

# ETSI TS 127 010 V13.0.0 (2016-01)



**Digital cellular telecommunications system (Phase 2+);  
Universal Mobile Telecommunications System (UMTS);  
LTE;  
Terminal Equipment to User Equipment (TE-UE)  
multiplexer protocol  
(3GPP TS 27.010 version 13.0.0 Release 13)**



---

Reference

RTS/TSGC-0327010vd00

---

Keywords

GSM,LTE,UMTS

**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
Sous-Préfecture de Grasse (06) N° 7803/88

---

**Important notice**

The present document can be downloaded from:  
<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the only prevailing document is the print of the Portable Document Format (PDF) version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at  
<http://portal.etsi.org/tb/status/status.asp>

If you find errors in the present document, please send your comment to one of the following services:  
<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

---

**Copyright Notification**

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.  
The copyright and the foregoing restriction extend to reproduction in all media.

© European Telecommunications Standards Institute 2016.  
All rights reserved.

**DECT™**, **PLUGTESTS™**, **UMTS™** and the ETSI logo are Trade Marks of ETSI registered for the benefit of its Members.  
**3GPP™** and **LTE™** are Trade Marks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.  
**GSM®** and the GSM logo are Trade Marks registered and owned by the GSM Association.

---

## Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

---

## Foreword

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

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

---

## Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

# Contents

Intellectual Property Rights .....	2
Foreword.....	2
Modal verbs terminology.....	2
Foreword.....	6
Introduction .....	6
1 Scope .....	7
2 References .....	7
3 Abbreviations .....	7
4 Overview of Multiplexing System .....	8
5 Non Error Recovery mode Options.....	9
5.1 Service Interface Definition .....	9
5.1.1 Service Definition Model.....	9
5.1.2 Start up services .....	10
5.1.3 DLC establishment services.....	11
5.1.4 Data services .....	12
5.1.5 Power Control services .....	12
5.1.5.1 Sleep services .....	12
5.1.5.2 Wakeup services .....	12
5.1.6 DLC Release services .....	12
5.1.7 Close down services.....	13
5.1.8 Control Services.....	13
5.1.8.1 27.010 Services .....	13
5.1.8.1.1 DLC parameter negotiation .....	13
5.1.8.1.2 DLC Service Negotiation service .....	14
5.1.8.1.3 Test service.....	14
5.1.8.1.4 Flow control services.....	14
5.1.8.2 Port Emulation Services .....	15
5.1.8.2.1 Remote DLC parameter negotiation service.....	15
5.1.8.2.2 DLC Control Parameter service .....	15
5.1.8.2.3 DLC Line status indication service.....	16
5.2 Frame Structure .....	16
5.2.1 Frame Fields .....	16
5.2.1.1 Flag Sequence Field .....	16
5.2.1.2 Address Field .....	16
5.2.1.3 Control Field .....	17
5.2.1.4 Information Field .....	17
5.2.1.5 Length Indicator .....	17
5.2.1.6 Frame Checking Sequence Field (FCS).....	18
5.2.2 Format Conventions.....	18
5.2.3 Frame Validity .....	19
5.2.4 Frame Abort.....	19
5.2.5 Inter-frame Fill.....	19
5.2.6 Basic Option .....	19
5.2.6.1 Constraint.....	19
5.2.7 Advanced Option .....	20
5.2.7.1 Control-octet transparency .....	20
5.2.7.2 Start/stop transmission - extended transparency .....	20
5.2.7.3 Flow-control transparency .....	20
5.2.7.4 Frame Structure .....	20
5.3 Frame Types .....	21
5.3.1 Set Asynchronous Balanced Mode (SABM) command.....	21

5.3.2	Unnumbered Acknowledgement (UA) response .....	21
5.3.3	Disconnected Mode (DM) response .....	21
5.3.4	Disconnect (DISC) command .....	21
5.3.5	Unnumbered information with header check (UIH) command and response .....	21
5.3.6	Unnumbered Information (UI) command and response .....	22
5.4	Procedures and States .....	22
5.4.1	DLC Establishment .....	22
5.4.2	DLC Release .....	22
5.4.3	Information Transfer .....	22
5.4.3.1	Information Data .....	22
5.4.3.2	Priority .....	23
5.4.4	Frame Variables .....	23
5.4.4.1	Functions of the poll bit .....	23
5.4.4.2	Functions of the final bit .....	24
5.4.5	Time-out considerations .....	24
5.4.6	Multiplexer Control Channel .....	24
5.4.6.1	Message format .....	24
5.4.6.2	Operating procedures .....	25
5.4.6.3	Message Type and Actions .....	25
5.4.6.3.1	DLC parameter negotiation (PN) .....	25
5.4.6.3.2	Power Saving Control (PSC) .....	27
5.4.6.3.3	Multiplexer close down (CLD) .....	27
5.4.6.3.4	Test Command (Test) .....	28
5.4.6.3.5	Flow Control On Command (FCon) .....	28
5.4.6.3.6	Flow Control Off Command (FCoff) .....	28
5.4.6.3.7	Modem Status Command (MSC) .....	28
5.4.6.3.8	Non Supported Command Response (NSC) .....	30
5.4.6.3.9	Remote Port Negotiation Command (RPN) .....	31
5.4.6.3.10	Remote Line Status Command (RLS) .....	33
5.4.6.3.11	Service Negotiation Command (SNC) .....	34
5.4.7	Power Control and Wake-up Mechanisms .....	36
5.4.8	Flow Control .....	37
5.4.8.1	RTR Flow Control .....	37
5.4.8.2	XON/XOFF Flow Control .....	37
5.5	Convergence Layers .....	38
5.5.1	Type 1 - Unstructured Octet Stream .....	38
5.5.2	Type 2 - Unstructured Octet Stream with flow control, break signal handling and transmission of V.24 signal states .....	38
5.5.3	Type 3 - Uninterruptible Framed Data .....	40
5.5.4	Type 4 - Interruptible Framed Data .....	40
5.6	DLCI Values .....	41
5.7	System Parameters .....	41
5.7.1	Acknowledgement Timer (T1) .....	42
5.7.2	Maximum Frame Size (N1) .....	42
5.7.3	Maximum number of retransmissions (N2) .....	42
5.7.4	Window Size (k) .....	42
5.7.5	Response Timer for multiplexer control channel (T2) .....	42
5.7.6	Response Timer for wake-up procedure (T3) .....	42
5.8	Start-up and close-down of multiplexer .....	42
5.8.1	Start-up procedure .....	42
5.8.2	Close-down procedure .....	43
6	Error Recovery Mode Option .....	43
6.1	Frame Types .....	43
6.1.1	Information transfer, I, command and response .....	43
6.1.2	Receive ready, RR, command and response .....	43
6.1.3	Receive not ready, RNR, command and response .....	44
6.1.4	Reject, REJ, command and response .....	44
6.2	Procedure and State .....	44
6.2.1	Frame state variables and sequence numbers .....	44
6.2.1.1	General .....	44
6.2.1.2	Send state variable V(S) .....	44

6.2.1.3	Send sequence number N(S) .....	44
6.2.1.4	Receive state variable V(R).....	44
6.2.1.5	Receive sequence number N(R) .....	44
6.2.1.6	Use of the P/F bit to assist in error recovery .....	45
6.2.2	Exchange of information (I) frames.....	45
6.2.2.1	Sending I frames .....	45
6.2.2.2	Receiving I frames .....	45
6.2.2.3	Reception of incorrect frames .....	46
6.2.2.4	Station receiving acknowledgements .....	46
6.2.2.5	Exception conditions and recovery .....	46
6.2.2.5.1	Busy.....	46
6.2.2.5.2	N(S) sequence error.....	46
6.2.2.5.3	Poll/final (P/F) bit (checkpoint) recovery.....	46
6.2.2.5.4	REJ recovery .....	47
6.2.2.5.5	SABM Command .....	47
6.2.2.5.6	DISC Command .....	47
<b>Annex A (informative): Advice to TE software implementers .....</b>		<b>48</b>
<b>Annex B (informative): Explanatory notes on the CRC Calculation .....</b>		<b>49</b>
B.1	Example.....	49
B.2	Reflected bits.....	49
B.3	Implementation.....	50
B.3.1	Calculate FCS for the example given earlier.....	50
B.3.2	Check FCS for the example given earlier.....	50
B.3.3	The transmitter code.....	50
B.3.4	The receiver code .....	50
B.3.5	Reversed CRC table .....	51
<b>Annex C (informative): Change History .....</b>		<b>52</b>
History .....		53

---

## Foreword

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

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:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

---

## Introduction

The multiplexer protocol described in the present document operates between an UE and a TE and allows a number of simultaneous sessions over a normal serial asynchronous interface. Each session consists of a stream of bytes transferring various kinds of data; for instance, voice, fax, data, SMS, CBS, phonebook maintenance, battery status, GPRS, USSD etc. This permits, for example, SMS and CBS to be transferred to a TE when a data connection is in progress. Many other combinations are possible including digital voice. It is, for instance, possible to transfer digital voice in combination with SMS. The multiplexer allows a complete system to be partitioned in a flexible way between a UE and TE.

The design of the multiplexer is flexible and independent of UE/TE platforms, and allows existing applications to work without any modifications.

The multiplexer is designed, with special care for battery-powered devices, to include very important functionality such as power saving control and priorities. It is also specially designed to require minimum processing power and memory consumption.

The multiplexer is defined as a single mode with different options based on the ISO HDLC standard (ISO/IEC 13239) although the basic option is not in accordance with HDLC.

In the basic option, the multiplexer does not make use of any transparency mechanism or error recovery method. The advanced option uses the ISO HDLC standard transparency mechanism and gives the multiplexer an easy re-synchronisation method and the ability to operate over links which use DC1/DC3 (XON/XOFF) flow control. The advanced option also may include error-recovery for links subject to errors.

In its basic option, the multiplexer is intended for use in situations where the link between UE and TE is of a very good quality and where the HDLC transparency mechanism (byte stuffing) can not be implemented in the UE. If an UE supports the HDLC transparency mechanism, it shall be used by the multiplexer. The ISO HDLC transparency mechanism must be used if loss of synchronisation may occur caused by, for example, data over-runs or under-runs. The error-recovery option should be used in situations where the link is subject to errors.

The multiplexer is based on a control channel. On this channel, management information is exchanged, such as parameter negotiation, power saving control information, testing, flow control, close down etc.

The multiplexer is optional, but when supported, it is activated with the AT+CMUX command described in 3GPP TS 27.007 [4].

---

# 1 Scope

The scope of the present document is to define a multiplexing protocol between a UE and a TE. The multiplexing protocol can be used to send any data, for instance voice, SMS, USSD, fax etc.

The present document describes the protocol, but not the commands or data transported with it.

---

# 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. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] Void.
- [2] ISO/IEC 13239 (1997): "Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures".
- [3] 3GPP TS 27.005: "Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)".
- [4] 3GPP TS 27.007: "AT command set for User Equipment (UE)".
- [5] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [6] 3GPP TS 46.021: "Half rate speech; Substitution and muting of lost frames for half rate speech traffic channels".
- [7] ISO/IEC 646 (1991): "Information technology - ISO 7-bit coded character set for information interchange".

---

# 3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ABM	Asynchronous Balanced Mode
DLC	Data Link Connection
DM	Disconnected Mode
ERM	Error-Recovery Mode
FCS	Frame Check Sequence
MSC	Modem Status Command
PSC	Power Saving Control
SABM	Set Asynchronous Balanced Mode
UAU	Unnumbered Acknowledgement
UIH	Unnumbered Information with header Check
UI	Unnumbered Information

Additional abbreviations can be found in 3GPP TR 21.905 [5].