values are set according to notes 5 and 9. ~~If octet 4a is omitted the default condition according to ETS 300 102-1 applies.~~

5) ~~The GSM 04.08 parameter value shall be set to "unstructured" where the network indicates connection element "transparent".~~ This PLMN parameter value is inserted if the comparable ISDN parameter value is missing.

6) The value of the Intermediate Rate field of the GSM Bearer Capability information element shall only depend on the values of the user rate or the radio channel requirement in the same information element. If the connection element is "transparent“, the value is 16 kbit/s, if the user rate is 9.6 or 12 kbit/s, and 8 kbit/s otherwise. For any other connection element setting the value is 16 kbit/s, if the radio channel requirements are "full rate" or "dual, full rate preferred", or "dual, half rate preferred", and 8 kbit/s, if the radio channel requirements is "half rate".

7) This ~~GSM 04.08~~PLMN BC parameter value is inserted, if the ~~GSM~~ PLMN BC parameter "Information Transfer Capability" indicates "Unrestricted digital information", "facsimile group 3" or "alternate speech/facsimile group 3, starting with speech".

8) Where the network indicates "asynchronous" and connection elements "non-transparent", "both, transparent preferred" or "both, non-transparent preferred" , then the GSM BC should be forwarded without parameter user information layer 2 protocol, see also (10).

9) The PLMN parameter value shall be set to "unstructured" where the network indicates connection element "transparent". Where the network indicates connection elements "non transparent" "both, transparent preferred" or "both, non transparent preferred" the value of the parameter structure shall be set to "SDU Integrity".

10) Mapping of parameter values of this octet to ~~GSM~~ PLMN BC parameters and values are subject to specific application rules, i.e. unless otherwise explicitly stated in an appropriate TS mapping to ~~GSM~~ PLMN BC parameters shall not take place.

11) This value shall be used when the value of the ~~GSM~~ PLMN BC parameter "Information Transfer Capability" indicates the value "3,1 kHz audio ex PLMN", "facsimile group 3" or "alternate speech/facsimile group 3, starting with speech" which is reserved for MAP operations.

12) The modem encoding of both ~~Draft ETS 300 102-1/prA1~~ Q.931 (05/98) and ETS 300 102-1 version 1 shall be accepted and mapped according to ~~GSM 04.08~~3G TS 24.008.

13) Value not used for currently defined bearer services and Teleservices.

14) NIC is only supported in GSM for "3,1 kHz Ex PLMN audio" interworking with synchronous data transmission.

15) Because the required flow control mechanism can not be indicated to the MS (refer to ~~GSM 07.01~~3G TS 27.001), the network shall check if the flow control mechanism selected by the MS and indicated in the CALL CONFIRMED message suits to the requirements requested by the ISDN terminal adaptor. In case of a mismatch the call shall be released in the IWF.

    Because an asymmetric flow control mechanism (with respect to transmitting and receiving side) is not supported in ~~GSM~~ the PLMN~~s~~, the different values of the ISDN BC-IE parameters "flow control on Tx" and "flow control on Rx" shall be interpreted in the following way:

    - "Flow control on Rx" set to "accepted" matches with "outband flow control", irrespective of the value of the parameter "flow control on Tx"

    - "Flow control on Rx" set to "not accepted" and "flow control on Tx" set to "not required" matches with "inband flow control" and "no flow control"

    - where "Flow control on Rx" is set to "not accepted" and "flow control on Tx" to "required" the call shall be released by the IWF

16) If in case of 3,1 kHz audio interworking "inband negotiation possible" is indicated and the parameter user rate is set to "rate is indicated by E bits specified in Recommendation I.460 or may be negotiated inband" the user rate in the ~~GSM~~ PLMN BC-IE shall be set according to a network preferred value, whereas the preferred value of the Radio Channel Requirement shall be considered. If ISDN BC parameter ~~ISDN BC~~ modem type is present, its value shall be ignored. The PLMN BC parameter ~~GSM BC~~ modem type shall be set according to the user rate in case of connection element "transparent" and to "autobauding type 1" in case of connection element "non transparent", "both, transparent preferred" or "both, non transparent preferred". In case of data compression high speed modems, like V.32bis, V.34 and/or V.~~34~~ 90 may be used in the IWF.

For unrestricted digital interworking the call shall be rejected if these values are indicated.
If the ~~GSM~~PLMN- BC parameter modem type indicates "autobauding type 1" or "none", then the ~~GSM BC~~PLMN BC parameter other modem type shall be set to "no other modem type".

17) For the use of NIRR see ~~GSM 07.01~~3G TS 27.001. The VMSC shall set this parameter dependent upon its capabilities and preferences.

18) If compression is supported by the MSC, the value "data compression possible" may be set. Depending on the capabilities of the MSC, the user rate value and the intermediate rate value is set to an appropriate value.

19) Only applicable if the parameter ISDN-BC ITC indicates "3.1 kHz audio" and for "UDI" calls if User Rate > "19.2 kbit/s".

20) The user rate of the ~~GSM~~ PLMN BC is set to the value for the fall-back bearer service. In case the mobile station does not support the fixed network user rate (i.e. the call confirmation message does not contain the fixed network user rate parameter), the network may release the call for a transparent connection element.

21) The modem type parameter of the ~~GSM~~PLMN-BC is taken into account, only.

22) In case no LLC is received and the ISDN-BC received consists of octets 1 to 4 only, coded:

Coding standard:	CCITT
Information Transfer capability:	UDI
Transfer mode:	circuit
Information transfer rate:	64kbit/s,

the following ~~GSM~~PLMN-BC parameters, indicating a 64 kbit/s bit transparent service, shall be set to:

fixed network user rate:	64 kbit/s
connection element:	transparent

The other parameters of the ~~GSM~~PLMN-BC shall be set to values indicating a fall-back service.

23) When the MSC is directly connected to a restricted 64 kbit/s network, the ISDN BC-IE is coded with an ITC = RDI ~~(not applicable to ISDNs conforming to ETS 300 102-1)~~.
An ISDN BC-IE, as specified in ETR 018 and shown below, shall be taken to indicate that interworking with an indirectly connected restricted 64 kbit/s network is required

Coding standard:	CCITT
Information Transfer capability:	UDI
Transfer mode:	circuit
Information transfer rate:	64 kbit/s
User information layer 1 protocol:	V.110/X.30
Synchronous/Asynchronous:	synchronous
Negotiation:	In-band negotiation not possible
User rate:	56 kbit/s

In this case the ~~GSM~~ PLMN BC parameter Information Transfer Capability is set to „Other ITC“ and Other ITC parameter is set to „restricted digital“. All the corresponding fields in the ~~GSM~~ PLMN BC shall be derived from the ISDN LLC.

24) V.120 interworking is required if the ISDN LLC parameter User Information Layer 1 Protocol is set to „V.120“. In this case the ~~GSM~~ PLMN BC parameter Rate Adaptation is set to „Other rate adaptation“ and Other Rate Adaptation parameter is set to „V.120“. All the corresponding fields in the GSM BC shall be derived from the ISDN LLC.

25) This parameter is only included in case of non-transparent multislot connections.

26) This value was used by services defined for former GSM releases and does not need to be supported.

10.2.3 Transparent service support ~~(see GSM 03.10)~~

The protocol stacks for transparent services are specified in GSM 03.10 (GSM) and in 3G TR 23.910 (UMTS).

In UMTS, the transparent services are based in the Iu User Plane protocol specified in 3G TS 25.415.

In GSM, ~~08.20 identifies~~ the rate adaptation scheme ~~to~~shall be utilized on the BSS to MSC link as identified in GSM 08.20. The transcoding function will generate the 64 kbit/s rate adapted format utilizing the 8 and 16 kbit/s intermediate data rates. The MSC - MSC/IWF will utilize the same rate adaptation scheme as that indicated in GSM 08.20, i.e. adapted to 64 kbit/s.

10.2.3.1 Structure of the MSC/IWF for UMTS

The transmission towards the RNC is based on AAL2. The Iu UP is used in the transparent mode.

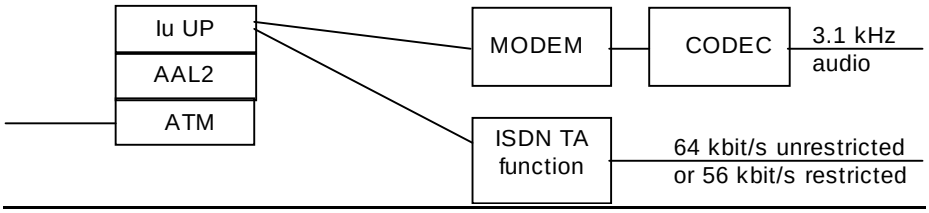


Figure 10: Structure of the MSC/IWF (transparent)

~~10.2.3.1 MSC - IWF rate adaptation scheme~~

~~This link consists of a 64 kbit/s channel with the information, both user data and in band parameter information (where provided) rate adapted in conformance to GSM 08.20.~~

10.2.3.2 ~~Rate adaptation process in~~Structure of the MSC/IWF for GSM

When interworking to the unrestricted digital bearer service rate adaptation according to ITU-T V.110 will be necessary within the MSC/IWF. For multislot, TCH/F14.4 or EDGE operations MSC/IWF shall adapt the data stream as defined in GSM 04.21 and GSM 08.20. NOTE: From the perspective of MSC/IWF, a TCH/F28.8 EDGE configuration is identical to a multislot 2×TCH/F14.4 configuration.

When interworking to the 3,1 kHz audio service, then the same process as for the PSTN case is necessary (section 9.2.3.2).

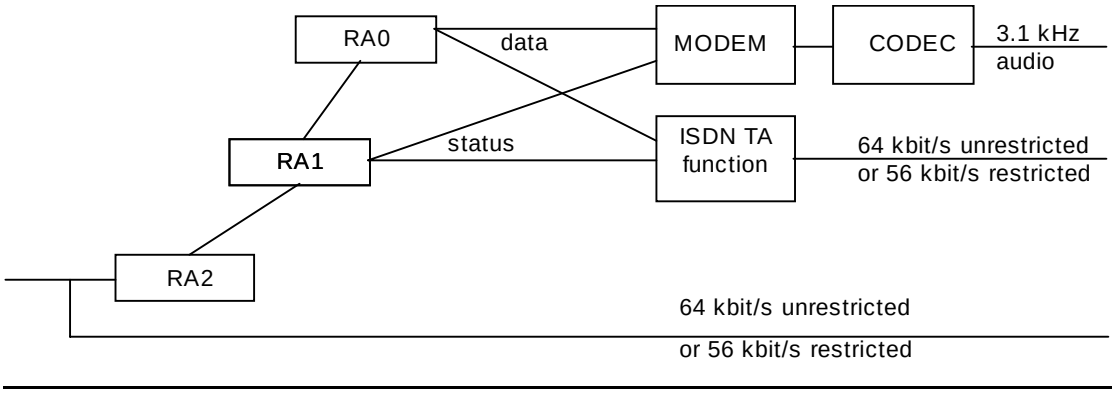
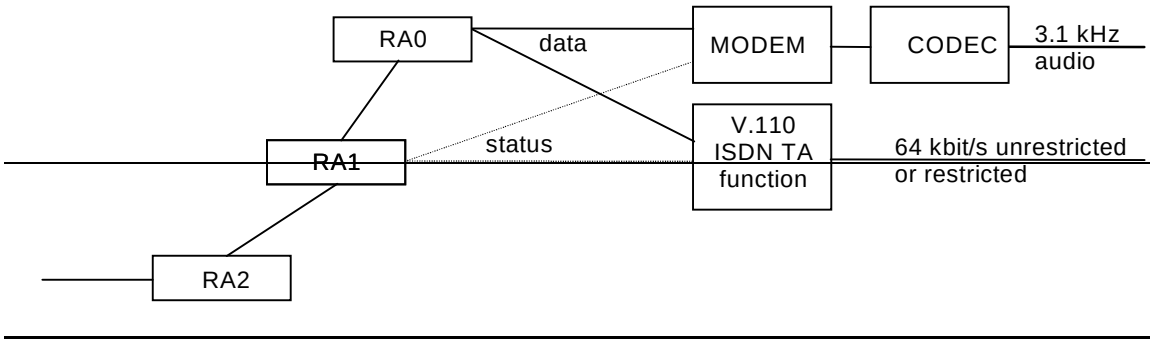


Figure 11: Structure of the MSC/IWF (transparent)

10.2.3.3 Mapping of signalling MS/MSC/IWF to modem or ISDN (V.110) TA-function interface requirements

For the 3,1 kHz audio interworking case see subclause 9.2.3.3.



~~Figure 8: Structure of the MSC/IWF (transparent)~~

Status bits SA, SB and X can be used to convey channel control information associated with the data bits in the data transfer state. Table 8 shows the mapping scheme between the V.24 circuit numbers corresponding to the V-series DCE functions 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 B. 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 GSM 04.21 and 08.20 for GSM. For UMTS refer to 3G TR 23.910.

NOTE. Although the interface to the ISDN TA function is described in terms of V.24 interchange circuit functions, this does not imply that such circuits need to be physically realised.

Table 8: Mapping scheme at the IWF for the transparent mode

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

NOTE 1. The SB bit towards the IWF, according to the General Mapping (annex B), could be used to carry CT 105 from the mobile DTE to the ISDN TA function in the IWF. However, CT 105 should always be ON at the DTE interface 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. Therefore, CT 105 shall always be set to ON at the IWF ISDN TA function during 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 since there is no flow control in transparent mode.

NOTE 5. CT 107 is not used by the IWF.

NOTE 6. CT 108 is used in the call setup and answering processes.

10.2.3.4 Establishment of end-to-end terminal synchronizations

Prior to exposing the traffic channel of a PLMN connection to transmission of user data, the controlling entities of the connection ~~have to~~shall assure of the availability of the traffic channel. This is done by a so called synchronizations process:

- starting on the indication of "physical connection established" resulting from the PLMN-inherent outband signalling procedure This indication is given on sending the message CONNECT in case of MOC, CONNECT ACKNOWLEDGEMENT in case of MTC and MODIFY COMPLETE (which is sent after reception of the ASSIGN COMPLETE message) 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).

Network interworking within an MSC/IWF is concerned with the terminating side (to the MS / UE) and the transit side (to the fixed network) of a connection. Both sides ~~have to~~shall be treated individually related to the synchronizations process.

10.2.3.4.1 Terminating side (towards the MS / UE)

10.2.3.4.1.1 GSM Traffic channel types TCH/F4.8 and TCH/F9.6

With respect to the terminating side the procedure is as follows:

- sending of synchronizations pattern 1/OFF (all data bits "1"/all status bits "OFF") to the MS using the RA1/RA2 rate adaptation function. 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 synchronizations pattern from the MS within valid V.110 frames, 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. This implies that the E1, E2 and E3 bit of the V.110 frame shall be checked for the appropriate user rate in order to distinguish the synchronization pattern from the BSS idle data frame.

- Timer T (= 500 ms) is started for each of the allocated traffic channel(s) of the call on receipt of the synchronizations pattern from the MS.

- When the frame alignment pattern and, in case of multislot operation, the multiframe alignment pattern have been recognized as a steady state, the MSC/IWF continues sending the synchronizations patterns to the MS until a timer T expires.

10.2.3.4.1.2 GSM Traffic channel type TCH/F14.4

With respect to the terminating side the procedure is as follows:

- ~~Searching for detection of the A-TRAU frame alignment pattern (TS 08.20) from the BSS.~~

- ~~After the detection of the A-TRAU frame alignment pattern, sending~~Sending A-TRAU frames with the data rate set in the bits C1-C4 (TS 08.20) and data bits set to one, sending the multiframe structure with the alignment pattern (bit M1) and with the status bits OFF (bit M2) and, in a multislot case, sending substream numbers (bit M2).

- Searching for the detection of the multiframe alignment pattern „0000 1001 0110 0111 1100 0110 1110 101“ (TS 04.21) in the bit M1 and, in a multislot 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 recognition of five successive M1 bits.)

- Timer T (= 500 ms) is started for each of the allocated traffic channel(s) of the call on receipt of the synchronizations pattern from the MS.

- When the frame alignment pattern and the multiframe alignment pattern have been recognized as a steady state, the MSC/IWF continues sending the synchronizations patterns to the MS until a timer T expires.

10.2.3.4.1.3 UMTS User Plane

The procedures are the same as for the modem case, but, depending on implementation, the IWF may through connect before the fixed network leg has been synchronised.

10.2.3.4.2 Transit side (towards the fixed network)

In case of interworking to the ISDN "3,1 kHz audio" bearer service the synchronization process is as for the PSTN interworking case (see subclause 9.2.3.4.2).

In case of V.110 interworking to the ISDN unrestricted digital bearer service the following synchronization process ~~has to~~shall be performed.

- The interchange circuits towards the V.110 ISDN TA function are held in the OFF condition until timer T ~~(see below)~~ expires, when they are switched to ON. ~~When the frame alignment pattern and, in case of multislot operation or TCH/F14,4, the multiframe alignment pattern have been recognized as a steady state, the MSC/IWF continues sending the synchronizations patterns to the MS until a timer T (= 500 ms) expires.~~

- From this time, after the expiration of the timer T of every allocated traffic channel, the information on CT106 and CT109 from the IWF V.110 ISDN TA function are directly mapped to the X and SB bits, respectively, towards the MS. For TCH/F14.4 the X and SB bits are mapped to the M2 multiframe bits according to GSM 04.21. Circuit 108 to the selected V.110 ISDN TA function associated with the connection will be switched from the "OFF" to "ON" condition, thus initiating the synchronization process on the fixed network according to ITU-T V.110. The IWF is allowed to map CT 104 to the data bits sent towards the MS and to map data bits received from the MS to CT 103.

10.2.3.5 Network independent Clocking (NIC)

Due to the incompatibility between the ISDN and the GSM requirements for NIC interworking is not provided between these two formats. As such no NIC function is required in providing interworking to the ISDN. In this case, the IWF shall disregard the value of bits E4, E5, E6 and E7 in the data transmission phase.

10.2.4 Non-transparent service support (See GSM 03.10)

The protocol stacks for non-transparent services are specified in GSM 03.10 (GSM) and in 3G TR 23.910 (UMTS). Both of the systems use the Radio Link Protocol (RLP) specified in 3G TS 24.022.

In UMTS, the non-transparent services are based in the Iu User Plane protocol specified in 3G TS 25.415.

In GSM, ~~08.20 identifies~~ the corresponding necessary support concerning the rate adaptation scheme ~~to~~shall be utilized on the BSS-MSC link as identified in GSM 08.20.

For the non-transparent service support the MSC/IWF will select the modem and speed based on the Compatibility information contained in either the call set-up or call confirmed message, reference subclause 9.2.1 and 9.2.2. Where the Modem Type indicated is autobauding type 1, the MSC/IWF may select any speed and modem type according to what it can negotiate with the remote modem. In this case User Rate and Fixed Network User Rate, if present, has no meaning.

10.2.4.1 Structure of the MSC/IWF for UMTS

The transmission towards the RNC is based on AAL2. The Iu UP is used in the support mode. The RLP/L2R extends to the MS.

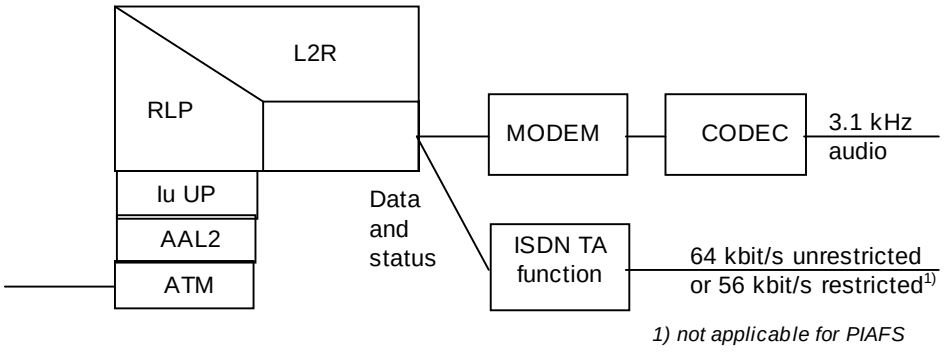


Figure 12: Structure of the MSC/IWF (non-transparent)

10.2.4.2 Structure of the MSC/IWF for GSM

~~10.2.4.1 MSC - IWF Rate adaptation scheme~~

~~This~~ The rate adaptation process will be the same as for the transparent case~~.~~ , except that a TCH/F43.2 channel coding is also supported. From MSC/IWF's perspective a TCH/F43.2 EDGE configuration is identical to a multislot 3×TCH/F14.4 configuration.

~~10.2.4.2 Structure of the MSC/IWF~~

GSM 03.10 identifies the protocol layer structure for the non-transparent case, the MSC/IWF provides the inverse of the action in the MS terminal adaptation function. For a multislot configuration refer to GSM 03.10.

The V.110 and V.120 ISDN TA (terminal adapter) functions provide the same functionality and operational behaviour as fixed ISDN terminal adapters that conform to the corresponding ITU-T Recommendations (V.110 or V.120).

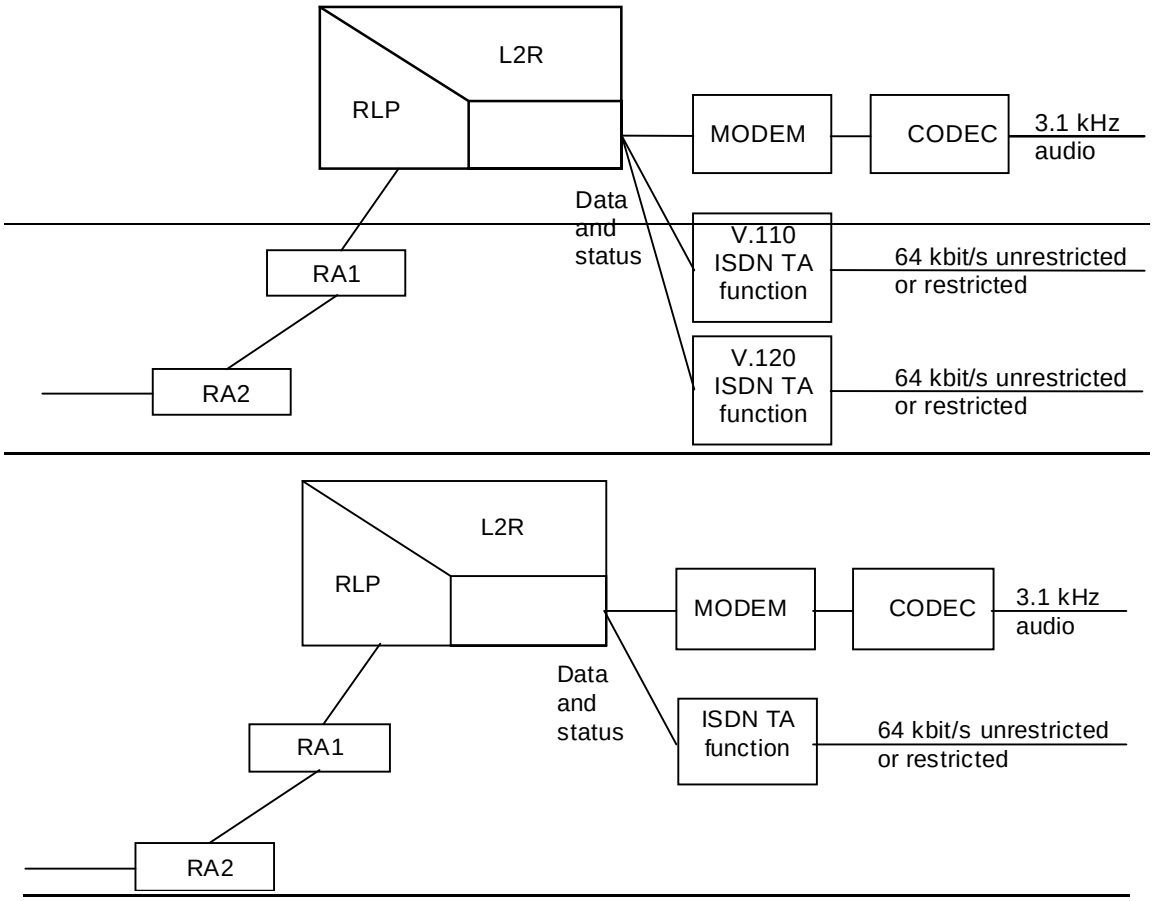


Figure ~~9~~13: Structure of the MSC/IWF (non-transparent)

10.2.4.3 Re-constitution of user data

~~GSM 04.22~~3G TS 24.022 refers to the frame of user data in the radio link protocol. The layer 2 relay functions in the MS and the MSC/IWF (identified in GSM 03.10 and 3G TS 23.910) contain the mechanism for packing and unpacking the user data into the L2R protocol data units.

10.2.4.4 Layer 2 relay functionality

Specific functionality is required on the L2R dependant upon the service which is being requested to be supported. The selection of the appropriate L2R function will be determined by the MSC/IWF on the basis of the bearer capability information signalled in the call set-up request, or call confirmation message. The prime information element being transparent or non transparent service indication. In addition the particular L2R function - type of protocol to be terminated and mode of flow control to be applied (see appropriate subclauses in ~~07~~ 3G TS 27 series) - will be selected on the basis of the user's layer 2 indication.

The specific interaction between the L2R function and the RLP function and the L2R frame structure will be the same as that detailed in the Annex to the appropriate ~~GSM 07~~3G TS 27 series.

10.2.4.5 In band signalling mapping flow control

This entails the L2R function providing the means of controlling and responding to flow control function of the modem (or in the rate adapted frame) plus any synchronizations requirements related to flow control. for synchronous services flow control is covered by the protocol indicated whereas for asynchronous services a specific rule applies for flow control (see ~~GSM 07.01~~3G TS 27.001).

In case of interworking to the ISDN "3,1kHz audio" bearer service the flow control process is as for the PSTN interworking case (see subclause 9.2.4.5). In case of interworking to the ISDN unrestricted digital bearer service the following procedures apply:

The flow control function chosen will be dependent upon the availability of the "user information layer 2" information element of the GSM BC and if available its value.

For V.110 interworking, outband flow control will be by means of the "X" bit in the V.110 frame to the ISDN.

For V.120 interworking, outband flow control shall be as follows. In Multiple frame acknowledged mode the functions of the data link control sublayer (send RNR or withhold update of the sequence state variable V(R)) shall be used. In Unacknowledged mode the RR bit in the Control State octet shall be used.

If flow control is provided irrespective of the type used, the L2R function ~~must~~shall:

a) provide immediate indication of flow control to the fixed network on receipt of flow control request from the MS.

and/or

b) provide immediate indication of flow control to the MS on receipt of flow control request from the fixed network i.e. in the next available L2R status octet to be transmitted.

Where in band (X-on/X-off) flow control is in use, then the X-on/X-off characters will not be passed across the radio interface.

If no flow control is provided the involved end systems are responsible for performing in-band flow control on their own by taking into account the buffer capacity of the MSC/IWF as stated below.

10.2.4.5.1 Conditions requiring flow control - if flow control is provided - towards the fixed network

The L2R function will initiate flow control in the following circumstances:

1) The transmit buffer to the radio side reaches a preset threshold (BACK PRESSURE).

2) The L2R function receives a "flow control active" indication.

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

No flow initiation/removal will take place at the L2R function and loss of data may occur, if no flow control is provided.

10.2.4.5.2 Conditions requiring flow control towards the MS

The L2R function will transmit to the MS a "flow control active indication", if flow control is provided, in the following circumstances:

1) If the receive buffer from the radio side reaches a preset threshold (BACK PRESSURE).

2) If a flow control indication is received from the fixed network customer. On receipt of this flow control indication, transmission of data from the receive buffers towards the fixed network terminal is halted.

On removal of the buffer congestion or fixed network flow control indication, the L2R function will send a "flow control inactive" indication towards the MS. In addition, for the fixed network indication, transmission of data from the receive buffers will be restarted.

If no flow control is provided at the L2R function, no flow control initiation/removal will take place by the MSC/IWF. Data might be lost without any indication by the MSC/IWF to the end systems involved.

10.2.4.6 Data buffers

10.2.4.6.1 Transmit buffers (towards MS)

Incoming data from the fixed network customer shall be buffered such that if the MSC/IWF is unable to transfer data over the radio path the 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 flow control towards the fixed network shall be initiated if flow control is provided as per subclause 10.2.4.5.1.

10.2.4.6.2 Receive buffers (from MS)

Incoming data from the MS is buffered such that if the fixed network terminal is unable to accept the data then it is not lost.

The buffer shall be capable of holding the data. Its size is up to the implementers. When the buffer becomes half full, the L2R function will send a "flow control active" indication towards the MS if flow control is provided at the L2R function, as per subclause 10.2.4.5.2.

10.2.4.7 BREAK Indication

The BREAK indication is managed as detailed in subclause 9.2.4.7.

When V.120 rate adaptation is being used in protocol sensitive asynchronous mode on the ISDN, the L2R break condition shall map on to the BR bit of the V.120 header octet.

10.2.4.8 Signalling mapping of modem or ISDN (V.110 or V.120) TA-function status information

Status information is carried between the modem or ISDN (V.110 or V.120) TA-function in the IWF and the terminal adaption function in the MS by the L2R function. The L2RCOP entity transfers interface status information between L2Rs via the status octets SA, SB and X in L2RCOP-PDUs (~~07.02~~3G TS 27.002). Table 9 shows the mapping scheme between the V.24 circuit numbers corresponding to the V-series DCE functions 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 B. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

NOTE. Although the interface to the ISDN TA function is described in terms of V.24 interchange circuit functions, this does not imply that such circuits need to be physically realised.

Table 9: Mapping scheme at the IWF for the non-transparent mode

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

NOTE 1. The SB bit towards the IWF, according to the General Mapping (annex B), could be used to carry CT 105 from the mobile DTE to the ISDN TA function in the IWF. However, CT 105 should always be ON at the mobile DTE interface 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. Therefore, CT 105 shall always be set to ON at the ISDN TA function during the data transfer state.

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

NOTE 3. The condition of CT 133 (or other flow control mechanism) may also be affected by the state of the L2R transmit buffer (towards the MS) in the IWF and the state of RLP (RR/RNR).

NOTE 4. The condition of status bit X towards the MS may also be affected by the state of the L2R receive buffer in the IWF (from the MS).

NOTE 5. CT 107 is not used by the IWF.

NOTE 6. CT 108 is used in the call setup and answering processes.

NOTE 7. For inband flow control, CT 106 is not mapped and the status bit X towards the MS is controlled by the reception of XON and XOFF characters from the ISDN TA function.

NOTE 8. For inband flow control, changes in the condition of the status bit X from the MS result in the sending of XON or XOFF to the ISDN TA function. CT 133 is always set to ON.

10.2.4.9 Support of out-band flow control

Out-band flow control in the case of V.110 rate adaption requires V.110 TA to TA "end-to-end flow control" as defined therein. If this functionality is requested by MS but cannot be supported by the MSC/IWF for any reason (refer also to note 15 of table 7B) the call pending shall be released.

For V.120 interworking, outband flow control shall be as follows. In Multiple frame acknowledged mode the functions of the data link control sublayer (send RNR or withhold update of the sequence state variable V(R)) shall be used. In Unacknowledged mode the RR bit in the Control State octet shall be used.

10.2.4.10 Synchronizations

In case of interworking to the ISDN "3,1kHz audio" bearer service the synchronization process is as for the PSTN interworking case (see subclause 9.2.3.4). In case of interworking to the ISDN unrestricted digital bearer service the following synchronization process ~~has to~~shall be performed:

10.2.4.10.1 V.110 and V.120 Frame synchronizations

The ISDN frame synchronizations will need to be mapped to the frame synchronizations utilized on the MSC/IWF to MSC link.

10.2.4.10.2 RLP Frame start indication

The frame start indication is defined in GSM 08.20. Link establishment and frame error recovery are defined in ~~GSM 04.22~~3G TS 24.022.

10.2.4.10.3 L2R Frame synchronizations

The synchronizations of user data and its interaction between the L2R function and RLP function are defined in ~~GSM 07~~3G TS 27 series .

10.2.4.10.4 Establishment of end-to-end terminal synchronizations

Prior to exposing the traffic channel of a PLMN connection to transmission of user data, the controlling entities of the connection ~~have to~~shall assure of the availability of the traffic channel. This is done by a 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 sending the message CONNECT in case of MOC, CONNECT ACKNOWLEDGEMENT in case of MTC and MODIFY COMPLETE (which is sent after reception of the ASSIGN COMPLETE message) 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 in-band information (data, status).

Network interworking within an MSC/IWF is concerned with the terminating side (to the MS) and the transit side (to the fixed network) of a connection. Both sides ~~have to~~shall be treated individually related to the synchronization process.

10.2.4.10.4.1 Terminating side (towards the MS)

The procedures are the same as for the modem case.~~With respect to the terminating side the procedure is as follows:~~

- ~~reception of V.110 or A-TRAU frames on all allocated traffic channels for the call is required before the MSC/IWF shall reply with an RLP UA frame to the MT's RLP link establishment request (if the MSC/IWF initiates the RLP link establishment, reception of V.110 or A-TRAU frames on all allocated traffic channels for the call must be detected first)~~

- ~~waiting for RLP link establishment by the MT (in addition the MSC/IWF may initiate the RLP link establishment).~~

10.2.4.10.4.2 Transit side (towards the fixed network)

Depending upon implementation, the synchronization of the V.110 or V.120 rate adaptation protocol on the ISDN transit network may be performed either after RLP establishment or in parallel to the RLP establishment. In case of the parallel establishment, data received from the transit side during RLP establishment shall be stored within the L2R buffers until the RLP establishment at the terminating side has been finished. When the RLP has been established and on recognizing frame alignment the information from/to the RLP is mapped by the L2R entity applicable to this particular bearer capability.

For V.110 rate adaptation on the ISDN, the synchronization process consists of sending the V.110 frame structure and looking for incoming frame synchronization according to the procedures in ITU-T V.110.

For V.120 rate adaptation the following applies. In Multiple frame acknowledged mode, data (I frames) may be sent following an exchange of SABME and UA in the traffic channel. In Unacknowledged mode, data (UI frames) may be sent immediately after an ISUP CONNECT or CONNECT COMPLETE message has been received on the ISDN signalling channel. Optionally, an XID exchange may take place in the traffic channel to verify link integrity.

Note. V.120 allows UI frames to be sent in Multiple frame acknowledged mode at any time in addition to I frames. Whilst the IWF shall not follow this procedure when sending frames, such a sequence of I and UI frames may be received by the IWF. Although not specified in V.120, it is recommended that the IWF should deliver to the MS, the contents of the sequence of I and UI frames in the order in which they are received.

10.2.4.11 Data compression

When data compression is invoked within a non-transparent bearer service, interworking to the ISDN is realized by mapping the ~~GSM~~ PLMN user rate to at least the same user rate in the ISDN. When the ISDN user rate is the same flow control will ensure data integrity, but the overall performance will be slow. When the ISDN user rate is higher the overall performance may be faster.

10.2.4.12 Additional aspects of V.120 Interworking

V.120 rate adaptation may be invoked with either synchronous or asynchronous services. V.120 is applicable to both UDI and RDI connections.

10.2.4.12.1 V.120 Signalling parameters

The signalling parameters relevant to V.120 will be carried in the ISDN LLC and ~~GSM~~ PLMN BC and ~~GSM~~ PLMN LLC information elements. The mapping of the parameter values takes place in the MSC/IWF.

For mobile terminated calls both single-numbering and multi-numbering scenarios may apply, as defined in subclause 9.2.2. The HLR shall not store an ISDN LLC with the MSISDN.

10.2.4.12.2 V.120 Protocol parameters

The following restrictions apply for the parameters relevant for V.120:

- BS 2x NT will use the protocol sensitive asynchronous mode~~,~~. BS 3x 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.

10.2.4.12.3 Data compression on the ISDN

Whilst V.110 rate adaptation does not support standardized data compression, V.42bis data compression may be used with V.120 protocol sensitive asynchronous mode. This is described in V.120 (10/96) annex C.

10.2.4.12.4 Use of the V.120 Control State (header extension) octet

The bits in the V.120 Control State octet are not used for the control of V.24 interface circuits. In unacknowledged mode the RR bit in the Control State octet is used to carry flow control information between the peer terminal adaption protocol entities. In acknowledged mode the Control State octet is not required.

10.2.4.13 Interworking with restricted 64 kbit/s networks

10.2.4.13.1 Rate adaptation

Both V.110 and V.120 rate adaption protocols may be used on a restricted 64 kbit/s network.

For V.110 rate adaption, the procedure is described in ~~CCITT~~ ITU-T Rec. I.464. The RA2 function shall set the 8th bit of each octet in the 64 kbit/s stream to binary 1. A consequence of this is that the highest permitted intermediate rate is 32 kbit/s. At the receiver, the 8th bit shall be ignored.

Rec. V.120 states that the user data shall be rate adapted to 56 kbit/s by using only the first 7 bits of each octet in the 64 kbit/s stream. The 8th bit shall be set to binary 1. At the receiver, the 8th bit shall be ignored.

10.2.4.13.2 MSC - ISDN signalling

When interworking indirectly with restricted 64 kbit/s networks the ISDN BC information element shall be coded according to ETR 018 (as shown in the notes to tables 7A and 7B). The information corresponding to the GSM BC-IE shall be communicated in the ISDN LLC-IE which shall be provided by the MS for mobile originated calls.

In the case of direct interworking, an ITC = RDI in the GSM BC-IE maps on to an ITC = RDI in the ISDN BC-IE for both MO and MT calls ~~(not applicable to ISDNs conforming to ETS 300 102-1)~~.

10.2.4.14 Service level up and down grading

Text in 9.2.4.~~12~~ 13 applies here as well.

10.2.5 DTE/DCE interface (Filtering)

This is described in section 9.2.5.

10.3 Interworking Alternate speech facsimile group 3 calls

10.3.1 Alternate speech data bearer interworking

10.3.1.1 General

The procedure for the alternate speech/facsimile group 3 service is invoked at the MS-MSC link during the call set-up phase. This service is invoked by indication of repeated bearer capability information elements in the setup message

and/or call confirmed message, respectively (preceded by a repeat indicator "circular"), one indicating speech and the other indicating "facsimile group 3" plus user rate etc., as for normal single calls. The bearer capability first indicated i.e. speech or facsimile determines the first selection required of the network by the subscriber. Depending on the type of service requested and direction of call establishment (M0/MT, see relevant clauses of the ~~07~~ 3G TS 27 series) low layer and high layer capabilities may also be included. The MSC/IWF will perform both compatibility checking and subscription checking for mobile originated calls and optionally for mobile terminated calls (single numbering scheme) on both sets of capabilities as for normal data calls. If either the subscription check or the compatibility check fails then the call shall be rejected. The only exception to this is when TS61/TS62 negotiation takes place, see ~~GSM 07.01~~3G TS 27.001.

As regards the supplementary services the application rules are laid down in ~~GSM 02.04~~3G TS 22.004.

The speech phase of the call, when invoked, is handled by the transcoder and will utilize the normal telephony teleservice interworking requirements and mobile network capabilities. The Facsimile group 3 phase of the call, when invoked, will utilize the appropriate data interworking capability (e.g. IWF) and may use either the transparent or non-transparent mobile network capability.

The network shall provide, for service and operational reasons, a rapid and reliable changeover of capability upon request from the mobile user. This changeover may involve the disabling, by-passing or introduction of particular network functions (e.g. speech coder, modem etc.) and change of the channel configuration on the radio interface. This changeover is initiated on the receipt of the "MODIFY" message (see ~~GSM 04.08~~3G TS 24.008) from the MS. The network itself will not initiate a changeover.

10.3.1.2 Mobile originated ISDN terminated

If one bearer capability information element indicates the ITC value "facsimile group 3", the call set up is as for the PSTN case. Interworking is provided to the ISDN bearer service 3,1 kHz audio for the whole connection, including the speech phase. The MODIFY message (see ~~GSM 04.08~~3G TS 24.008) will be generated by the mobile subscriber. This message is not transmitted to the ISDN, i.e. no outband correlation between the user on the fixed network and the mobile user will be possible. In this instance it is necessary for change of network capabilities to be carried out in the mobile network.

10.3.1.3 ISDN originated mobile terminated

In principle this is handled as for normal ISDN originated call.

When the calling user however indicates an ISDN BC-IE with an ITC value "3,1 kHz audio" and a HLC "facsimile group 3", i.e. the call arrives at the GSM with compatibility information allowing for deducing the Teleservice "Facsimile transmission", the call setup is as described in subclause 10.2.2 (case 3 in HLR, case 5 in VMSC).

In the information transfer phase the call is dealt with as indicated in the previous paragraph.

11 Frame Synchronization

Potentially two links are involved in the MSC/IWF regarding the need for frame synchronization, i.e~~ the MSC/IWF-BSS interface and the MSC/IWF-PSTN/ISDN interface~~ the link towards the MS and the link towards the fixed network. The ~~MSC/IWF-BSS~~ links towards the MS are covered by ~~the TSs dealing with the GSM transcoder function (i.e.~~ GSM TS 08.20 and 08.60 for GSM and 3G TS 25.415 for UMTS~~)~~. For the ~~MSC/IWF-PSTN/ISDN interface~~link towards the fixed network, the appropriate sections of ITU-T V-series modem, V.110 and V.120 Recommendations apply.

11.1 Initial frame synchronization

11.1.1 Terminating side (towards the MS / UE)

In UMTS, the terminating side is not synchronous.

In GSM, ~~F~~for transparent/non-transparent and interworking to the PSTN or ISDN the interface to the BSS is managed as follows. As soon as the outband signalling exchange indicates that the traffic channel is available the MSC/IWF will start sending frames with the frame contents set as indicated in subclause 9.2.3.4.1 towards the BSS. The MSC/IWF will seek to attain V.110 or A-TRAU frame synchronization on the incoming data from the BSS. V.110 synchronization will be considered to be completed in line with the procedures described in subclause 9.2.3.4.1.1. A-TRAU frame synchronization will be considered to be completed in line with the procedures described in 9.2.3.4.1.2. The incoming data will only be considered valid once the frame synchronization procedure defined in clause 9.2.3.4.1 is complete. For non-transparent interworking to the PSTN or ISDN, the procedures described in subclause 9.2.4.10.1 shall be followed.

11.1.2 Transit side (towards the fixed network)

11.1.2.1 Interworking to the PSTN

In the case of interworking to the PSTN the procedures for initial synchronization for the transparent services are covered in subclause 9.2.3.4.2 and the non-transparent services in subclause 9.2.4.10.2.

11.1.2.2 Interworking to the ISDN

In the case of interworking to the ISDN the procedures for initial synchronization for the transparent services are covered in subclause 10.2.3.4.2 and the non-transparent services in subclause 10.2.4.10.4.2.

11.2 Action on loss of frame synchronization

The IWF should attempt to recover synchronization as described in the following subsections. If the resynchronization attempt fails, the IWF may clear the call.

11.2.1 Loss on the transit side (towards the fixed network)

If loss of frame synchronization is detected from the fixed network in line with the procedures specified in the ITU-T recommendation applicable to the type of interworking (V.110, V.120 or V-series modem), then re-synchronization is initiated in line with the procedures specified in that recommendation. No change of behaviour of the MSC/IWF on the BSS/MSC link is necessary.

11.2.2 Loss on the terminating side (towards the MS / UE)

In UMTS, the terminating side is not synchronous, so loss of synchronisation is not possible. For T services, frames may be lost or arrive irregularly, which handling is implementation dependent.

In GSM, ~~I~~if the MSC/IWF detects a loss of frame synchronisation on one or more substreams on the BSS/MSC link, the MSC/IWF initiates a re-synchronisation on the substreams in question as specified in the following.

The MSC/IWF shall detect a loss of V.110 frame synchronisation in line with the rules specified in ITU-T V.110. The MSC/IWF shall detect a loss of A-TRAU frame synchronisation when an A-TRAU frame has been received with at least one error in the synchronisation pattern (ref GSM TS 08.20).

If loss of synchronization is detected on the BSS/MSC link then a re-synchronization process should be initiated. However for this link to the BSS it is only necessary to search for the frame alignment pattern incoming from the BSS. In the case of A-TRAU the synchronisation shall take care of the multiframe alignment according to subclause 9.2.3.4.1.2 and the MSC/IWF shall set the control bit UFE (Uplink Frame Error, see GSM TS 08.20) in the next downlink A-TRAU frame to indicate the framing error to the BSS.

There shall be no action regarding the outgoing frame towards the BSS, other than to continue sending the rate adapted frames made up of the incoming data from the fixed network. During the re-synchronization process data shall continue

to be sent towards the fixed network via the modem or ISDN (V.110 or V.120) TA-function as if the frame synchronization were still available. The mapping of the status bits is unchanged during re-synchronization.

Once synchronization has been re-attained the RLP will recover any possible loss of data on the BSS/MSC link in the case of non-transparent services. The indication of UFE will be stopped in the case of A-TRAU.

12 Call Clearing

When a call is to be cleared, the MSC/IWF ~~has to~~shall handle both the links, towards the MS as well as towards the fixed network~~MSC/IWF-BSS interface and the MSC/IWF-ISDN/PSTN interface~~.

At the ~~MSC/IWF-BSS interface~~link towards the MS out-band (~~04.08~~3G TS 24.008) signalling shall be used. Changes in the in-band status bits shall not be used to signal call clearing.

At the ~~MSC/IWF-PSTN/ISDN interface~~link towards the fixed network, the clearing procedures appropriate to the fixed network shall be used, together with any additional procedures described in the ITU-T recommendation applicable to the type of interworking (V.110, V.120 or V-series modem).

Annex A (Informative): SDLs

The following SDLs are intended to assist in the interpretation of the text in subclause 10.2.2 and are not intended to indicate implementation requirements. Therefore these SDLs are informative only.

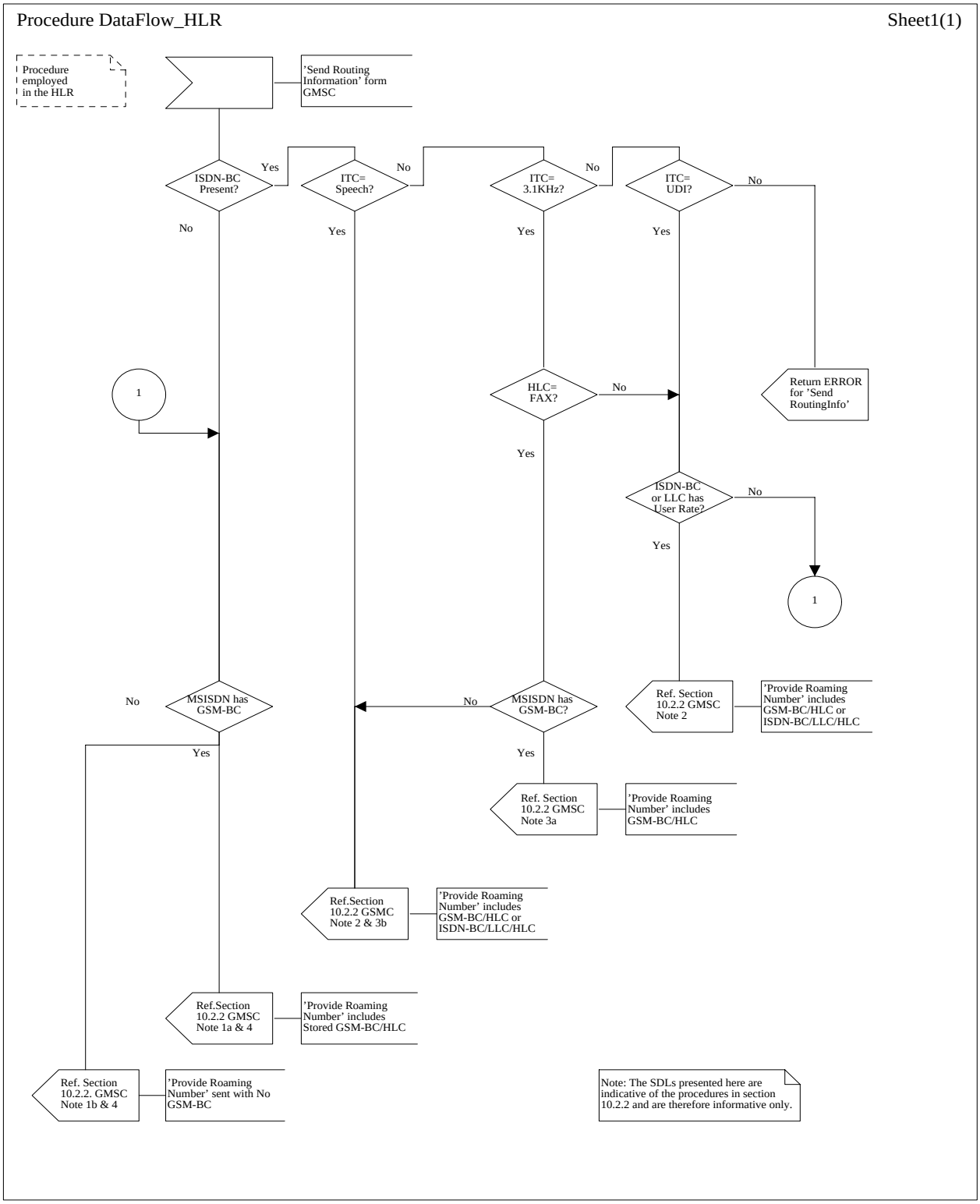


Figure A-1 (Sheet 1 of 1): Procedures in the HLR

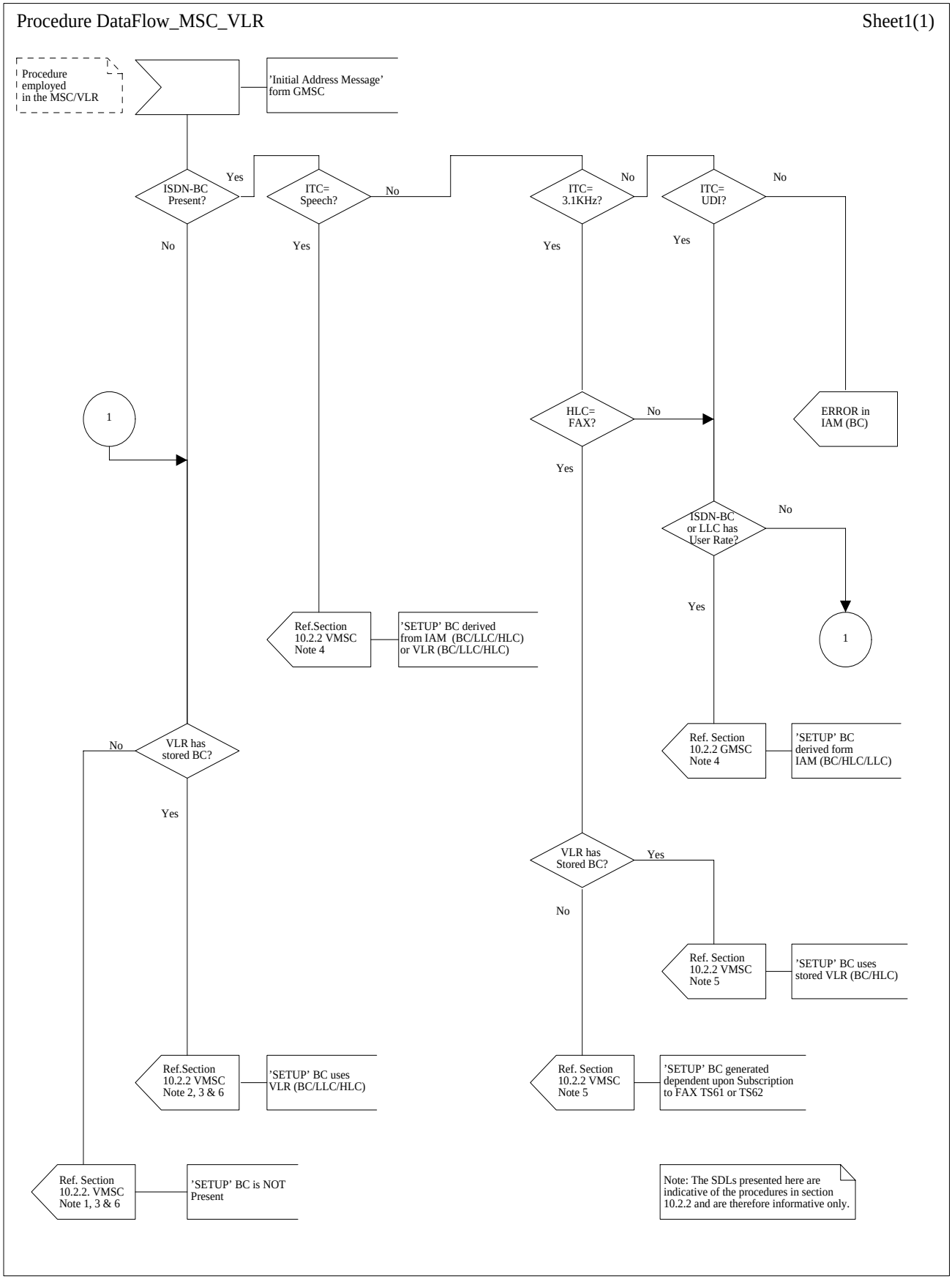


Figure A-2 (Sheet 1 of 1): Procedures in the MSC/VLR

Annex B (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 in the IWF. 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.

Since the V.24 circuits that are outputs from a DCE are inputs to a DTE (and vice versa), this mapping is the reverse of that used in the MT (~~07.02~~3G TS 27.002, ~~07.03~~3G TS 27.003).

For example, CT 109 is an output from the modem in the IWF and maps on to SB towards the MT. In the MT, SB is mapped on to CT 109 which is an input to the attached DTE.

Table B1: General mapping scheme at the IWF

Status bit direction: MS to IWF	Status bit direction: IWF to MS	Signal at IWF modem interface
SB		105 (note 3)
	X (note 1)	106
	SA	107
SA		108
	SB	109
X		133 (notes 2, 3)

NOTE 1. The condition of X towards the MS may also be affected by the state of any transmit buffer in the IWF.

NOTE 2. The condition of CT 133 towards the modem may also be affected by the state of any receive buffer in the IWF or layer 2 flow control condition between the MT and IWF.

NOTE : 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 at the DTE/MT interface 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/UMTS) there should be no conflict.