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Technical Specification

**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
Terminal Adaptation Functions (TAF)
for services using asynchronous bearer capabilities
(3G TS 27.002 version 3.2.0 Release 1999)**

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Contents

Foreword

This Technical Specification has been produced by the 3GPP.

This TS defines the interfaces and Terminal Adaptation Functions (TAF) integral to a Mobile Termination (MT) which enables the attachment of asynchronous terminals to a MT within the 3GPP system.

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

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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1 Scope

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

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

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

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

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

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

1.1 Normative references

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

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

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

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

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

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

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

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

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

[9] Reference not used.

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

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

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

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

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

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

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

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

[18] Reference not used.

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

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

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

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

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

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

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

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

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

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

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

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

[31] GSM 09.07 (ETS 300 976): "Digital cellular telecommunication system (Phase 2+); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

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

1.3 Abbreviations

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

2 Reference Configuration

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

2.1 Customer Access Configuration

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

2.2 Terminal Adaptation Function (TAF)

The TAF provides facilities to allow manual or automatic call control functions associated with circuit switched services. The following functions are also included:

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

3 Terminal Adaptation Functions for transparent services

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

3.1 Rate Adaptation

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

3.1.1 Rate Adaptation - R interface

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

3.1.2 Rate Adaptation - S Interface (I.420)

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

3.2 Interchange Circuit Signalling Mapping - V-series interface

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

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

3.2.1 Mapping of V.24 circuits to status bits

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.3 Interface Signal Levels - R interface

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

3.4 Call Establishment and Clearing Signalling Mapping

3.4.1 V-series interface Autocalling/answering

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

a) Auto Calling

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

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

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

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

b) Auto Answer

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

During the call establishment phase:

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

3.4.2 S Interface (I.420) Signalling Mapping

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

3.4.3 Call Establishment Manual Operation - Utilizing the Unrestricted Digital Capability

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

3.4.4 V-series interface Call Clearing

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

During the call clearing phase:

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

4 Terminal Adaptation Functions for non-transparent services

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

4.1 Data Structure

4.1.1 Data Structure on S Interface

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

4.1.2 Data Structure on R Interface

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

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

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

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

See annex A.

4.2 Signalling Mapping

4.2.1 Interchange Circuit Signalling Mapping - V-series interface

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

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

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

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

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

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

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

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

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

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

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

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

4.2.2 Call Establishment and Clearing Signalling Mapping

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

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

4.3 Flow Control

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

4.3.1 Conditions Requiring Flow Control towards the Network

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

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

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

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

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

4.3.2 Conditions Requiring Flow Control towards TE2

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

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

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

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

4.3.3 Local Flow Control

Two methods of local flow control are allowed:

Outband

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

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

Inband

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

d) From TAF: As from TE2

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

4.3.4 Character Orientated Protocol with No Flow Control

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

4.4 Buffers

4.4.1 TX Buffers

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

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

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

4.4.2 RX Buffers

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

The buffer size should be up to the implementers.

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

4.5 Bit Transparency

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

4.6 Transportation of "BREAK" condition

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

Annex A describes how the L2R will transport the "BREAK" indication.

4.7 Data Compression

L2R optionally includes a data compression function according to ITU-T V.42bis that spans from the MS to the IWF in the MSC. The error correction function is provided by RLP instead of ITU-T V.42. RLP XID is used to negotiate compression parameters. L2R includes the V.42bis control function especially for reinitializing in case of break recognition or RLP reset and error indication by the data compression function respectively.

Table 3: Minimum set of Interchange Circuits

Circuit Number	Circuit Name	Ground	Data		Control	
			To TE2	From TE2	To TE2	From TE2
CT102	Common return	x				
CT103	Trans-mitted data			x		
CT104	Received data return		x			
CT105	Request to send (Note 2)					x
CT106	Ready for sending				x	
CT107	Data set ready				x	
CT108/2	Data terminal ready					x
CT109	Data channel received line signal detector				x	
CT125	Calling indicator (Note 1)				x	
CT133	Ready for Receiving (Note 2)					x

NOTE 1: CT125 is used with the automatic answering function of the TAF.

NOTE 2: CT105 and CT133 are assigned to the same connector pin on both the standard 25 pin connector (ISO 2110) and the commonly used 9 pin connector (annex B). When this pin is used for CT133 then on the DCE (MT) side of the interface CT 105 is treated as being always in the ON condition. Similarly, when this pin is being used for CT105 then on the DCE (MT) side of the interface CT 133 is treated as being always in the ON condition. As circuit 133 is used only in duplex operation and circuit 105 is used only in half duplex operation (which is not supported by GSM) there should be no conflict.

Table 4: Minimum Set of Call Set-up Commands and Indications

	Description	IA5 Characters
Commands from TE2	Call Request with Number provided 0,1..9,*,#,A,B,C,D	CRN
	Connect Incoming Call	CIC
	Disregard Incoming Call	DIC
Indications to TE2	Call Failure Indication XX = CB,AB,NT,FC (Note)	CFI XX
	INcoming Call	INC
	VALid	VAL
	INValid	INV

NOTE: CB = Local MT busy
AB = Abort call
NT = No answer
FC = Forbidden call *

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

5 Terminal interfacing to GSM 04.08 Mapping

Only those elements/messages that are of particular relevance are considered.

Interface procedures not directly mappable to GSM 04.08 [5] (i.e. V.25 bis VAL/INV) are not considered. Mobile management procedures of GSM 04.08 [5] are not considered applicable.

Mapping of other call establishment or clearing messages to the S interface e.g. "Call proceeding" etc. have not been included. It is assumed these will be able to be mapped directly and are of no relevance to the V.25 bis or manual interface.

For the Alternate speech/group 3 facsimile service it will be necessary for the TAF to generate a "Modify" message for transmission on the Dm channel. This shall be according to the defined procedure in GSM 04.08 [5].

5.1 Mobile Originated Calls

Call establishment is initiated by the keypad or DTE action:

a) Setup

Element	Derived from		
	MMI	V.25 bis message	S interface message
Called Address	Keypad	CRN/CRI/CRS	Setup
Called Sub Address	Keypad	CRI	Setup
HLC	Derived from internal settings or MMI infor- mation.		Setup
LLC	Same as HLC		Setup
BC	Same as HLC GSM 07.01 gives allowed values		Setup (with addi- tional information from MMI originated settings)

b) Release Complete

Element	Derived from		
	MMI	V.25 bis message	S interface message
Cause	Display (optional)	CFI	Release Complete

5.2 Mobile Terminated Calls

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

a) Setup

Element	Mapped on to		
	MMI	V.25 bis message	S interface message
Called Address	Display (optional)	INC	Setup
Called Sub Address	Display (optional)	Not applicable	Setup
HLC	Display (optional)	Not applicable	Setup
LLC	Display (optional)	Not applicable	Setup
BC	Display (optional)	Not applicable	Setup (with PLMN specific elements removed)

b) Call Confirm

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

c) Connect

Connect is sent in response to connect from the S interface, from MMI, or when the timeout period referred to in V.25bis has expired. This period shall be between 5 and 10 seconds. During this time the automatic answering of the incoming call can be prevented by issuing a DIC command. The CIC can be used to cancel the effect of a preceding DIC command (see Recommendation V.25bis [11]).

5.3 Call Clearing

5.3.1 Mobile initiated

Call clearing is initiated by the keypad or DTE action:

Disconnect

Element	Derived from		
	MMI	V.25 bis	S interface message
Cause	Keypad	DTE shall turn CT 108/2 OFF	Disconnect or inband V.110 disconnect request

5.3.2 Network initiated

Call clearing is initiated by receipt of Disconnect at the MS:

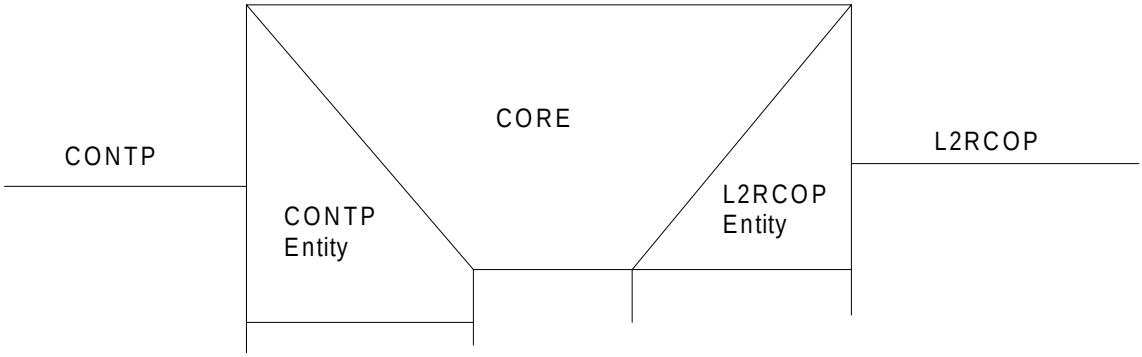
Disconnect

Element	Mapped on to		
	MMI	V.25 bis	S interface message
Cause	Display (optional)	MS shall turn CT 107 OFF	Disconnect

Annex A (Normative): L2R Functionality

A.1 Introduction

This annex describes the L2R functionality for non-transparent character oriented protocols. The general aspects of L2Rs are described in GSM 07.01 [7]. Figure 1 shows the 3 sub-functions of a character oriented L2R.



CONTP Character Oriented Non-Transparent Protocol

CORE Character Oriented Relay Entity

L2RCOP L2R Character Oriented Protocol

Figure 1

Section 2 describes the L2R Character Oriented Protocol (L2RCOP) and section 3 the use of the L2RCOP.

A.2 The L2RCOP

Information is transferred between L2Rs in fixed length n octet Protocol Data Units (PDUs). This corresponds to the fixed length of the RLP frame information field. The octets within the L2RCOP-PDU are numbered 0 to n-1, octet 0 is transmitted first. The value of n depends on the negotiated RLP version and frame type (GSM 04.22). The bits within the octets are numbered 1 to 8, bit 1 is transmitted first.

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

- Each octet contains a status octet, an information octet or fill

  Octet 0 contains either a status octet or a user information octet.

- Octet 0 shall always contain a status octet in case at least one status octet is transported in the L2RCOP PDU. In RLP-versions 0 and 1 a PDU always carries at least one status octet. In RLP version 2 a PDU carries status octet(s) only if actual status change(s) has taken place within the period represented by the PDU. Here the L2R status flag in the RLP version 2 header is set to 1 when status octet(s) is carried in the PDU.

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

- The 3 status bits correspond to SA, SB and X in CCITT Recommendation V.110. The SA, SB and X bits use bit positions 8,7,6 in the status octets. When a status bit changes the current state of all three bits shall be transmitted.

- Information octets are character octets or encoded character octets

- Character octets are coded in the following way:

    - The first bit of the character received/transmitted corresponds to bit position 1 in the octet. The second bit to bit 2, ... and the seventh bit to bit 7. For order of transmission of IA5 characters see CCITT Recommendation V.4 [10].

    - 7 bit characters are padded with a 0 in bit position 8. Received parity (if used) is inserted in bit position 8, if parity is not used bit 8 is set to 0.

    - Any start/stop bits are removed by the L2R.

- Encoded character octets are provided by the compression function. They are encoded according to ITU-T V.42bis.

- Information octets are inserted into L2RCOP-PDUs in order of transmission in octets 1 to n-1 for RLP single-link operation, in octets 1 to n-1 for RLP multi-link operation with status octet transportation, and in octets 0 to n-1 for multi-link operation with no status octet transportation.

- The address field in the status octets indicates the position of next status octet within the L2RCOP-PDU. This indicates the number of characters between status octets. Thus if two status octets are inserted into L2RCOP-PDU at offsets l and m the address value will be defined by m-l-1. Address bit 2^0 corresponds to bit 1 in the status octets. Address bit 2^1 to bit 2 etc.

- Status octets are inserted in the character stream whenever a status change needs to be transmitted.

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

    - Last status change, remainder of L2RCOP-PDU empty. Address field value 31

    - Last status change, remainder of L2RCOP-PDU full of characters. Address field value 30

    - Destructive break signal, remainder of L2RCOP-PDU empty. Address field value 29

    - Destructive break acknowledge, remainder of L2RCOP-PDU empty. Address field value 28

        - L2RCOP-PDU contains at least two status octets which are separated by more than 23 characters; the address-field value in the first octet of the two-octet status field is 27 and the address bits in the pointer octet of the status field indicate the number of characters between the two-octet status field and the next status octet.

    - Address field values from n-1 to 26 are reserved. In case of a PDU more than 25 octets in length, address field values from 24 to 26 are reserved.

- When it is necessary to insert a status octet into the character stream when no status change has occurred, e.g. to indicate that the reminder of a L2RCOP-PDU is empty or to indicate a break signal, the current status shall be repeated.

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

Three examples of an L2RCOP PDU are shown in Figure 2.

	8	7	6	5	4	3	2	1	
0	SA	SB	x	0	0	0	1	1	
1	1	1	0	0	0	1	1	1	IA5 "G" (odd parity)
2	1	1	0	1	0	0	1	1	IA5 "S" (odd parity)
3	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)
4	SA	SB	x	1	1	1	1	1	(last status change, rest of PDU empty)
.									
.									
.									
n-1									

Figure 2a Single-link RLP and multi-link RLP with status octet transfer in PDU.

	8	7	6	5	4	3	2	1	
0	1	1	0	1	0	0	1	1	IA5 "S" (odd parity)
1	1	1	0	0	0	1	1	1	IA5 "G" (odd parity)
2	1	1	0	1	0	0	1	1	IA5 "S" (odd parity)
3	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)
4									
.									
.									
.									
n-1	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)

Figure 2b Multi-link RLP L2RCOP PDU with no status octet transfer

	8	7	6	5	4	3	2	1	
0	SA	SB	X	0	0	0	1	1	
1	1	1	0	0	1	1	0	1	IA5 "M" (odd parity)
2	1	1	0	0	0	0	0	1	IA5 "A" (odd parity)
3	1	1	0	1	0	0	1	0	IA5 "R" (odd parity)
4	SA	SB	X	1	1	0	1	1	
5	R	0	1	0	0	0	1	1	
.				.					
.				.					
41	SA	SB	X	0	0	0	0	1	
42	1	1	0	0	1	1	0	1	IA5 "K" (odd parity)
43	SA	SB	X	1	1	1	1	0	
.				.					
.				.					
65	1	1	0	0	1	1	1	1	IA5 "O" (odd parity)

Figure 2c A 66-octet RLP L2RCOP PDU with status octets separated by more than 23 octets

A.3 Use of the L2RCOP

The CORE relays status changes, break conditions and characters in both directions between the CONTP entity and the L2RCOP entity.

The L2RCOP entity performs the following functions.

A.3.1 Radio Link Connection Control

Given appropriate indications from the signalling mechanisms the L2RCOP entity uses the services of the radio link to establish and release the connection to its peer L2RCOP entity in the IWF.

A.3.2 Data Transfer

The L2RCOP entity will assemble and disassemble L2RCOP-PDUs. Data characters are assembled into L2RCOP-PDUs until either:

- The PDU is full
- The Radio Link service can accept another Radio Link service Data Unit.

L2RCOP-PDUs are transferred to the peer L2RCOP entity using the data transfer services of the radio link.

A.3.3 Status Transfer

The L2RCOP entity transfers interface status information between L2Rs using bits SA, SB and X in the status octets in L2RCOP-PDUs. Status changes are inserted in the L2RCOP-PDU in the position corresponding to the position in the character stream that the interface status change occurred. When the RLP is established or reset a L2RCOP-PDU with the current status values shall be sent.

The general mapping between V.24 interface circuit numbers and status bits is described in annex C. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition. The specific mapping at the MT for the non-transparent bearer service is given in section 4.2.1. The mapping schemes used at the IWF are given in GSM 09.07 [31].

A.3.4 Flow Control

Flow control information is transferred between L2Rs in 2 ways, these are:

- back pressure caused by L2R buffer conditions
- use of the X-bit in status octets:
  - flow control active, X-bit = ONE
  - flow control inactive, X-bit = ZERO

A.3.5 Break

The transfer of break conditions between L2Rs is via the status octets with appropriate coding of the address field. Where the "Break Signal" is generated it shall conform to the definition shown in CCITT Recommendation X.28.

A.3.5.1 Normal Realization

The L2RCOP-PDU contains the mandatory status octet coded as the Destructive Break.

Upon the receipt of the "Break Signal", the L2R will destroy any existing data in front of the Break Signal in the same direction, and all the buffered data in the other direction. The L2R will then pass the Break Signal immediately on.

The termination of a break condition is indicated by sending an L2RCOP-PDU containing characters.

A.3.5.2 Realization in case of Data Compression is used

If the data compression function is used L2RCOP has to ensure the synchronization of the encoder and decoder according to ITU-T V.42bis.

Upon receipt of a L2RCOP-PDU containing a status octet that signals a Destructive Break L2R destroys all data in the TX and RX buffer and re-initializes the compression function. Then L2R will transmit a L2RCOP-PDU that contains the mandatory status octet coded as the Destructive Break Acknowledge. After that L2R will restart the data transfer.

Upon an receipt of the "Break Signal" by the CONTP, the L2R destroys any existing data in the TX and RX buffer and will then pass the Break Signal immediately by using L2RCOP-PDU containing a status octet coded as the Destructive Break. L2R will wait for a L2RCOP-PDU containing a mandatory status octet coded as Destructive Break Acknowledge. Following data received by the CONTP will be stored in the TX buffer. Data received in L2RCOP-PDUs will be discarded. After reception of the L2RCOP-PDU containing a mandatory status octet coded as Destructive Break Acknowledge L2R will re-initialize the data compression function and restart the data transfer.

Annex B (Informative): Use of a 9 pin connector as an MT2 type interface

For asynchronous data communications many of the physical pins on a standard 25 pin D-type connector (ISO 2110) are not used. As a result many communication devices have only a 9 pin connector to allow them to be made smaller. This interface is a MT2 type providing the correctV.24 signals are supported.

Table B1 gives the pin assignments for a 9 pin connector. Two variants are permitted -

1. Outband flow control

When outband (CT 133) flow control is required, pin number 7 carries CT 133 (Ready for Receiving). In this case CT 105 is not mapped to any physical pin. On the MT2 side of the interface, CT 105 is treated as being always in the ON condition.

2. No outband flow control

When no outband (CT 133) flow control is required, pin number 7 may carry CT 105 (Request to Send). In this case CT 133 is not mapped to any physical pin. On the MT2 side of the interface, CT 133 is treated as being always in the ON condition.

Table B1: Interchange circuit mappings

V.24 Circuit Number	Circuit Name	Pin Number
CT 102	Common ground	5
CT 103	TxD	3
CT 104	RxD	2
CT 105	RTS	7 (note)
CT 106	RFS (CTS)	8
CT 107	DSR	6
CT 108/2	DTR	4
CT 109	DCD	1
CT 125	CI	9
CT 133	RFR	7 (note)

NOTE: Only one of these mappings may exist at any one time.

Annex C (informative): General mapping of V.24 circuits to channel status bits

In the data transfer state, status bits SA, SB and X can be used to convey channel control information associated with the data bits. Table C1 shows the general mapping scheme between the V.24 circuit numbers and the status bits. A binary 0 corresponds to the ON condition, a binary 1 to the OFF condition. The specific mappings for the various GSM bearer types are given elsewhere in this specification.

Table C1: General mapping scheme at the MT

Signal at TE2/MT interface	Status bit direction: MT to IWF	Status bit direction: IWF to MT
CT 105 (note 3)	SB	
CT 106 (note 1)		X
CT 107		SA
CT 108/2	SA	
CT 109		SB
CT 133 (note 3)	X (note 2)	

NOTE 1. The condition of CT 106 may also be affected by the state of any transmit buffer in the MT.

NOTE 2. The condition of Status bit X towards the IWF may also be affected by the state of any receive buffer in the MT.

NOTE 3: CT105 and CT133 are assigned to the same connector pin on both the standard 25 pin connector (ISO 2110) and the commonly used 9 pin connector (annex B). When this pin is used for CT133 then on the MT side of the interface CT 105 is treated as being always in the ON condition. SB towards the IWF will therefore also always be ON.

Similarly, when this pin is being used for CT105 then on the MT side of the interface CT 133 is treated as being always in the ON condition. X towards the IWF will therefore also always be ON.

As circuit 133 is used only in duplex operation and circuit 105 is used only in half duplex operation (which is not supported by GSM) there should be no conflict.

Annex D:
Change history

Change history						
TSG CN#	**Spec**	**Version**	**CR**	**<Phase>**	**New Version**	**Subject/Comment**
Apr 1999	GSM 07.02	7.0.0				Transferred to 3GPP CN1
CN#03	27.002				3.0.0	Approved at CN#03
CN#04	27.002	3.0.0	001	R99	3.1.0	Introduction of EDGE channel codings into the specifications
CN#6	27.002	3.1.0	002	R99	3.2.0	Service clean-up for Release 99

History

Document history		
V3.2.0	January 2000	Publication