



# SLOVENSKI STANDARD SIST ETS 300 946 E4:2003

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8 [[ ]HJb]`WV] b]`hY`Y\_ca i b]\_UW`g\_]`g]ghYa `fZuU&ZL`E`Dfctc\_c`nUfUX]`g\_c  
dcj Yncj Ub`Y`fF @DLdcXU`cj `]b`hY`Ya Urg\_]`g]hcf]hYj `c`j a Ygb]\_i `g]ghYa Ua cV]bU  
dcgHJ`U!VUnbUdcgHJ`UfA G!6 GGL]b`j a Ygb]\_i `\_ca i HJW`g\_]Y[ U`W`b`f`U`g]ghYa U  
VUnbY`dcgHJ`Y!a cV]bY`g]hcf]hYj Y`f6 GG!A G7`L`f! GA`\$ ( "&ZfU`h`] ]WU) " "%L

Digital cellular telecommunications system (Phase 2+) (GSM); Radio Link Protocol (RLP) for data and telematic services on the Mobile Station - Base Station System (MS - BSS) interface and the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface (GSM 04.22 version 5.3.1)

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**ICS:**

33.070.50	Globalni sistem za mobilno telekomunikacijo (GSM)	Global System for Mobile Communication (GSM)
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**Digital cellular telecommunications system (Phase 2+);  
Radio Link Protocol (RLP) for data and telematic services on the  
Mobile Station - Base Station System (MS - BSS) interface  
and the Base Station System - Mobile-services Switching Centre  
(BSS - MSC) interface  
(GSM 04.22 version 5.3.1)**

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## Contents

Foreword .....	5
1 Scope .....	7
2 Normative references .....	7
2.1 Definitions and abbreviations .....	8
3 Introduction .....	9
4 Frame structure .....	10
4.1 Basic frame structure .....	10
4.2 RLP header .....	10
4.3 Order of transmission .....	11
4.4 Frame check sequence .....	11
5 Elements and procedure .....	11
5.1 Modes .....	11
5.1.1 Asynchronous Balanced Mode (ABM) .....	12
5.1.2 Asynchronous Disconnected Mode (ADM) .....	12
5.2 Header and parameters .....	12
5.2.1 Generally used bits .....	12
5.2.1.1 Command/response bit, C/R .....	13
5.2.1.2 Poll/Final bit, P/F .....	13
5.2.2 Unnumbered frames, U .....	13
5.2.2.1 Set asynchronous balanced mode SABM (11100) .....	13
5.2.2.2 Unnumbered Acknowledge, UA (00110) .....	13
5.2.2.3 Disconnect, DISC (00010) .....	14
5.2.2.4 Disconnected Mode, DM (11000) .....	14
5.2.2.5 Unnumbered Information, UI (00000) .....	14
5.2.2.6 Exchange Identification, XID (11101) .....	14
5.2.2.7 Test, TEST (00111) .....	15
5.2.2.8 Null information, NULL (11110) .....	15
5.2.2.9 REMAP (10001) .....	15
5.2.3 Supervisory frames, S, and numbered information transfer and supervisory frames combined, I+S .....	16
5.2.3.1 Numbering .....	16
5.2.3.2 Send Sequence number, N(S) .....	16
5.2.3.3 Receive sequence number, N(R) .....	16
5.2.3.4 L2R Status bit .....	17
5.2.3.5 Receive ready, RR (00) .....	17
5.2.3.6 Reject, REJ (01) .....	17
5.2.3.7 Receive not ready, RNR (10) .....	17
5.2.3.8 Selective reject, SREJ (11) .....	17
5.3 Error Recovery .....	18
5.3.1 Improper frames .....	18
5.3.2 N(S) sequence error .....	18
5.3.3 N(R) error .....	18
5.3.4 Time-out and checkpointing .....	18
5.3.4.1 Treatment of errors during link establishment, link reset and link disconnect .....	18
5.3.4.2 Treatment of errors during numbered information transfer .....	18
5.3.5 Contentious situations .....	19
5.4 Transitions between TCH/F9.6 and TCH/F14.4 channel codings .....	19
5.5 List of system parameters .....	20
5.5.1 RLP Version N° .....	20

5.5.2	Maximum number of outstanding I frames k (Window size) .....	20
5.5.3	Timer T1 .....	21
5.5.4	Maximum number of retransmissions N2.....	21
5.5.5	Data Compression Parameters .....	21
5.5.6	Re-sequencing period (Timer T4).....	21
5.6	Support for discontinuous transmission (DTX) .....	21
6	Service definitions.....	22
6.1	Introduction.....	22
6.2	Conventions .....	22
6.3	Queue model.....	22
6.4	List of Primitives .....	23
6.5	Possible RLP time sequence diagrams .....	25
Annex A (informative):	RLP SDL Diagrams .....	28
A.1	List of RLP entity states .....	28
A.1.1	(main) states .....	28
A.1.2	state variables .....	28
A.2	List of RLP entity events .....	32
History .....		64

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## Foreword

This fourth edition European Telecommunication Standard (ETS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI).

This ETS specifies the Radio Link Protocol (RLP) for data transmission over within the digital cellular telecommunications system.

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 rules.

Transposition dates	
Date of adoption of this ETS:	3 April 1998
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## 1 Scope

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

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

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

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

## 2 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.

- iTech STANDARD PREVIEW  
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- [1] GSM 01.04 (ETR 350): "Digital cellular telecommunication system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 04.21 (ETS 300 945): "Digital cellular telecommunication system; Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".  
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- [3] GSM 07.02 (ETS 300 914): "Digital cellular telecommunication system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".
- [4] GSM 07.03 (ETS 300 584): "Digital cellular telecommunication system (Phase 2); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".
- [5] GSM 09.04: "Digital cellular telecommunication system; Interworking between the Public Land Mobile Network (PLMN) and the Circuit Switched Public Data Network (CSPDN)".
- [6] 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 facility (PAD) access".
- [7] GSM 09.06 (ETS 300 975): "Digital cellular telecommunication system (Phase 2+); Interworking between a Public Land Mobile Network (PLMN) and a Packet Switched Public Data Network/Integrated Services Digital Network (PSPDN/ISDN) for the support of packet switched data transmission services".
- [8] GSM 09.07 (ETS 300 976): "Digital cellular telecommunications 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)".



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

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

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

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

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

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

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

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

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

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

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

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

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

### 3 Introduction

Three versions of RLP are defined:

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

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

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

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

RLP frames are sent in strict alignment with the radio transmission. (For details, see GSM 04.21). RLP frames are of a fixed size of 240 (TCH/F9.6 channel coding) or 576 bits (TCH/F14.4 channel coding). Whenever a frame is to be sent, the RLP entity has to provide the necessary protocol information to be contained in it. Provision is made for discontinuous transmission (DTX).

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

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

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

## 4 Frame structure

### 4.1 Basic frame structure

An RLP-frame has a fixed length of either 240 or 576 bits consisting of a header, an information field, and an FCS (frame check sequence) field. The size of the components depends on the the radio channel type, RLP version and on the RLP frame. As a benefit of using strict alignment with underlying radio transmission there is no need for frame delimiters (like flags etc.) in RLP. In consequence, there is no "bit-stuffing" necessary in order to achieve code transparency. Frames cannot be aborted while being transmitted.

#### a) 240 bit frame size

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Header	Information	FCS
--------	-------------	-----

version 0 and 1, version 2 (U frames only) 16 bit 200 bit 24 bit

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version 2 (S and I+S frames only) 24 bit 192 bit 24 bit

#### b) 576 bit frame size

Header	Information	FCS
--------	-------------	-----

version 0, 1, and version 2 (U frames only) 16 bit 536 bit 24 bit

version 2 (S and I+S frames only) 24 bit 528 bit 24 bit

Figure 1: Frame structure

### 4.2 RLP header

An RLP-header carries one of three types of control information, the first being unnumbered protocol control information (U frames), the second being supervisory information (S frames), the third being user information carrying supervisory information piggybacked (I + S frames).

### 4.3 Order of transmission

The header, as defined in clause 5.2, shall be transmitted from left to right. The FCS shall be transmitted commencing with the highest order term. The order of bit transmission for the information field is from left to right.

### 4.4 Frame check sequence

The FCS shall be the ones complement of the modulo 2 sum of:

- a) the remainder of:

For 9.6/4.8 kbit/s channel coding:

$$x^{216} (x^{23} + x^{22} + x^{21} + x^{20} + x^{19} + x^{18} + x^{17} + x^{16} + x^{15} + x^{14} + x^{13} + x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)$$

For 14.4kbit/s channel coding:

$$x^{552} (x^{23} + x^{22} + x^{21} + x^{20} + x^{19} + x^{18} + x^{17} + x^{16} + x^{15} + x^{14} + x^{13} + x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)$$

divided modulo 2 by the generator polynomial:

$$x^{24} + x^{23} + x^{21} + x^{20} + x^{19} + x^{17} + x^{16} + x^{15} + x^{13} + x^8 + x^7 + x^5 + x^4 + x^2 + 1$$

and

- b) the remainder of the division modulo 2 by the generator polynomial:

$$x^{24} + x^{23} + x^{21} + x^{20} + x^{19} + x^{17} + x^{16} + x^{15} + x^{13} + x^8 + x^7 + x^5 + x^4 + x^2 + 1$$

of the product of  $x^{24}$  by the content of the frame, excluding the FCS field. (The first bit transmitted corresponds to the highest order term.)

Implementation note: As a typical implementation, at the transmitter, the initial content of the register of the device computing the remainder of the division is pre-set to all ones and is then modified by division by the generator polynomial (as described above) of the header and information field; the ones complement of the resulting remainder is transmitted as the 24 bit FCS sequence.

At the receiver, the initial content of the register of the device computing the remainder is pre-set to all ones. The final remainder after multiplication by  $x^{24}$  and then division (modulo 2) by the generator polynomial:

$$x^{24} + x^{23} + x^{21} + x^{20} + x^{19} + x^{17} + x^{16} + x^{15} + x^{13} + x^8 + x^7 + x^5 + x^4 + x^2 + 1$$

of the serial incoming protected bits and the FCS will be:

$$0\ 1\ 1\ 0\ 1\ 1\ 0\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ (x^{23} \text{ to } x^0, \text{ resp.})$$

in the absence of transmission errors.

## 5 Elements and procedure

### 5.1 Modes

An RLP entity can be in one of two modes:

- Asynchronous Balanced Mode (ABM)
- Asynchronous Disconnected Mode (ADM)

### 5.1.1 Asynchronous Balanced Mode (ABM)

In ABM, which is the data link operational mode, either RLP entity may send commands at any time and may initiate response frame transmission without receiving explicit permission to do so from the other RLP-station. In ABM, frames shall be used for information field transfer and/or to indicate status changes in the RLP-station.

### 5.1.2 Asynchronous Disconnected Mode (ADM)

In ADM, which is the data-link non-operational mode, the RLP entity shall be logically disconnected from the data link and shall, therefore, neither transmit nor accept numbered information frames.

The RLP entity shall, however, be permitted to transmit and accept NULL, DM, UI, TEST and XID frames. Either RLP entity can issue an SABM command at any time, in order to terminate the ADM state. In that case, entrance of the ABM state will be indicated by a UA response from the opposite station. If the opposite station is not able to enter ABM, it will indicate this by a DM response. All commands other than those mentioned above and any unsolicited response will be ignored in ADM under all circumstances.

## 5.2 Header and parameters

The formats defined for the header are listed in figure 2.

### 5.2.1 Generally used bits

NOTES: C/R = COMMAND/RESPONSE BIT  
P/F = POLL/FINAL BIT  
X = DONT CARES

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S <sub>1</sub>	S <sub>2</sub>	
0	0	R R
0	1	R E J
1	0	R N R
1	1	S R E J

M <sub>1</sub> M <sub>2</sub> M <sub>3</sub> M <sub>4</sub> M <sub>5</sub>	
1 1 1 0 0	S A B M
0 0 1 1 0	U A
0 0 0 1 0	D I S C
1 1 0 0 0	D M
1 1 1 1 0	N U L L
0 0 0 0 0	U I
1 1 1 0 1	X I D
0 0 1 1 1	T E S T
1 0 0 0 1	R E M A P

### Versions 0 and 1:

NOTES: N(S) : Bit 4 low order bit  
N(R) : Bit 11 low order bit

U	C/R	X	X	1	1	1	1	1	1	P/F	M1	M2	M3	M4	M5	X
S	C/R	S1	S2	0	1	1	1	1	1	P/F	N (R)					
I+S	C/R	S1	S2	N (S)					P/F	N (R)						
bit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

