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GLOBAL SYSTEM FOR
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Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities (GSM 07.02 version 5.3.0)

ETSI

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Contents

Foreword

This European Telecommunications Standard (ETS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI) and is now submitted for the One-step Approval Procedure (OAP) of the ETSI standards approval process.

This ETS 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 digital cellular telecommunications system (Phase 2+).

The contents of this ETS is subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of this ETS, it will be resubmitted for OAP by ETSI with an identifying change of release date and an increase in version number as follows:

Version 5.x.y

where:

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

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

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

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope

This ETS 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 (ETS 300 913) [7]. This ETS covers support of these services for the following interfaces and procedures:

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

The asynchronous data rates between the MT and the TE2 are defined in GSM 02.02 (ETS 300 904) [2].

1.1 Normative references

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

[1] GSM 01.04 (ETR 350): "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.02 (ETS 300 904): "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 (ETS 300 940): "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification".

[6] GSM 04.21 (ETS 300 945): "Digital cellular telecommunication system; Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface ".

[7] GSM 07.01 (ETS 300 913): "Digital cellular telecommunication system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[8] GSM 07.07 (ETS 300 916): "Digital cellular telecommunication system (Phase 2+); AT command set for GSM Mobile Equipment (ME)

[9] GSM 09.05: "Digital cellular telecommunication system; Interworking between the Public Land Mobile Network (PLMN) and the Packet Switched Public Data Network (PSPDN) for Packet Assembly/Disassembly (PAD) facility access".

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

[29] GSM 03.34 (TS 101 038): "Digital cellular telecommunications system (Phase 2+); High Speed Circuit Switched Data (HSCSD) - Stage 2 Service Description"

1.3 Abbreviations

Abbreviations used in this ETS are listed in GSM 01.04 (ETR 350) [1].

2 Reference Configuration

GSM 07.01 (ETS 300 913) [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 ETS specifically refers to the Mobile Terminations (MTs) which support terminals of the type TE1 and TE2 with asynchronous capabilities. The TAF is functionally a part of an MT1, MT2 or MT0 with an integral asynchronous data capability.

2.2 Terminal Adaptation Function (TAF)

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

- Conversion of electrical, mechanical, functional and procedural characteristics of the V series and ISDN type interfaces to those required by the PLMN

- Bit rate adaptation of the V series data signalling rates and the ISDN 64 kbit/s to that provided in the PLMN

- The mapping functions necessary to convert automatic calling and/or automatic answering procedures of recommendation V.25 bis or V.25 ter and parameters for asynchronous operation

- The mapping functions necessary to convert S interface signalling to the PLMN Dm channel signalling

- Flow control (in some cases resulting in non-transparency of data as described in section 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 (ETS 300 913) [7]

- Filtering of channel control information as described in GSM 07.01 (ETS 300 913) [7]

- Terminal compatibility checking

- Splitting and combining of the data flow in case of multislot 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 (ETS 300 945) [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 - V series

This is provided as indicated in GSM 04.21 (ETS 300 945) [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 (ETS 300 945) [6].

3.2 Interchange Circuit Signalling Mapping

The interchange circuit signalling mapping 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 2.

GSM 04.21 (ETS 300 945) [6] refers to the frame structure and identifies the use of the status bits for the carriage of signalling information.

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

The bits S and X are used to convey channel control information associated with the data bits in the data transfer stage as shown below. The S bits are put into two groups SA and SB to carry the condition of two interchange circuits. The X bit is used to carry the condition of circuit 106.

The mechanism for proper assignment of the control information from the transmitting signal rate adapter interface via these bits to the receiving signal rate adapter interface is shown below in table 1.

For the S and X bits, a ZERO corresponds with the ON condition, a ONE with the OFF condition.

108	S1,S3,S6,S8 = SA	107
105	S4,S9 = SB	109
106	X	106
TE --- > IWF		IWF ---- > TE

3.2.1 Multislot configurations

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

3.2.2 Channel coding TCH/F14.4

For information on the mapping of the interchange circuit signalling bits as specified in GSM 04.21.

3.3 Interface Signal Levels

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 Signalling Mapping

3.4.1 Autocalling/answering

The mapping of the V.25 bis [11] procedures to the messages of the PLMN signalling in GSM 04.08 (ETS 300 940) [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, call tone according to V.25 bis shall be generated in the IWF.

An alternative to CCITT V.25bis [11] is to use the ITU-T V.25 ter dial command as specified in GSM 07.07 (ETS 300 916) [8].

b) Auto Answer

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

3.4.2 S Interface (I.420) Signalling Mapping

The mapping of Q.931 signalling to GSM 04.08 (ETS 300 940) [5] signalling requires the inclusion, by the MT, of PLMN specific elements (e.g. transparent or not, half/full rate channel). For asynchronous Bearer services, requests for bearer capabilities not listed in table 4 (or where the "Users information layer 1 protocol" element does not indicate V.110) will result in call rejection.

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

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

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

3.4.4 Call Establishment Manual Operation - Utilizing the Unrestricted Digital Capability

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

4 Terminal Adaptation Functions for non transparent services

The V.24 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 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.

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

See annex A.

4.2 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. The mapping of these procedures to the V.24 interface is defined in annex A.

4.3 Flow Control

The passage of flow control information between L2Rs is described in annex A. Sections 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 section 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 section 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 section 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 is sent to indicate flow control active. XON is sent to indicate flow control inactive. The XON/XOFF characters are extended 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 and DC1/DC3 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 implementors.

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 implementors.

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 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 2: 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					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)					

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

NOTE 2: CT133 provides outband flow control according to V.42 and may be mapped to CT 105 if not provided.

NOTE 3: A 9 pin version of V.24 is commonly used as shown in annex B. This conforms to a MT2 type.

Table 3: 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 (ETS 300 940) [5] (i.e. V.25 bis VAL/INV) are not considered. Mobile management procedures of GSM 04.08 (ETS 300 940) [5] are not considered applicable.

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

For the Alternate speech/data, Alternate speech/group 3 facsimile and Speech followed by data services 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 (ETS 300 940) [5].

In addition for the Alternate speech/data case it will be necessary for the TAF to respond to an incoming "Modify" command with "Ack" or "Reject".

5.1 Mobile Originated Calls

a) Setup

<table>
<tr><th rowspan="2">Element</th><th colspan="3">Derived from</th></tr>
<tr><th>MMI</th><th>V.25 bis message</th><th>S interface message</th></tr>
<tr><td>Called Address</td><td>Keypad</td><td>CRN/CRI/CRS</td><td>Setup</td></tr>
<tr><td>Called Sub Address</td><td>Keypad</td><td>CRI</td><td>Setup</td></tr>
<tr><td>HLC</td><td colspan="2">Derived from internal settings or MMI infor- mation.</td><td>Setup</td></tr>
<tr><td>LLC</td><td colspan="2">Same as HLC</td><td>Setup</td></tr>
<tr><td>BC</td><td colspan="2">Same as HLC GSM 07.01 gives allowed values</td><td>Setup (with addi- tional information from MMI originated settings)</td></tr>
</table>

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]).

6 Functionality for the Support of Dedicated PAD Services

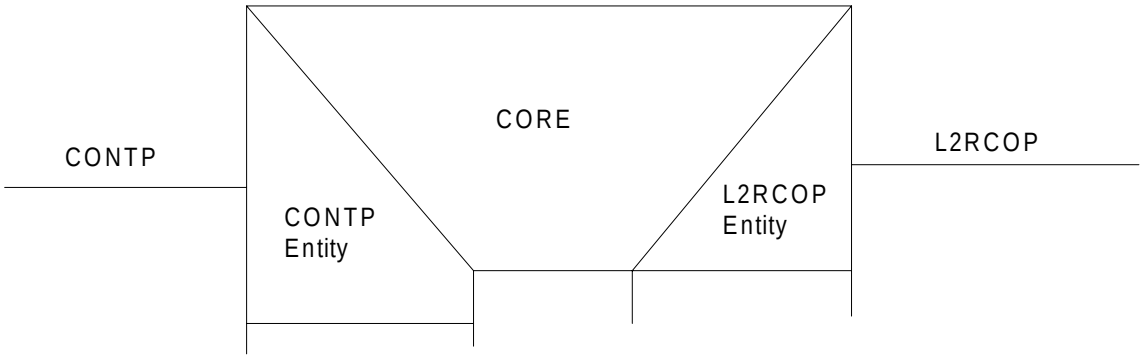
The TAF will need to provide the following information in addition to the Bearer capability values shown in annex B of GSM 07.01 (ETS 300 913) [7] in the case of Dedicated PAD access:

Numbering Plan Identifier : Private Number Plan
Type of Number : Dedicated PAD
In addition, the called number should be a short code, coded as indicated in GSM 09.05 [9].

Annex A (Normative): L2R Functionality

A.1 Introduction

This annex describes the L2R functionality for non-transparent character oriented protocols. The general aspects of L2Rs are described in GSM 07.01 (ETS 300 913) [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 information field of the RLP (24 or 25 octets RLP information field). The octets within the L2RCOP-PDU are numbered 0 to n-1, octet 0 is transmitted first. The bits within the octets are numbered 1 to 8, bit 1 is transmitted first. The value of n depends on the negotiated RLP version and frame type. For multi-slot RLP version n equals 24 and for single slot RLP n equals 25.

The RLP version value 2 indicates RLP multslot operation. The RLP version value 0 or 1 indicates RLP single slot operation.

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

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

- The octet 0 shall always contain a status octet in case at least one status octet is transportet in the L2RCOP PDU. In case of multi-slot RLP version octet 0 contains user information data only if no status octet will be transported in the L2RCOP PDU. In RLP-versions 0 and 1 a PDU always carries at least one status octet. In case of multi-slot operation the L2R status flag in the RLP header set to 1 indicates status octet in position 0.

- 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 slot operation (n equals 25), in octets 1 to n-1 for RLP multi-slot operation (n equals 24) with status octet transportation and in octet 0 to n-1 for multi-slot 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 (currently expected to be 23 or 22) 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

- 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.

Three example*s* 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 slot RLP (n=25) and multi slot RLP (n=23) 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 slot 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 567 bit RLP L2RCOP PDU with status octet transfer

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 via the status octets in L2RCOP-PDUs. The meaning of the bits is exactly the same as that defined in CCITT Recommendation V.110. 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. After a RLP-reset a L2RCOP-PDU with the current status octet must be sent.

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 the 9 pin version of V.24 as a MT2 type

For asynchronous data communications many of the physical pins on a standard V.24 25 pin D-type are not used. As a result many communication devices only support 9 pins to make communicating devices smaller. This interface is a MT2 type providing the correct functionality is supported.

This table gives the layout of a 9 pin version of the V.24 interface. When full V.42 functionality is required CT 133 will be mapped to CT 105.

Circuit Number	Circuit Name	Pin Number
CT 102	Common ground	5
CT 103	TxD	3
CT 104	RxD	2
CT 105	RTS	7
CT 106	CTS	8
CT 107	DSR	6
CT 108/2	DTR	4
CT 109	DCD	1
CT 125	CI	9

History

Document history			
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