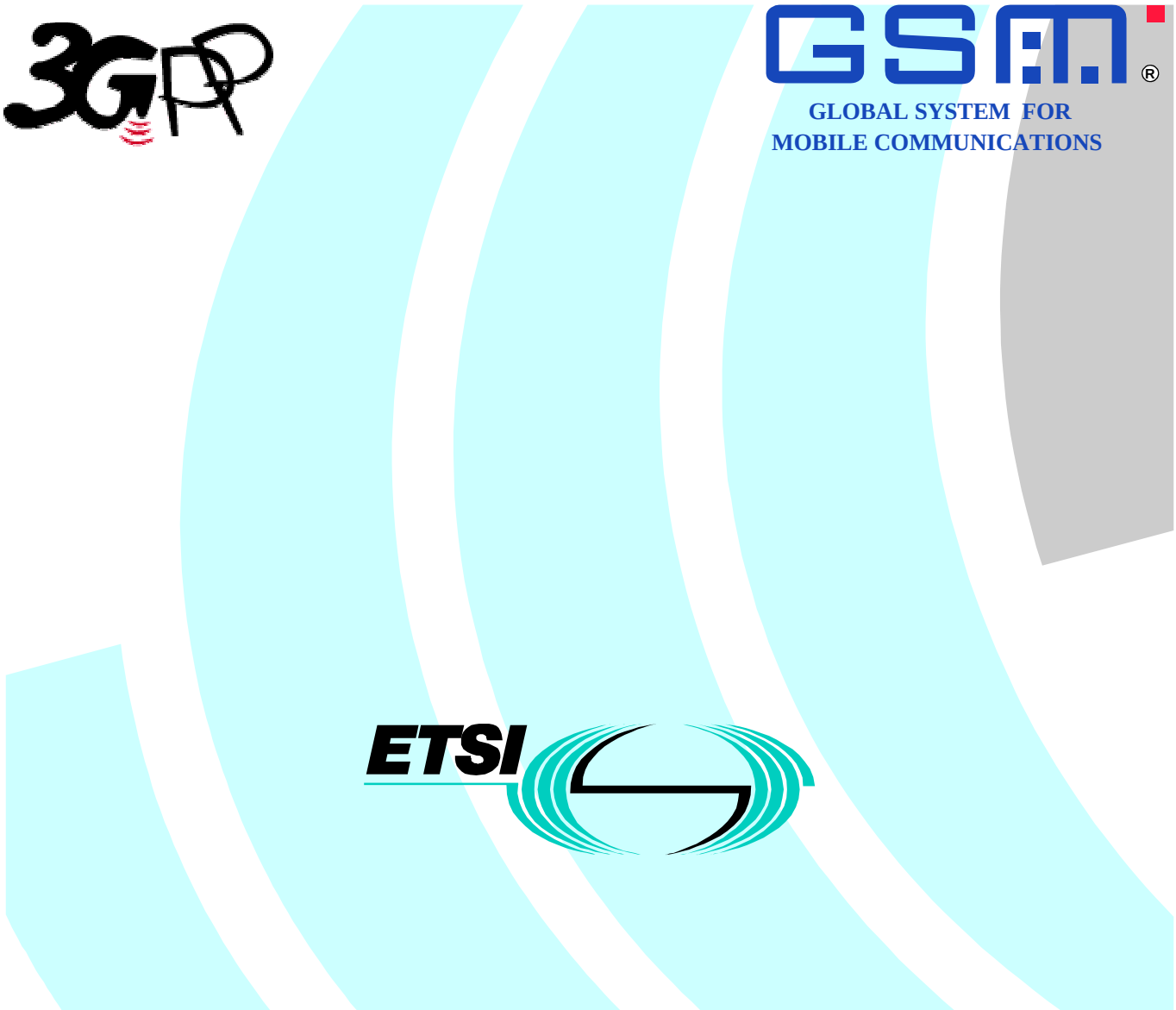
ETSI TS 127 003 V3.3.0 (2000-03)

Technical Specification

**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
Terminal Adaptation Functions (TAF) for services using
synchronous bearer capabilities
(3G TS 27.003 version 3.3.0 Release 1999)**



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Foreword

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Contents

Foreword

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

The present document defines the interfaces and Terminal Adaptation Functions (TAF) integral to a Mobile Termination (MT) which enables the attachment of synchronous terminals to a MT within the 3GPP system.

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

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1 Scope

The present document defines Terminal Adaptation Functions (TAF) which are integrated in a Mobile Termination (MT) and which enable the attachment of Synchronous Terminals to an MT (see GSM 04.02 [3]). The general aspects of Terminal Adaptation Functions are contained in specification 3G TS 27.001 [9]. The present document covers support of synchronous data services (see 3G TS 22.002 [6]) for the following interfaces and procedures:

- V.22 [15] DTE/DCE Interface;
- V.22 bis [16] DTE/DCE Interface;
- V.26 ter [19] DTE/DCE Interface;
- V.32 [21] DTE/DCE Interface;
- X.21 [23] DTE/DCE Interface;
- X.21 bis [24] DTE/DCE Interface;
- X.32 [30] Procedure;
- V.25 bis [18] Procedure;
- I.420 [11] Interface (S).

LAPB is the only synchronous non-transparent protocol which is considered in the present document.

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

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

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

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

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

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

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

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

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

[6] 3G TS 22.002: "Circuit Bearer Services (BS) supported by Public Land Mobile Network (PLMN)".

[7] 3G TS 24.008: "Mobile Radio Interface Layer 3 specification; Core Network Protocols-Stage 3".

[8] 3G TS 24.022: "Radio Link Protocol (RLP) for Circuit Switched Bearer and Teleservices".

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

[10] 3G TR 21.905: "3G Vocabulary".

[11] ITU-T Recommendation I.420 (1998): "Basic user-network interface".

[12] ITU-T Recommendation Q.931: "ISDN user-network interface layer 3 specification for basic call control".

[13] ITU-T Recommendation V.10: "Electrical characteristics for unbalanced double-current interchange circuits operating at data signalling rates nominally up to 100 kbit/s".

[14] ITU-T Recommendation V.11: "Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates nominally up to 10 Mbit/s ".

[15] ITU-T Recommendation V.22 (1988): "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".

[16] ITU-T Recommendation V.22 bis (1988): "2400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[17] ITU-T Recommendation V.24 (1996):"List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[18] ITU-T Recommendation V.25 bis (1996): "Synchronous and asynchronous automatic dialling procedures on switched networks".

[19] ITU-T Recommendation V.26 ter (1988): "2400 bits per second duplex modem using the echo cancellation technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[20] ITU-T Recommendation V.28 (1993): "Electrical characteristics for unbalanced double-current interchange circuits".

[21] ITU-T Recommendation V.32 (1993): "A family of 2-wire, duplex modems operating at data signalling rates of up to 9600 bit/s for use in the general switched telephone network and on leased telephone-type circuits".

[22] ITU-T Recommendation V.110 (1996): "Support of data terminal equipments with V-Series interfaces by an integrated services digital network".

[23] ITU-T Recommendation X.21 (1992): "Interface between Data Terminal Equipment and Data Circuit-terminating Equipment for synchronous operation on public data networks".

[24] ITU-T Recommendation X.21 bis (1988): "Use on public data networks of Data Terminal Equipment (DTE) which is designed for interfacing to synchronous V-Series modems".

[25] ITU-T Recommendation X.24 (1988): "List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) on public data networks".

[26] ITU-T Recommendation X.26 (1993): "Electrical characteristics for unbalanced double-current interchange circuits operating at data signalling rates nominally up to 100 kbit/s ".

[27] ITU-T Recommendation X.27 (1996): "Electrical characteristics for balanced double-current interchange circuits operating at data signalling rates up to 10 Mbit/s".

[28] ITU-T Recommendation X.30 (1993): "Support of X.21, X.21 bis and X.20 bis based Data Terminal Equipment (DTEs) by an Integrated Services Digital Network (ISDN)".

[29] ITU-T Recommendation X.31 (1995): "Support of packet mode terminal equipment by an ISDN".

[30] ITU-T Recommendation X.32 (1996): "Interface between Data terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in packet mode and accessing a Packet-Switched Public Data Network through a public switched telephone network or an Integrated Services Digital Network or a Circuit-Switched Public Data Network".

[31] 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".

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

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

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

2.1 Abbreviations

In addition to the abbreviations listed below, the present document also uses termslisted in 3GTR 21.905 [10] and GSM 01.04 [1].

AU	Access Unit
BORE	Bit Oriented Relay Entity
EDGE	Enhanced Data for Global Evolution
FFS	For further studies
IrDA	Infrared Data Association
IrPHY	InfraredPHYsical layer
ITU-T	ITU-Telecommunication Standardization Sector
MUX	Multiplexer
PCMCIA	Personal Computer Memory Card Association
PC	Personal Computer

3 General

3.1 Customer access configuration

The GSM PLMN access reference configuration is described in figure 1 of GSM 04.02 [3]. The present document specifically refers to the MTs which support terminal equipments (TE1 or TE2) that use synchronous bearer capabilities.

3.2 Terminal Adaptation Function

The TAF is functionally part of an MT0, MT1 or MT2 (see GSM 04.02 [3]). The terminal adaptation provides facilities to allow manual or automatic call control functions associated with circuit switched data services, in case of ITU-T V series interfaces. The ITU-T X.21[23] DTE/DCE interface allows only for automatic call control functions. The following functions are included:

- conversion of electrical, mechanical, functional and procedural characteristics of the ITU-T V-series, ITU-T X-series and ISDN type interfaces to those required by a GSM PLMN;
- bit rate adaptation of ITU-T V-series and ITU-T X-series data signalling rates and the ISDN 64 kbit/s to that provided in the GSM PLMN;
- the mapping of ITU-T V.25 bis [18] AUTO CALL/AUTO ANSWER procedures and ITU-T X.21[23] procedures to the GSM PLMN Dm-channel signalling;
- the mapping functions necessary to convert ITU-T S-interface signalling to PLMN Dm-channel signalling;
- synchronization procedure, which means the task of synchronizing the entry to and the exit from the data transfer phase between two subscriber terminals. This is described in the specification 3G TS 27.001 [9];
- filtering of channel control information. This is described in the specification 3G TS 27.001 [9];
- compatibility checking (see 3G TS 27.001 [9]);
- layer 2 relaying (see annex 1);
- flow control;
- in Call Modification function (see clause 4);
- splitting and combining of the data flow in case of multi substream data configurations.

3.3 TAF Interfacing to other MT functions

TAF interfacing is shown in figure 1.

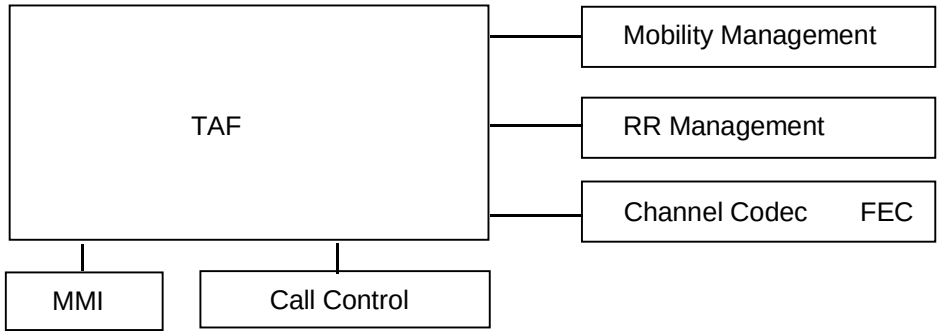


Figure 1: TAF interfacing to other MT functions

4 Terminal Adaptation Functions for synchronous transparent services

Specification GSM 03.10 [2] refers to the models for connection types supporting synchronous transparent services.

4.1 Rate Adaptation in GSM

Rate adaptation on the MS-BS interface is described in GSM 04.21[4]. The synchronous data services make use of the following rate adaptation functions: RA1, RA2, RA1/RA1', RA1' and in case of TCH/F28.8 usage, EDGE-MUX. See also figures 6, 7 and 8 in GSM 03.10 [2]. The D-bits of the rate adaptation frames are used to convey user data and the S- and X-bits are used to convey channel status information associated with the data bits in the data transfer state, or to carry substream numbering between the Split/Combine functions in case of mult substream operation. For the S- and X-bits, a ZERO corresponds to the ON condition, a ONE to the OFF condition.

4.1.1 Rate adaptation - ITU-T V-series

This is provided as indicated in specification GSM 04.21 [4]. The functions applied in this case are shown in figure 2 (see model 2b in figures 6, 7 and 8 of GSM 03.10 [2]).

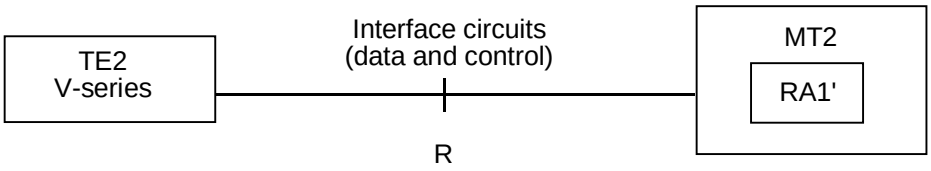


Figure 2: Rate adaptation for V-series terminals

4.1.2 Rate adaptation - ITU-T X.21

This is provided as indicated in specification GSM 04.21 [4]. The functions applied in this case are shown in figure 3 (see model 2b in figures 6, 7 and 8 of GSM 03.10 [2]).

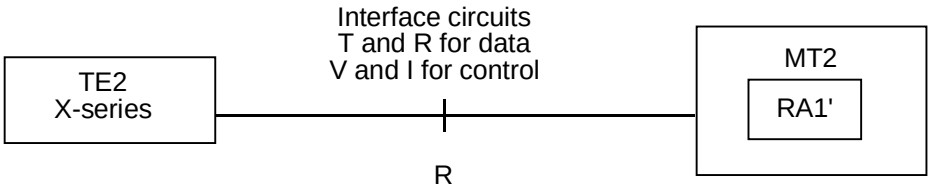


Figure 3: Rate adaptation for ITU-T X.21 [23] terminals

4.1.3 Rate adaptation - ITU-T S-interface

The functions applied in this case are shown in figure 4 (see model 2a in figures 6, 7 and 8 of GSM 03.10 [2]).

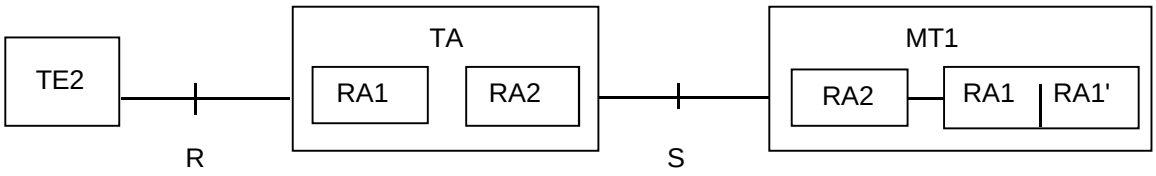


Figure 4a: Rate adaptation for ITU-T S-interface

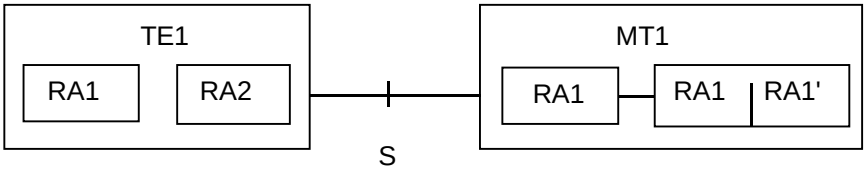


Figure 4b: Rate adaptation for ITU-T S-interface (continued)

There are two cases to be considered for the RA1 function:

a) V-series interface:

- for the V-series type of terminal equipments the rate adaptation functions are as described in GSM 04.21 [4].

b) ITU-T X.21 [23]-interface:

- for terminal equipments using the ITU-T X.21 [23]-interface the rate adaptation functions are identical to those described in GSM 04.21 [4], but the notation used is as described in ITU-T recommendation X.30 [28];
- the notation used is as follows:
  - the conversion of the user rates of 2.4 kbit/s and 4.8 kbit/s to 8 kbit/s and user rate of 9.6 kbit/s to 16 kbit/s shall be implemented by means of the 40 bit frame structure shown in figure 5;
  - figure 5 shows that in addition to the basic frame, a two frame multiframe is employed. In odd frames, octet 0 contains all zeros, whilst in even frames octet 0 consists of a one followed by seven E bits. The order of bit transmission of the 40 bit frame is from left-to-right and top-to-bottom;
  - this two frame multiframe corresponds to the 80 bit frame structure presented in GSM 04.21 [4] as shown in figure 6. The 24 information bits P1,..,P8, Q1,..Q8, R1,..,R8 of odd frames correspond with D1,..,D24 and those of even frames correspond with D25,..,D48 respectively. For the status bits there is the following correspondence: odd frame SQ, X, SR, SP = S1,X,S3,S4 and even frame SQ, X, SR, SP = S6, X, S8, S9.
- option for a manufacturer of mobile stations:
  - in transparent mode support of a packet mode TE1 or TE2/TA, which uses flag stuffing.

		Bit number 1	2	3	4	5	6	7	8
Octet 0	Odd frames	0	0	0	0	0	0	0	0
	Even frames	1	E1	E2	E3	E4	E5	E6	E7
Octet 1		1	P1	P2	P3	P4	P5	P6	SQ
Octet 2		1	P7	P8	Q1	Q2	Q3	Q4	X
Octet 3		1	Q5	Q6	Q7	Q8	R1	R2	SR
Octet 4		1	R3	R4	R5	R6	R7	R8	SP
NOTE:	Bit X, if not used for the optional flow control or for the indication of the far end synchronization, shall be set to 0 (see ITU-T Recommendation V.110 [22]).								

Figure 5: 40 bit frame structure of ITU-T X.30 [28]

	X.30 [28] Two frame multifr.								V.110 [22] 80-bit frame							
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
odd	1	P1	P2	P3	P4	P5	P6	SQ	1	D1	D2	D3	D4	D5	D6	S1
frame	1	P7	P8	Q1	Q2	Q3	Q4	X	1	D7	D8	D9	D10	D11	D12	X
	1	Q5	Q6	Q7	Q8	R1	R2	SR	1	D13	D14	D15	D16	D17	D18	S3
	1	R3	R4	R5	R6	R7	R8	SP	1	D19	D20	D21	D22	D23	D24	S4
	1	E1	E2	E3	E4	E5	E6	E7	1	E1	E2	E3	E4	E5	E6	E7
even	1	P1	P2	P3	P4	P5	P6	SQ	1	D25	D26	D27	D28	D29	D30	S6
frame	1	P7	P8	Q1	Q2	Q3	Q4	X	1	D31	D32	D33	D34	D35	D36	X
	1	Q5	Q6	Q7	Q8	R1	R2	SR	1	D37	D38	D39	D40	D41	D42	S8
	1	R3	R4	R5	R6	R7	R8	SP	1	D43	D44	D45	D46	D47	D48	S9

Figure 6: Correspondence of ITU-T X.30 [28] and ITU-T V.110 [22] frames

4.2 Interchange Circuit Signalling Mapping

4.2.1 ITU-T V-series interchange circuit mapping

The interchange circuit signalling mapping at the interface between the TE2 and the MT shall conform to ITU-T recommendation V.24 [17]; while the signal levels at the interface shall conform either to ITU-T recommendation V.28 [20], or to IrDA IrPHY Physical signalling standard specification [34], or to PCMCIA 2.1 [33], or to PC-Card 3.0 [33] electrical specifications or to later revisions.

The signals required at this interface are shown in table 2.

- Specification GSM 04.21 [4] refers to the frame structure and identifies the use of status bits for the carriage of signalling information

Status bits SA, SB and X are used to convey channel control information associated with the data bits in the data transfer state. Table 1 shows the mapping scheme between the ITU-T V.24 [17]circuit numbers and the status bits for the transparent mode. It also shows how the unused status bits should be handled. It is derived from the general mapping scheme described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

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

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

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

NOTE 1: The SB bit towards the IWF, according to the General Mapping (27.002, annex C), could be used to carry CT 105. However, CT 105 should always be ON in the data transfer state since only duplex operation is supported. Also, many DTEs use the connector pin assigned to CT 105 for CT 133. No interchange circuit shall be mapped to the SB bit which shall always be set to ON in the data transfer state.
NOTE 2: CT 133 is not mapped since there is no flow control in transparent mode.
NOTE 3: The SA bits in both directions are available only with certain channel codings. Therefore, for maximum compatibility, they should not be mapped.
NOTE 4: The X bit towards the IWF is not mapped and shall always be set to ON in the data transfer state since there is no flow control in transparent mode.
NOTE 5: CT 107 is controlled by the channel synchronization process (3G TS 27.001 [9]).
NOTE 6: CT 108/2 may be used in the call setup and answering processes.
NOTE 7: The status bits are filtered before being mapped to the ITU-T V.24 [17] circuits (3G TS 27.001 [9]).

Table 2: Minimum set of V-series interchange circuits

Circuit Number	Circuit Name	Ground	Data		Control	
			to TE2	from TE2	to TE2	from TE2
CT102	Common Return	X				
CT103	Transmitted data			X		
CT104	Received data		X			
CT105	Request to send					X
CT106	Ready for sending				X	
CT107	Data set ready				X	
CT108.2	Data terminal ready					X
CT109	Data channel received line signal detector				X	
CT114	Transmitter signal element timing				X	
CT115	Receiver signal element timing				X	
CT125	Calling in-dicator (note)				X	

NOTE: CT125 is used with the AUTO ANSWER function of the TAF.

Use of Network Independent Clocking:

Network Independent Clocking is only applicable to calls using ITC value "3.1 kHz audio ex PLMN".

Within the GSM network the coding of the values for bits associated with NIC is specified in GSM specifications GSM 04.21 [4] and GSM 08.20 [5]. In the forward (transmitting) direction the multiframes shall be coded in exact accordance with that specified in those specifications. Bit E6 is set to "1" in alternate modified ITU-T V.110 [22] frames at the transmitter. However, the use of this bit at the receiver for monitoring frame Synchronization, or any other purpose, is not specified and is left to the discretion of the implementor.

A "perfect linear block Code" is used in C1-C5, whose error correction properties may be utilized in the receiver, in order to ensure reliable operation of NIC.

The NIC sending function has to recognize when the difference between the applicable clock speed of the GSM network and the interface speed generates a positive or negative whole bit requirement. When this positive or negative condition occurs, the NIC codewords specified in specification GSM 04.21 [4] are used to transport this condition to the receiving NIC function. Transmission of the codeword shall clear the positive or negative condition related to that codeword at the sending function. The sending function shall not send more than one positive or negative compensations within a contiguous period of time corresponding to 10 000 user data bits minus the number of user data bits necessary to make up an even number of ITU-T V.110 [22] frames between compensations (NIC compensation is coded in two ITU-T V.110 [22] frames). This results from the requirements to compensate for maximum clock differences of ± 100 parts per million. If the receiving function receives NIC compensations more often than a contiguous period of time corresponding to 10 000 user data bits, there is no guarantee that data will not be lost.

The NIC receiving function has to provide the capability to support the compensation requirements of the sending function. This compensation is managed by manipulating the clock speed of the interface, within the standard constraints of that interface.

Overall, the compensation functions have to be capable of managing clock tolerances of ±100 parts per million.

The NIC function has to recognize and manage the conversion of the NIC information received incoming from an ISDN terminal Interface. The conversion has to be made to the NIC format used within the GSM System as defined in specifications GSM 04.21 [4] and GSM 08.20 [5]). The NIC function has to manage the conversion of the GSM NIC format into that used within the ISDN in the traffic direction towards the ISDN terminal interface.

Due to the incompatibility between the ISDN and the GSM requirements NIC interworking is nor provided between these two formats. as such no NIC function is required in providing interworking to the ISDN for unrestricted digital.

Action on loss of synchronization:

If five consecutive NIC multiframes have incorrect framing bit values in E7, the receiver shall stop applying clocking compensation to the received data. Resynchronization shall be attempted and compensation shall resume when synchronization is achieved.

Signal element timing:

Receiver signal element timing (CT115) is generated by MT2. In the transparent case, this shall be synchronized to the output of RA1' function. In the non transparent case it is output from the L2R on the basis of the current user data rate. A transition from ON to OFF condition shall nominally indicate the centre of each signal element on CT104.

Transmitter signal element timing is generated by MT2 (CT114), this may be synchronized to CT115.

In the case of alternate Speech/Group 3 Facsimile in GSM, there may be a Channel Mode Modify during the course of the facsimile portion of the call. If this occurs in GSM, the user data rate changes and this is reflected to the ITU-T V.24 [17] interface as a change in the clock speed on CT 114 and CT 115.

4.2.1.1 Multislot configurations (Channel coding TCH/F9.6 or TCH/F4.8 kbit/s)

In transparent multislot configurations status bits S1, S3 and the X-bit between the D12 and D13 in the ITU-T V.110 [22] 80-bit intermediate rate frame - are used for transferring substream numbering information. The S4-bit is used for frame synchronization between the parallel substreams (ref GSM 04.21[4]).

4.2.1.2 Channel coding TCH/F14.4 and TCH/F28.8

For information on the mapping of the interchange circuit signalling bits in the 14,5 multiframe structure, refer to GSM 04.21[4].

4.2.2 ITU-T X.21 [23] Interchange circuit mapping

The interchange circuit signalling mapping at the interface between the TE2 and the MT shall conform to ITU-T recommendations ITU-T X.21 [23] and ITU-T X.24 [25]; while the signal levels at the interface shall conform either to ITU-T recommendation ITU-T X.26 [26]/(ITU-T V.10 [13]), or to ITU-T X.27 [27] /(ITU-T V.11 [14]) - see also paragraph 2.1 of ITU-T recommendation X.21 [23], or to IrDA IrPHY Physical signalling standard specification [34], or to PCMCIA 2.1 [33], or to PC-Card 3.0 [33] electrical specifications or to later revisions.

The signals required at this interface are shown in table 3.

Specification GSM 04.21 [4] refers to the frame structure and identifies the use of status bits for the carriage of signalling information.

Status bits (S1, S3, S4, S6, S8, S9):

For the purpose of alignment with the case where the ITU-T X.21 [23] TE2 is connected to the MT via a TA conforming to ITU-T recommendation X.30 [28], the notation for the S-bits shall be SP, SQ and SR as in figure 5 in. For the bits SP, SQ and SR, a ZERO corresponds to the ON condition, a ONE to the OFF condition.

The bits SP, SQ and SR are used to convey channel associated status information. The mapping of the information on circuit C of the ITU-T X.21 [23] interface to the S bits and from the S bits to the circuit I in the distant interface should be done in such a way that the SP, SQ and SR bits are associated with the bit-groups P, Q and R. To assure proper and secure operation the mapping scheme has to be consistent with ITU-T recommendations X.21 [23]and X.24 [25].

The mechanism for mapping is as follows:

- in all cases where ITU-T X.21 [23] - byte timing interchange circuit B is not provided, the status bits SP, SQ and SR of the bit groups P, Q and R are evaluated by sampling the circuit C in the middle of the 8th bit of the respective preceding bit group. On the other hand, the conditions of the status bits SP, SQ and SR are adopted by the circuit I beginning with transition of the respective 8th bit of a bit-group P, Q and R to the first bit of the consecutive bit group on the circuit R;

- in the case where ITU-T X.21 [23]-byte timing interchange circuit B is provided for character alignment, the circuit C is sampled together with the bit 8 of the preceding octet and the circuit I is changing its state at the boundaries between the old and new octets at the circuit R. This operation is defined in ITU-T recommendation X.24 [25].

Table 3: ITU-T X.21 [23] interchange circuits

Interchange circuit	Interchange circuit name	Data		Control		Timing toTE2
		to TE2	from TE2	to TE2	from TE2	
G	Common return					
Ga	TE2 common return					
T	Transmit		X		X	
R	Receive	X				
C	Control				X	
I	Indication			X		
S	Signal element timing					X
B	Byte timing (note)					X

NOTE: According to ITU-T recommendation X.21 [23] the provision of the 8 bit timing interchange circuit B is not mandatory.

4.2.3 Case of ITU-T S-interface

At the S-interface an ITU-T X.30 [28] rate adapted bit stream is provided by the TE1 or TE2-TA combination (see figure 4). The terminal adaptation function within the MT does not have any interchange circuit signalling mapping function to perform.

4.3 Call establishment signalling mapping at TE/MT interface

4.3.1 ITU-T V-series interfaces

4.3.1.1 VOID

4.3.1.2 Call establishment manual operation - utilizing the Unrestricted Digital Capability

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

4.3.1.3 ITU-T V.25 bis [18]auto call/auto answer

The mapping of the ITU-T V.25 bis [18] procedures to the messages of the PLMN Dm-channel signalling (3G TS 24.008 [7]) is defined in clause 4.

Auto Call:

This procedure is provided according to ITU-T V.25 bis [18] using only circuit 108/2. A subset of ITU-T V.25 bis [18] is shown in table 4. This subset gives minimum level of control and indication.

During the call establishment phase, i.e. after signalling, call tone according to ITU-T V.25 bis [18] shall be generated in the IWF, where appropriate.

Auto Answer:

This procedure is provided according to ITU-T V.25 bis [18].

Table 4: Minimum set of ITU-T V.25 bis [18] Call Set-up Commands and Indications

	Description	IA5Characters
Commands	Call Request with Number	CRN
from TE2	provided 0,1..9,*,#,A,B,C,D	
	Disregard Incoming Call	DIC
	Connect Incoming Call	CIC
Indications	Call Failure Indication	CFI XX
to TE2	XX = CB,AB,NT,FC (Note)	
	INcoming Call	INC
	VALid	VAL
	INValid	INV

NOTE to table 4: CB = Local MT busy
AB = Abort call
NT = No answer
FC = Forbidden call (*)

(*) Forbidden call indication results from contravention of rules for repeat call attempts as defined by the appropriate national approvals administration. It is recommended that this is the responsibility of the MT, not the TE2.

4.3.2 ITU-T X-series interfaces

4.3.2.1 ITU-T X.21 bis [24] call establishment manual operation - utilizing the Unrestricted Digital Capability

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

4.3.2.2 ITU-T X.21 bis [24] /ITU-T V.25 bis [18] call establishment signalling mapping

The mapping of the ITU-T V.25 bis [18] procedures to the messages of the PLMN Dm-channel signalling (3G TS 24.008 [7]) is defined in clause 6.

Auto Call:

This procedure is provided according to ITU-T V.25 bis [18] using only circuit 108/2. A subset of ITU-T V.25 bis [18] is shown in table 4. This subset gives minimum level of control and indication.

Auto Answer:

This procedure is provided according to ITU-T V.25 bis [18].

4.3.2.3 ITU-T X.21 [24] call establishment signalling mapping

The mapping of the ITU-T X.21 [24] procedures to the messages of the PLMN Dm-channel signalling (3G TS 24.008 [7]) is defined in clause 7.

4.3.3 ITU-T S-interface (ITU-T I.420 [11]) signalling mapping

The mapping of ITU-T Q.931 [12] signalling to 3G TS 24.008 [7] signalling requires the inclusion, by the MT, of PLMN specific elements (eg. transparent or not, half or full rate channel). The required Bearer Capability Elements are shown in 3G TS 27.001 [9] annex 2.

4.3.4 Void

5 Terminal Adaptation Functions for synchronous non-transparent services in GSM

5.1 Rate Adaptation and protocol model

5.1.1 ITU-T R-interface

For the protocol model and rate adaptation function applied in this case see Models 4b and 4e of figures 6, 7 and 8 in GSM 03.10 [2]).

5.1.2 ITU-T S-interface

For the cases where the method indicated in ITU-T X.30 [28] is used see Models 4a and 4d of figures 6, 7 and 8 in GSM 03.10 [2]).

For the cases where the HDLC interframe flag stuffing shown in the recommendation ITU-T X.31 [29] is used see Models 4c and 4f of figures 6, 7 and 8 in GSM 03.10 [2]).

5.2 Signalling Mapping (GSM only)

5.2.1 Interchange circuit signalling mapping

Status bits SA, SB and X are used to convey channel control information associated with the data bits in the data transfer state. Table 5 shows the mapping scheme between the ITU-T V.24 [17] circuit numbers and the status bits for the non-transparent mode. It also shows how the unused status bits should be handled. It is derived from the general mapping scheme described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition.

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

Table 5: Mapping scheme at the MT for the non-transparent mode

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

NOTE 1: The SB bit towards the IWF, according to the General Mapping (27.002, annex C), could be used to carry CT 105. However, CT 105 should always be ON in the data transfer state since only duplex operation is supported. Also, many DTEs use the connector pin assigned to CT 105 for CT 133. No interchange circuit shall be mapped to the SB bit, which shall always be set to ON in the data transfer state.
NOTE 2: The SA bits (both directions) are not mapped since CTs 107 and 108/2 are handled locally (notes 5, 6).
NOTE 3: The condition of status bit X towards the IWF may also be affected by the state of the receive buffer in the MT.
NOTE 4: The state of CT 106 (or other local flow control mechanism) may also be affected by the state of the transmit buffer in the MT and the state of the RLP (RR/RNR).
NOTE 5: CT 107 is controlled by the channel synchronisation process (3G TS 27.001 [9]).
NOTE 6: CT 108/2 may be used in the call setup and answering processes.
NOTE 7: For inband local flow control, changes in the condition of the status bit X from the IWF also result in the sending of XON or XOFF to the DTE.
NOTE 8: For inband local flow control, CT 133 is not mapped and the status bit X towards the IWF is controlled by the reception of XON and XOFF characters from the DTE.

5.2.2 Call establishment signalling mapping

FFS

5.3 Flow Control

The passage of flow control information between L2Rs is described in annex 1.

5.3.1 Conditions requiring flow control towards the network

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

(i) if the receive buffer from the radio side reaches a preset threshold;

(ii) if local flow control is initiated by the TE2 (see subclause 5.3.3 a)). On receipt of this flow control indication transmission of data from the receive buffer towards the TE2 is halted.

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

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

5.3.2 Conditional requiring flow control towards TE2

The L2R function shall immediately activate local flow control (see subclause 5.3.3 b)) under the following circumstances:

(i) the transmit buffer reaches a pre-set threshold;

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

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

5.3.3 Local flow control

Only inband flow control is allowed:

a) from TE2:

- RNR is sent to indicate flow control active. RR is sent to indicate flow control inactive. Where RR/RNR is utilized then the TAF shall generate flow control active/inactive immediately.

b) from TAF: As from TE2.

- where this method is used, the L2R shall pass the RNR/RR frames to the TE2.

5.4 Buffers

5.4.1 TX buffers

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

The buffer shall be capable of holding n1 bytes. When the buffer is half full, TE2 shall be flow controlled as per subclause 5.3.2. The value for n1 is up to the implementors.

5.4.2 RX buffers

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

The buffer size should be n2 bytes. The value for n2 is up to the implementors.

When the buffer becomes half full, the L2R shall send a "flow control active" indication.

6 V- and S-series interface procedures to 3G TS 24.008 [7] mapping

Interface procedures not directly mappable to 3G TS 24.008 [7] (ie. ITU-T V.25 bis [18] VAL/INV) are not considered. Mobile management procedures of 3G TS 24.008 [7] are not considered applicable.

Mapping of other call establishment or clearing messages to the S interface e.g. "Call proceeding", etc. have not been included. It is assumed that these may be mapped directly and thus are of no relevance to the ITU-T V.25 bis [18] or manual interface.

6.1 Mobile Originated calls

a) SET-UP.

Element	Derived from		
	MMI	ITU-T V.25 bis [18] message	ITU-T S interface message
Called Address	Keypad	CRN/CRI/CRS	Setup
Called Sub Address	Keypad	CRI	Setup
HLC	Derived from internal settings or MMI information.		Setup
LLC	Same as HLC		Setup
BC	Same as HSC 3G TS 27.001 [9] gives allowed values		Setup (with additional information from MMI oriented settings)

b) RELEASE COMPLETE.

Element	Derived from		
	MMI	ITU-T V.25 bis [18] message	ITU-T S interface message
Cause	Display (optional)	CFI	Release complete

6.2 Mobile Terminated calls

Call establishment is initiated by receipt of Setup at the MS:

a) SET-UP.

Element	Mapped on to		
	MMI	ITU-T V.25 bis [18] message	ITU-T S interface message
Called Address	Display (optional)	INC	Set-up
Called Sub Address	Display (optional)	Not applicable	Set-up
HLC	Display (optional)	Not applicable	Set-up
LLC	Display (optional)	Not applicable	Set-up
BC	Display (optional)	Not applicable	Set-up (with PLMN specific elements removed)

b) CALL CONFIRM.

Information for the BC element in the call confirm is derived from e.g. MMI or by internal settings.

c) CONNECT.

Connect is sent in response to connect from the S-interface, CIC from ITU-T V.25 bis [18] or from MMI.

7 ITU-T X.21 [23] interface procedures to 3G TS 24.008 [7] mapping

7.1 ITU-T X.21 [23] procedures mapping

The ITU-T X.21 [23] procedures mapping is shown in figures 10 and 11. The Bearer Capability Elements required on Dm channel are shown in 3G TS 27.001 [9] annex 2.

NOTE: DTE corresponds to TE2 and DCE corresponds to MT2 in the signal names of ITU-T X.21 [23] interface.

7.1.1 Mobile originated call (see figure 7)

Call Request of TE2 to Dm channel SET-UP:

At R interface: In Ready state both TE2 and MT transmit (1,OFF). When the calling TE2 indicates Call Request (0,ON), the MT transmits Proceed to Select (+,OFF). Then the TE2 sends the Selection signals (IA5,ON) and End of Selection (+,ON) and enters the state DTE Waiting (1,ON). The MT shall transmit DCE Waiting (SYN,OFF).

At MS-MSC interface: By receiving Call Request at R-interface, the MT shall start mobile originated call establishment (CHANNEL REQUEST message etc.). When the MT has received Selection signals and End of Selection from TE2, it shall send SET-UP, when possible.

CALL PROCEED:

After the traffic channel assignment is complete, the MT shall start sending (1,OFF) within the 40 bit frames (see seubclauses 4.1.3 and 4.2.2) via the Bm (Lm) channel.

Dm channel ALERT to Call Progress to TE2:

This is applicable only to manually answered calls.

When the MT receives ALERT from Dm channel, it shall transmit Call Progress signals (IA5,OFF) to TE2 and then enter the state DCE Waiting (SYN,OFF).

Dm channel CONN to Ready For Data to TE2:

When the MT receives CONN from Dm channel, it shall respond with CONN ACK message and it may send DCE Provided Information to the calling TE2. The MT transmits then Connection in Progress (1,OFF) to TE2.

When the MT receives a frame with all data bits set to ONE, it performs the switch-through of data and control lines to TE2.

7.1.2 Mobile terminated call (see figure 7)

Dm channel SET-UP to Incoming Call to TE2:

When the TE2 is in Ready state and the MT receives SET-UP via Dm channel, the MT shall respond with ALERT in case of manual answering. Via R interface the MT transmits Incoming Call (Bell OFF) to TE2.

Call Accepted of TE2 to Dm channel CONN:

When the MT receives Call Accepted via R interface (1,ON), it shall send CONN message via Dm channel.

Dm channel CONN ACK to Ready For Data to TE2:

When the MT receives CONN ACK from Dm channel, it shall start sending (1,OFF) within the 40 bit frames via the Bm (Lm) channel. Via R interface the MT transmits Connection in Progress (1,OFF) to TE2 after delivering DCE Provided Information if any.

When the MT receives a frame with all data bits set to ONE, it performs the switch-through of data and control lines to TE2.

7.1.3 Mobile termination clearing (see figure 8)

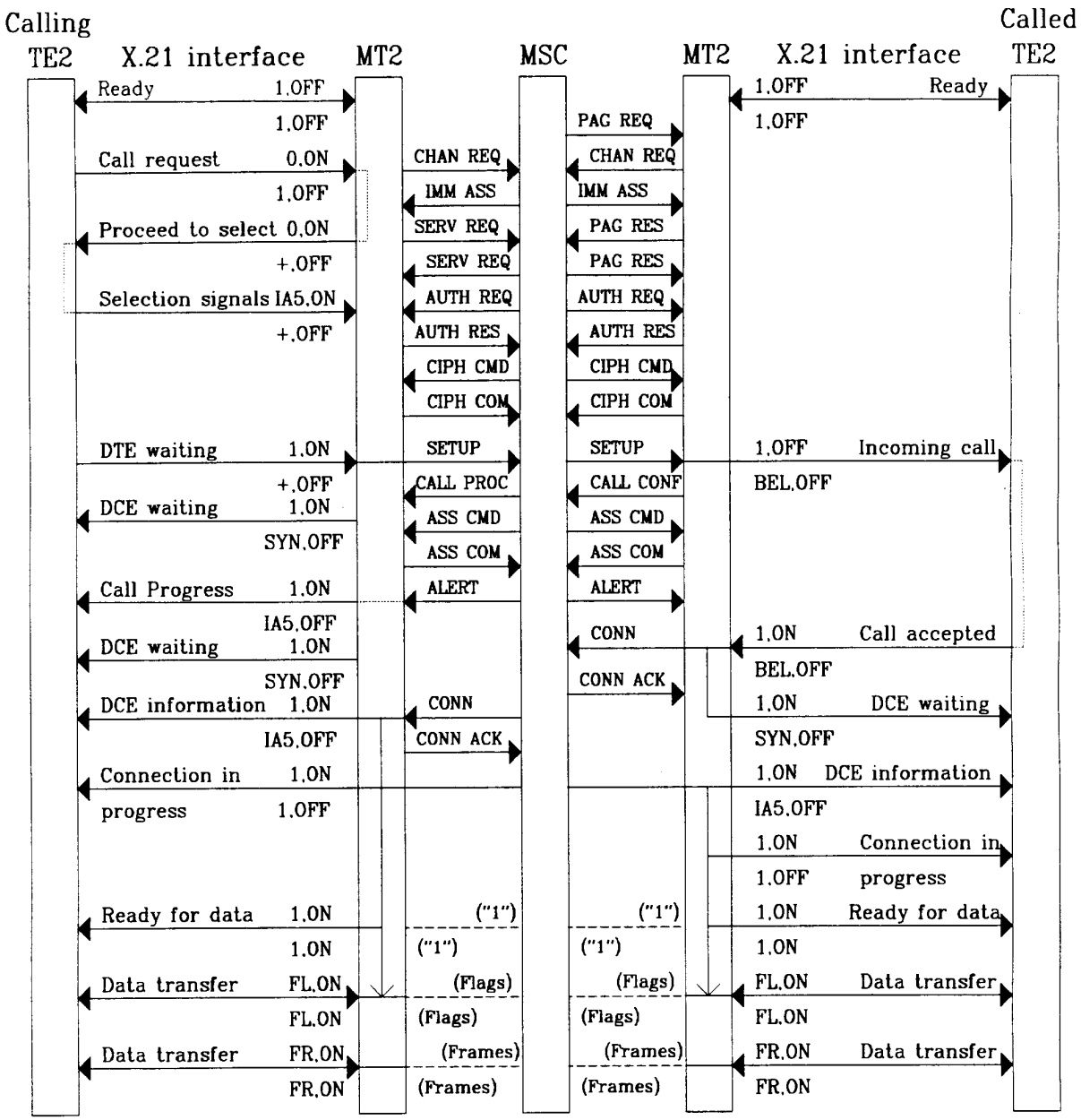
DTE Clear Request (0,OFF) is transmitted via Bm (Lm) channel to the cleared terminal. The MT at the clearing TE2 recognizes the Clear Request, transmits DCE Clear Confirmation (0,OFF) to TE2 and sends DISCONNECT message via Dm channel. When the radio channel is released, the MT shall transmit DCE Ready (1,OFF) and TE2 shall then enter the state DTE Ready (1,OFF).

7.1.4 Distant end terminal clearing

When the MT receives DCE Clear Request via Bm (Lm) channel, it shall transmit DCE Clear Indication (0,OFF) to its TE2 via R interface. After the MT has received DTE Clear Confirmation (0,OFF), it sends DISCONNECT message via Dm channel. When the radio channel is released, the MT shall transmit DCE Ready (1,OFF) and TE2 shall then enter the state DTE Ready (1,OFF).

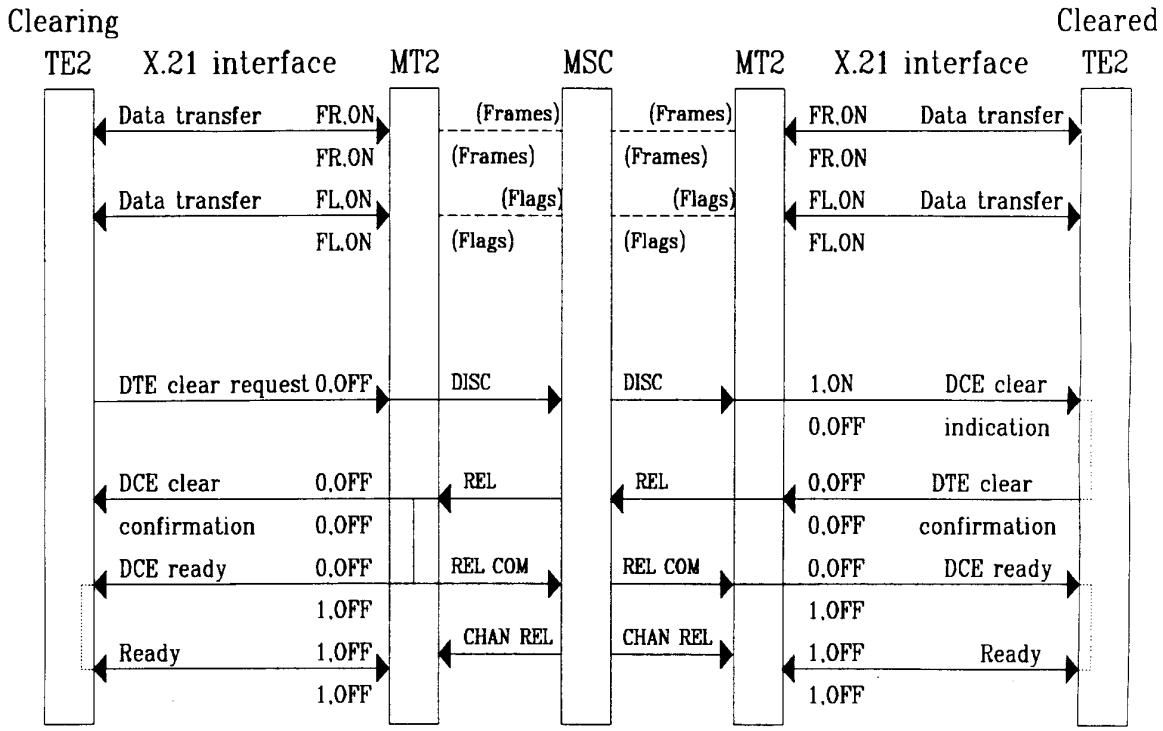
7.1.5 Network generated clearing (see figure 8)

When the MT has received DISCONNECT message via Dm channel, it shall transmit DCE Clear Indication (0,OFF) to its TE2 via R interface. After the MT has received DTE Clear Confirmation (0,OFF) and the radio channel is released, the MT shall transmit DCE Ready (1,OFF) and TE2 shall then enter the state DTE Ready (1,OFF).



NOTE: In the signal names of ITU-T X.21 [23] interface DTE corresponds with TE2 and DCE corresponds with MT2.

Figure 7: Example of a calling and a called TE2 (ITU-T X.21 [23])



NOTE: In the signal names of ITU-T X.21 [23] interface DTE corresponds with TE2 and DCE corresponds with MT2.

Figure 8: Example of a clearing and a cleared TE2 (ITU-T X.21 [23])

7.2 Dm Signalling causes mapping to ITU-T X.21 [23] call progress signals

The mapping of PLMN Dm channel signalling to ITU-T X.21 [23] call progress signals and DCE Provided Information is shown in table 6.

7.3 ITU-T X.21 [23] FACILITIES MAPPING

The ITU-T X.21 [23] facilities are shown in table 7. The mapping of these to PLMN supplementary services is for FFS.

Table 6: Mapping of Dm cause fields to ITU-T X.21 [23] call progress signals

Item	Dm signalling cause	Code	ITU-T X.21 call progress signal sign.	Code
01	Unassigned (unallocated) number	01	Not obtainable	43
02	No route to destination	03	Not obtainable	43
03	Channel unacceptable	06	Not obtainable	43
04	Normal call clearing	16	----	
05	User busy	17	Number busy	21
06	No user responding	18	No connection	20
07	User alerting, no answer	19	No connection	20
08	Call rejected	21	Controlled not ready	45
09	Number changed	22	Changed number	42
10	Destination out of order	27	Uncontrolled not ready	46
11	Invalid number format (incomplete)	28	Selection sign. procedure error	22
12	Facility rejected	29	Invalid facility request	48
13	Response to status enquiry	30	----	
14	Normal, unspecified	31	----	
15	No circuit/channel available	34	No connection	20
16	Network out of order	38	Out of order	44
17	Temporary failure	41	Out of order	44
18	Switching equipment congestion	42	Network congestion	61
19	Access information discarded	43	----	
20	Requested circuit/channel not available	44	No connection	20
21	Resources unavailable, unspecified	47	Network congestion	61
22	Quality of service unavailable	49	----	
23	Requested facility not subscribed	50	Invalid facility request	48
24	Bearer capability not authorized	57	Incompat. user class of service	52
25	Bearer capability not presently available	58	Network congestion	61
26	Service or option not available, unspecified	63	No connection	20
27	Bearer service not implemented	65	Invalid facility request	48
28	Only restricted digital information bearer capability is available	70	Invalid facility request	48
29	Service or option not implemented, unspecified	79	Invalid facility request	48
30	Invalid call reference value	81	Not obtainable	43
31	Incompatible destination	88	Not obtainable	43
32	Invalid transit network selection	91	Not obtainable	43
33	Invalid message, unspecified	95	Selection signal transmis. error	23
34	Mandatory info. element error	96	Selection signal procedure error	22
35	Message type non-existent or not implemented	97	Selection signal procedure error	22
36	Message not compatible with call state or message type non-existent or not implemented	98	Selection signal procedure error	22
37	Information element non-existent or not implemented	99	Selection signal procedure error	22
38	Invalid info. element contents	100	Selection signal transm. error	23
39	Message not compatible with call state	101	Selection signal procedure error	22
40	Recovery on timer expiry	102	Not obtainable	43
41	Protocol error, unspecified	111	Selection signal procedure error	22
42	Interworking, unspecified	127	RPOA out of order	72

Table 7: ITU-T X.21 [23] facilities

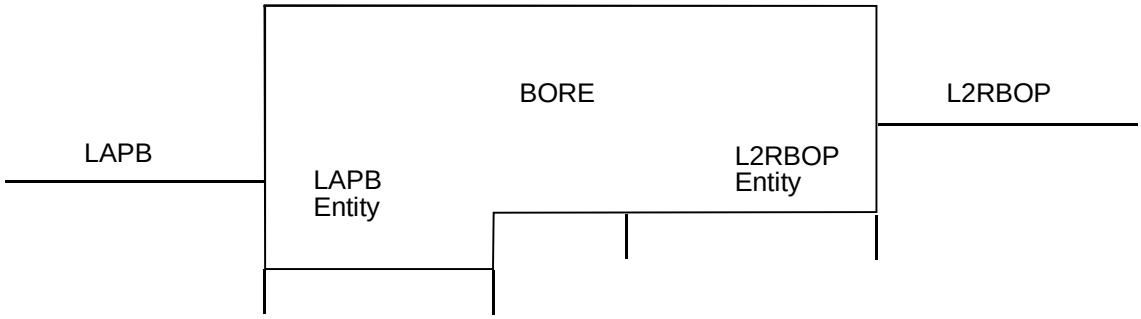
Facility request code	Facility
1	Closed user group
45	DTE inactive registration
45	DTE inactive cancellation
60	Multiple address calling
61	Charging information
62	Called line identification
63	Redirection of callactivation
63	Redirection of callcancellation
63	Redirection of callstatus
64	Reverse status
65	Direct call registration
65	Direct call cancellation
66	Abbreviated address registration
66	Abbreviated address cancellation

8 Void

Annex A (normative): L2R Functionality

A.1 Introduction

This annex describes the Layer 2 Relay (L2R) functionality required to support LAPB non-transparently. The general aspects of L2Rs are described in specification 3G TS 27.001 [9]. Figure 1 shows the three sub-functions of the L2R.



LAPB Link Access Protocol Balanced
BORE Bit Oriented Relay Entity
L2RBOP L2R Bot Oriented Protocol

Figure 1: Sub-functions of the L2R

Clause 2 describes the L2R Bit Oriented Protocol (L2RBOP) and clause 3 describes the use of the L2RBOP to transport LAPB information fields.

A.2 L2RBOP

The LAPB user information fields and interface status changes are transferred between L2Rs using the services of the radio link. The L2RBOP entity segments and reassembles the LAPB user information fields to fit into the service data units (SDUs) handled by the radio link. I.e. segments of LAPB user information fields and interface status changes are transferred between L2Rs in n octet Protocol Data Units (PDUs). This corresponds to the fixed length of the RLP frame information field. The octets within the L2RBOP-PDU are numbered 0 to n-1, octet 0 is transmitted first. The value of n depends on the negotiated RLP version and frame type (3G TS 24.002 [8]). The bits within the octets are numbered 1 to 8, bit 1 is transmitted first.

The RLP version value 2 indicates RLP multi-link operation. The RLP version value 0 or 1 indicates RLP single-link operation.

The L2RBOP also provides facilities for transferring LAPB connection control information between L2Rs. This LAPB connection control information allows concatenated LAPB connections to be established, reset and released.

The L2RBOP PDUs are coded as follows:

- each octet contains a status octet, 1 - 8 bits of user information, control information or fill;
- octet 0 shall always contain a status octet in case at least one status octet is transportet in the L2RBOP PDU. In RLP-versions 0 and 1 a PDU always carries at least one status octet. In RLP version 2 a PDU carries status octet(s) only if actual status change(s) has taken place within the period represented by the PDU. Here the L2R status flag in the RLP version 2 header is set to 1 when status octet(s) is carried in the PDU;

- status octets contain 3 status bits and 5 address bits. In cases where two status octets within the PDU are separated by more than 23 octets, the first status octet in octet m is followed by a pointer octet in octet m+1 forming a two-octet status field. The pointer octet contains one reserved bit and seven address bits indicating the number of characters between the status field and the second status octet;

- the 3 status bits are used to convey the interface conditions that are conveyed by the S and X bits in ITU-T recommendations V.110 [22] and X.30 [28]. In the case of ITU-T V series interfaces the 3 status bits correspond to SA, SB and X bits specified in ITU-T V.110 [22]. In the case of ITU-T X series interfaces only 2 bits are used and these correspond to S and X bits specified in ITU-T X.30 [28]. The ITU-T V series SA, SB and X bits use bit positions 8, 7 and 6 respectively in the status octets. The ITU-T X series S and X bits use bit positions 7 and 6 respectively, in this case bit position 8 is unused;

- LAPB user information is carried in L2RBOP-PDU information octets such that the first LAPB user information bit, in any consecutive group of 8, received or transmitted corresponds to bit position 1 in the octet. The second to bit position 2, etc.;

- information octets are inserted into the L2RBOP-PDU in order of arrival in octets 1 to n-1 for RLP single-link operation, in octets 1 to n-1 for RLP multi-link operation with status octet transportation and in octets 0 to n-1 for multi-link operation with no status octet transportation;

- the address field in the status octets indicates the position of the next status octet within the L2RBOP-PDU. This indicates the number of information octets between status octets. Thus if two status octets are inserted into an L2RBOP-PDU at offsets l and m the address field value for the status octet at offset 1 shall be defined by m-l-1 (m>l+1). The low order bit of the address corresponds to bit 1 of the octet and the high order bit to bit 5;

- status octets are inserted in the information stream whenever a status change needs to be transmitted;

- only address values 1 to n-2 (n-2 ≤ 23) in the address field of status octets are used for addressing purposes. The implication of not allowing address value 0 to be used for addressing is that two status octets can not be sent after each other. The remaining codes are used to indicate:

  - last status change, remainder of L2RBOP-PDU is empty. Address field value is 31;

  - last status change, remainder of L2RBOP-PDU full of information octets. Address field value is 30;

  - end of a LAPB user information field. Address field value is 29. This is used to delimit LAPB user information fields. In this case the 3 status bits do not have their usual meaning. They are used to indicate the number of information bits in the previous information octet. A binary number in the range 0 to 7 is contained in bit positions 8, 7 and 6, bit 6 is the low order bit. The values 1-7 indicates the number of information bits used, value 0 indicates all bits used. If this octet is not on the last position in a L2RBOP-PDU another status octet follows (e.g. an End of LAPB user information field in octet 0 is followed by a status octet in octet 1);

  - abort a LAPB user information field transfer. The address field value is 28. This is used to abort the transmission of a LAPB user information field after sending one or more segments in L2RBOP-PDUs. If this octet is not on the last position in a L2RBOP-PDU another status octet is following (e.g. an Abort a LAPB user information field transfer in octet 0 is followed by a status octet in octet 1);

  - L2RBOP-PDU contains at least two status octets which are separated by more than 23 characters; the address-field value in the first octet of the two-octet status field is 27 and the address bits in the pointer octet of the status field indicate the number of characters between the two-octet status field and the next status octet.

- address field values from n-1 to 26 are reserved. In case of a PDU more than 25 octets in length, address field values from 24 to 26 are reserved.- When it is necessary to insert a status octet into the information stream when no status change has occurred, e.g. to indicate that the remainder of an L2RBOP-PDU is empty or to indicate end of a LAPB user information field, the current status shall be repeated;

- in case when 64 data octets are carried by a 66-octet PDU, a status octet is carried in octet 0 and another status octet within the first 24 data octets. (The first status octet gives the address of the second status octet, which carries value 30 in its address field);

- LAPB connection control information is transferred between L2Rs by use of a connection control PDU. Connection control PDUs consists of an L2RBOP PDU with the status octet in octet 0 containing address field value 0. The coding of the remainder of the L2RBOP connection control PDU is as follows:

- octet 1 contains the connection number, always 0 for LAPB. Other values are reserved for future use;
- octet 2 contains the connection control information. The connection control information values are 1 for Connect, 2 for Reset, 3 for Disconnect and 4 for loss of LAPB interframe fill. This octet is coded as a binary number with the low order bit corresponding to bit 1;
- the use of octets 3 to n-1 is reserved.

- LAPB exchange identification frames (XID) are transferred between L2Rs by use of exchange identification PDUs. These PDUs consist of L2RBOP PDUs with the status octet in octet 0 containing address field values 0. The coding of the remainder of the PDU is as follows:
  - octet 1 contains the connection number, always 0 for LAPB. Other values are reserved for future use;
  - octet 2 contains the exchange identification indication. The values are 5 for an Exchange Identification Request and 6 for an Exchange Identification Acknowledge. The values 7 to 255 are reserved. This octet is coded as a binary number with the low order bit corresponding to bit 1;
  - the octet 3 contains a normal status octet. The rest of the PDU and of the following PDUs, if any, is used to transfer the XID information and it is treated like normal user data information PDUs as far as the coding is concerned.

A.3 Use of the L2RBOP

The L2R function required to support LAPB non-transparently consists conceptually of the three sub-functions shown in figure 1, i.e. the LAPB entity, the BORE and the L2RBOP entity. These perform the following functions:

- LAPB entity - This terminates the LAPB protocol from the terminal or the network. The service provided by the LAPB entity to the BORE is described in ISO DIS 8886.2 [32] - OSI Data link service definition;
- L2RBOP entity - This uses the services provided by the radio link, see specification 3G TS 24.022 [8]. The service provided by the LAPB entity to the BORE;
- BORE - This concatenates the data link services provided by the use of the L2RBOP and LAPB.

The functions are described in more detail in the following subclauses.

A.3.1 Radio Link Connection Control

The L2RBOP entity uses the services of the radio link to establish, reset and release the connection to its peer L2RBOP entity. The radio link connection shall be established and released as a result of indications from the signalling mechanisms when the supporting circuit switched connection is established.

After an RLP reset or RLP disconnect the L2RBOP entities shall assume that the remote LAPB connection is in disconnected state. No data can therefore be transported between the L2RBOP entities before an exchange of the connection control PDU "Connect" has taken place. All connection control PDUs transferred before the RLP reset are no longer valid and must not be acknowledged. All PDUs (except XID) received by the L2RBOP entities after an RLP reset or disconnect and before a new connection control PDU "Connect" has been received shall be discarded by the L2RBOP entity.

A.3.2 Status transfer

The L2RBOP entity transfers interface status information between L2Rs via the status octets in the L2RBOP-PDUs. The meaning of the bits is exactly the same as that defined in ITU-T recommendation V.110 [22]and X.30 [28]. Status changes are inserted in the L2RBOP-PDU in the position corresponding to the position in the information stream at the DTE/DCE interface that the interface status change occurred. When the RLP is established or reset a L2RBOP-PDU with the current status octet shall be sent.

A.3.3 LAPB connection control

The L2RBOP entity transfers LAPB connection control information between L2Rs via the L2RBOP connection control PDUs. This allows a LAPB connection to be established, reset and released when the remote LAPB connection is established, reset and released or vice versa. L2RBOP connection control PDUs containing connect or reset requests shall be acknowledged by a similarly coded L2RBOP connection control PDU in the reverse direction. Data transfer between L2Rs is not allowed until the connection control acknowledge PDU is received.

In the case of requests crossing they shall each be treated as acknowledgements of the other.

A.3.4 LAPB exchange identification

The L2RBOP entity transfers a LAPB exchange identification request/acknowledge between L2Rs via the L2RBOP exchange identification PDUs. This allows transfer of identification information prior to link establishment and/or during the link (especially with respect to ISO 8885 [31]/DADI). A L2RBOP exchange identification request PDU shall be answered by an associated exchange identification acknowledge PDU. In case of crossing of two requests each request shall be answered individually. A LAPB exchange identification request with identification information shall be acknowledged by the LAPB entity from L2R only when the acknowledge from the remote LAPB connection is indicated by an exchange identification acknowledge PDU sent by the remote L2RBOP entity.

A.3.5 Data Transfer

The L2RBOP entity assembles and disassembles L2RBOP-PDUs by segmenting and reassembling the LAPB user information fields.

A.3.6 Flow control

Flow control information is transferred between L2Rs in two ways, these are:

- back pressure caused by L2R buffer conditions;
- use of the X-bit in the status octet;

  X = 1 flow control active;

  X = 0 flow control inactive.

Annex B (informative): Change history

Change history						
TSG CN#	**Spec**	**CR**	**<Phase>**	**Version**	**New Version**	**Subject/Comment**
Apr 1999	GSM 07.03			6.0.0		Transferred to 3GPP CN1
CN#03	27.003				3.0.0	Approved at CN#03
CN#04	27.003	001	R99	3.0.0	3.1.0	Introduction of EDGE
CN#06	27.003	002	R99	3.1.0	3.2.0	Introduction of Asynchronous interface for Real-time non-transparent FAX
CN#06	27.003	003	R99	3.1.0	3.2.0	R99 service clean-up (also subclause 8.3 removed)
CN#07	27.003	004	R99	3.2.0	3.3.0	UMTS clean up

History

Document history		
V3.3.0	March 2000	Publication