ETSI TS 101 376-4-11 V1.1.1 (2001-03)

Technical Specification

GEO-Mobile Radio Interface Specifications;
Part 4: Radio interface protocol specifications;
Sub-part 11: Radio Link Protocol (RLP) for Data Services;
GMR-1 04.022

Reference

DTS/SES-001-04022

Keywords

GMR, MSS, MES, satellite, GSO, S-PCN, GSM, data, interface, mobile, radio, RLP

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

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IPRs:

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TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,226,084	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,715,365	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,826,222	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,754,974	US
TS 101 376 V1.1.1	Digital Voice Systems Inc		US	US 5,701,390	US

IPR Owner: Digital Voice Systems Inc
One Van de Graaff Drive Burlington,
MA 01803
USA

Contact: John C. Hardwick
Tel.: +1 781-270-1030
Fax: +1 781-270-0166

Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 376 V1.1.1	Ericsson Mobile Communication	Improvements in, or in relation to, equalisers	GB	GB 2 215 567	GB
TS 101 376 V1.1.1	Ericsson Mobile Communication	Power Booster	GB	GB 2 251 768	GB
TS 101 376 V1.1.1	Ericsson Mobile Communication	Receiver Gain	GB	GB 2 233 846	GB
TS 101 376 V1.1.1	Ericsson Mobile Communication	Transmitter Power Control for Radio Telephone System	GB	GB 2 233 517	GB

IPR Owner: Ericsson Mobile Communications (UK) Limited
The Keytech Centre, Ashwood Way
Basingstoke
Hampshire RG23 8BG
United Kingdom

Contact: John Watson
Tel.: +44 1256 864821

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TS 101 376 V1.1.1	Hughes Network Systems		US	Pending	US

IPR Owner: Hughes Network Systems
11717 Exploration Lane
Germantown, Maryland 20876
USA

Contact: John T. Whelan
Tel: +1 301-428-7172
Fax: +1 301-428-2802

Project	Company	Title	Country of Origin	Patent n°	Countries Applicable
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	2.4-to-3 KBPS Rate Adaptation Apparatus for Use in Narrowband Data and Facsimile Communication Systems	US	US 6,108,348	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Cellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic ThroughputCellular Spacecraft TDMA Communications System with Call Interrupt Coding System for Maximizing Traffic Throughput	US	US 5,717,686	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Enhanced Access Burst for Random Access Channels in TDMA Mobile Satellite System	US	US 5,875,182	
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,314	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System	US	US 5,974,315	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Mutual Offset High-argin Forward Control Signals	US	US 6,072,985	US
TS 101 376 V1.1.1	Lockheed Martin Global Telecommunic. Inc	Spacecraft Cellular Communication System with Spot Beam Pairing for Reduced Updates	US	US 6,118,998	US

IPR Owner: Lockheed Martin Global Telecommunications, Inc.
900 Forge Road
Norristown, PA. 19403
USA

Contact: R.F. Franciose
Tel.: +1 610.354.2535
Fax: +1 610.354.7244

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES).

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Version 1.m.n

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- the third digit (n) is incremented when editorial only changes have been incorporated in the specification;
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The present document is part 4, sub-part 11 of a multi-part deliverable covering the GEO-Mobile Radio Interface Specifications, as identified below:

Part 1: "General specifications";

Part 2: "Service specifications";

Part 3: "Network specifications";

Part 4: "Radio interface protocol specifications";

Sub-part 1: "Mobile Earth Station-Gateway Station System (MES-GSS) Interface; GMR-1 04.001";

Sub-part 2: "GMR-1 Satellite Network Access Reference Configuration; GMR-1 04.002";

Sub-part 3: "Channel Structures and Access Capabilities; GMR-1 04.003";

Sub-part 4: "Layer 1 General Requirements; GMR-1 04.004";

Sub-part 5: "Data Link Layer General Aspects; GMR-1 04.005";

Sub-part 6: "Mobile earth Station-Gateway Station Interface Data Link Layer Specifications; GMR-1 04.006";

Sub-part 7: "Mobile Radio Interface Signalling Layer 3 General Aspects; GMR-1 04.007";

Sub-part 8: "Mobile Radio Interface Layer 3 Specifications; GMR-1 04.008";

Sub-part 9: "Performance Requirements on the Mobile Radio Interface; GMR-1 04.013";

Sub-part 10: "Rate Adaptation on the Access Terminal-Gateway Station Subsystem (MES-GSS) Interface; GMR-1 04.021";

Sub-part 11: "Radio Link Protocol (RLP) for Data Services; GMR-1 04.022";

Part 5: "Radio interface physical layer specifications";

Part 6: "Speech coding specifications";

Part 7: "Terminal adaptor specifications".

Introduction

GMR stands for GEO (Geostationary Earth Orbit) Mobile Radio interface, which is used for mobile satellite services (MSS) utilizing geostationary satellite(s). GMR is derived from the terrestrial digital cellular standard GSM and supports access to GSM core networks.

Due to the differences between terrestrial and satellite channels, some modifications to the GSM standard are necessary. Some GSM specifications are directly applicable, whereas others are applicable with modifications. Similarly, some GSM specifications do not apply, while some GMR specifications have no corresponding GSM specification.

Since GMR is derived from GSM, the organization of the GMR specifications closely follows that of GSM. The GMR numbers have been designed to correspond to the GSM numbering system. All GMR specifications are allocated a unique GMR number as follows:

GMR-n xx.zyy

where:

- xx.0yy (z = 0) is used for GMR specifications that have a corresponding GSM specification. In this case, the numbers xx and yy correspond to the GSM numbering scheme.
- xx.2yy (z = 2) is used for GMR specifications that do not correspond to a GSM specification. In this case, only the number xx corresponds to the GSM numbering scheme and the number yy is allocated by GMR.
- n denotes the first (n = 1) or second (n = 2) family of GMR specifications.

A GMR system is defined by the combination of a family of GMR specifications and GSM specifications as follows:

- If a GMR specification exists it takes precedence over the corresponding GSM specification (if any). This precedence rule applies to any references in the corresponding GSM specifications.

NOTE: Any references to GSM specifications within the GMR specifications are not subject to this precedence rule. For example, a GMR specification may contain specific references to the corresponding GSM specification.

- If a GMR specification does not exist, the corresponding GSM specification may or may not apply. The applicability of the GSM specifications is defined in GMR-1 01.201 [2].

1 Scope

The present document specifies the radio link protocol (RLP) for data transmission over radio interface of the GMR-1 Mobile Satellite System.

RLP covers the Layer 2 functionality of the ISO OSI Reference Model (ISO/IEC 7498 [12]). RLP provides the OSI Data Link Service (ISO/IEC 8886 [14]) to its users. It is based on ideas contained in ISO/IEC 3309 [10], ISO/IEC 4335 [11] and ISO/IEC 7809 [13] (HDLC of ISO) as well as ITU-T Recommendations X.25 and Q.92x (LAP-B and LAP-D of ITU-T, resp.).

RLP has been tailored to the special needs of digital radio transmission. The radio link protocol is similar to that described in GSM 04.22 [4]. However, for throughput and efficiency reasons, the RLP frame format used in RLP version 2 described in GSM 04.22 [5] shall be used for the GMR-1 mobile satellite system.

RLP is intended for use with nontransparent 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 adapters, i.e., GMR-1 07.002 [3] for the asynchronous case. Care shall be taken that this material is also applied to Interworking Functions; see GSM 09.04 [6], GSM 09.05 [7], GSM 09.06 [8], and GSM 09.07 [9].

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] GMR-1 01.004 (ETSI TS 101 376-1-1): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 1: Abbreviations and acronyms; GMR-1 01.004".

[2] GMR-1 01.201 (ETSI TS 101 376-1-2): "GEO-Mobile Radio Interface Specifications; Part 1: General specifications; Sub-part 2: Introduction to the GMR-1 Family; GMR-1 01.201".

[3] GMR-1 07.002 (ETSI TS 101 376-7-2): "GEO-Mobile Radio Interface Specifications; Part 7: Terminal adaptor specifications; Sub-part 2: Terminal Adaptation Functions (TAF) for Services Using Asynchronous Bearer capabilities; GMR-1 07.002".

[4] GSM 04.22 (ETSI ETS 300 563): "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 (V4.5.1))".

[5] GSM 04.22 (ETSI ETS 300 946): "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 V5.6.1 Release 1996)".

[6] GSM 09.04 (ETSI ETS 300 601): "European digital cellular telecommunications system (Phase 2); Interworking between the Public Land Mobile Network (PLMN) and the Circuit Switched Public Data Network (CSPDN) (GSM 09.04 (V4.0.2))".

[7] GSM 09.05 (ETSI ETS 300 602): "European digital cellular telecommunications system (Phase 2); Interworking between the Public Land Mobile Network (PLMN) and the Packet Switched Public Data Network (PSPDN) for Packet Assembly/Disassembly (PAD) facility access (GSM 09.05 (V4.4.2))".

[8] GSM 09.06 (ETSI ETS 300 603): "European digital cellular telecommunications 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 (GSM 09.06 (V4.5.0))".

[9] GSM 09.07 (ETSI ETS 300 604): "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) (GSM 09.07 (V4.12.1))".

[10] ISO/IEC 3309: "Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures - Frame structure".

[11] ISO/IEC 4335: "Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures - Elements of procedures".

[12] ISO/IEC 7498: "Information processing systems - Open Systems Interconnection - Basic Reference Model".

[13] ISO/IEC 7809: "Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures - Classes of procedures".

[14] ISO/IEC 8886: "Information technology - Open Systems Interconnection - Data link service definition".

[15] ITU-T Recommendation V.42bis: "Data Compression for Data Circuit Terminating Equipment (DCE) using Error Correction Procedures".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Command: instruction represented in the RLP header, causing the receiving RLP entity to execute a specific function

Frame check sequence: field of redundant information based on a cyclic code, used for error detection

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

Improper frame: RLP frame having an FCS error or having a header the contents of which is inconsistent with the present document

Non-transparent: in GMR-1 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: reply represented in the RLP-header, by which the sending RLP entity reports back about its status

RLP frame: 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: RLP frame that contains supervisory information in the absence of user information

Transparent: in GMR-1 system data transmission, a configuration where at layer 2 (and also at the layers above) no protocol conversion takes place

U frame: RLP frame that contains unnumbered protocol control information

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in GMR-1 01.004 [1] apply.

4 Introduction

Same as clause 3 of GSM 04.22 [4].

5 Frame structure

5.1 Basic frame structure

An RLP-frame has a fixed length of 240 bits containing header, an information field, and an FCS sequence field (24 bits). The size of the header and information fields varies with the RLP version, see GSM 04.22 [5] as illustrated in figure 5.1. As a benefit of using strict alignment with underlying radio transmission there is no need for frame delimiters (such as flags, etc.) in RLP. Consequently, there is no "bit-stuffing" necessary in order to achieve code transparency. Frames cannot be aborted while being transmitted.

Header	Information	FCS	
16 bits	200 bits	24 bits	for versions 0&1 and U frames of version 2
24 bits	192 bits	24 bits	for S and I+S frames of version 2

Figure 5.1: Frame structure from GSM 04.22 [5]

5.2 RLP header

Same as clause 4.2 of GSM 04.22 [4].

5.3 Order of transmission

Same as clause 4.3 of GSM 04.22 [4].

5.4 Frame check sequence

Same as clause 4.4 of GSM 04.22 [4].

6 Elements and procedure

6.1 Modes

Same as clause 5.1 of GSM 04.22 [4].

6.1.1 Asynchronous Balanced Mode (ABM)

Same as clause 5.1 of GSM 04.22 [4].

6.1.2 Asynchronous Disconnected Mode (ADM)

Same as clause 5.1.2 of GSM 04.22 [4].

6.2 Header and parameters

The formats defined for the header are listed in figure 6.2 in clause 6.2.1.

6.2.1 Generally used bits

NOTE 1: C/R = COMMAND/RESPONSE BIT

X = DON'T CARES

P/F = POLL/FINAL BIT.

Table 6.1

S_1	S_2	
0	0	R R
0	1	R E J
1	0	R N R
1	1	S R E J

$M_1M_2M_3M_4M_5$	
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	NULL
0 0 0 0 0	U I
1 1 1 0 1	X I D
0 0 1 1 1	T E S T

Versions 0 and 1:

NOTE 2: N(S): Bit 4 LSB

N(R): Bit 11 LSB.

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

Figure 6.1

Version 2:

NOTE 3: N(S): Bit 1 LSB

N(R): Bit 14 LSB

S = L2R Status Bit.

U	C/R	X	X	1	1	1	1	1	1	P/F	M1	M2	M3	M4	M5	X								
S	X	X	X	0	1	1	1	1	1	P/F	C/R	S1	S2	N(R)									X	X
I+S	N(S)									P/F	C/R	S1	S2	N(R)									S	X
bit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Figure 6.2: Header format

6.2.1.1 Command/Response Bit, C/R

Same as clause 6.2.1.1 of GSM 04.22 [4].

6.2.1.2 Poll/Final Bit, P/F

Same as clause 6.2.1.2 of GSM 04.22 [4].

6.2.2 Unnumbered Frames, U

6.2.2.1 Set Asynchronous Balanced Mode SABM (11100)

Same as clause 5.2.2.1 of GSM 04.22 [4].

6.2.2.2 Unnumbered Acknowledge, UA (00110)

Same as clause 5.2.2.1 of GSM 04.22 [4].

6.2.2.3 Disconnect, DISC (00010)

Same as clause 5.2.2.3 of GSM 04.22 [4].

6.2.2.4 Disconnected Mode, DM (11000)

Same as clause 5.2.2.4 of GSM 04.22 [4].

6.2.2.5 Unnumbered Information, UI (00000)

Same as clause 5.2.2.5 of GSM 04.22 [4].

6.2.2.6 Exchange Identification, XID (11101)

The information field is to be interpreted as exchange identification. This frame is used to negotiate and renegotiate parameters of RLP and layer 2 relay function. XID frames can be sent in both ADM and ABM.

The negotiation procedure is one step, i.e., one side will start the process by sending an XID command, offering a certain set of parameters from the applicable parameter repertoire (see table 6.2). In return, the other side will send an XID response, either confirming those parameter values by returning the requested values or by offering higher or lower ones in their place (see table 6.2 for sense of negotiation). An exception to this procedure is when the indicated RLP version is a lower one, and a limited set of the parameters presented in the XID command may be answered according to the negotiated version. This normally will end the negotiation process. XID frames are always used with the P/F-bit set to "1".

Without any prior XID exchange, default values will apply (see clause 6.4).

In the case of a collision of XID commands, all XID commands shall be ignored. The mobile earth station will restart the parameter negotiation on expiry of T1, while the interworking function will do so on expiry of twice the value of T1. An unsuccessful XID exchange will be repeated on expiry of T1. After N2 times of unsuccessful repetition, the link will be disconnected.

In table 6.2, a list of parameters constituting the parameter repertoire for this RLP version is given. In addition, the format of the XID information field is given.

Table 6.2: XID parameters from GSM 04.22 [5]

Parameter Name	Type	Length	Format (87654321)	Units	Sense of Negotiation	Valid in Versions
RLP version N°	1	1	Bbbbbbbb (note 1)	./.	down	≥ 0
IWF to MS window size	2	1	00bbbbbb	8	down	2
MS to IWF window size	3	1	00bbbbbb	8	down	2
Acknowledgement timer(T1)	4	1	bbbbbbbb	10 ms	up	≥ 0
Retransmission attempts (N2)	5	1	bbbbbbbb	./.	up	≥ 0
Reply delay (T2) (note 2)	6	1	bbbbbbbb	10 ms	up	≥ 0
Compression P_T P_0 P_1 low P_1 high P_2	7	4	aaaa 00bb cccccccc cccccccc dddddddd	./. ./. ./. ./.	none see [15] down down	≥ 1

NOTE 1: Characters "a", "b", "c" and "d" indicate a bit which is part of the parameter value in question. Parameters indicated by "a" are not negotiable.

NOTE 2: In case of negotiation of this parameter it may be necessary to negotiate also the "Acknowledgment timer" (T1).

The type and length are encoded within one octet, the type field occupying bits 8 to 5 and the length field occupying bits 4 to 1 ; 1 and 5 being the least significant bit respectively. The least significant bit will always be transmitted first.

A parameter item consists of the type/length-octet followed by the value of that parameter, where the length-indicator gives the number of octets the value actually occupies. Such parameter items may be arranged in arbitrary order, with the exception of the RLP version number, which will be sent first in RLP versions higher than "0". The parameter items shall begin in the first octet of the XID-information field and follow on contiguously. The parameter list is delimited by parameter type zero.

RLP version "2" is recommended for GMR-1 satellite applications even for single link connections that use Phase 2 signalling. For those network implementations in which the RLP version defaults to version 0 or 1 for single link connections, the UT will explicitly issue an XID command to request a change to version 2, and the MSC/IWF will honour that request. The default and recommended value for P_0 is 0, which implies that no data compression is to be used in either direction.

It is further noted that resequencing timer T4 that is applicable for multi-link configurations in GSM 04.22 [5] is not used in GMR-1 satellite system since GMR-1 system uses a single-link configuration. Therefore T4 is not listed as a parameter for negotiation in table 6.2 above.

6.2.2.7 Test, TEST (00111)

Same as clause 5.2.2.7 of GSM 04.22 [4].

6.2.2.8 Null Information, NULL (11110)

Same as clause 5.2.2.8 of GSM 04.22 [4].

6.2.3 Supervisory Frames, S, and Numbered Information Transfer and Supervisory Frames Combined, I+S

Same as clause 5.2.3 of GSM 04.22 [4].

6.2.3.1 Send Sequence Number, N(S)

The sequence number contains the number of the I frame. Where N(S) is concerned, modulus 480 arithmetic is applied for frame numbering, thus allowing for a maximum window size of 479. On mutual agreement between the communicating parties, a smaller window size may be established. With the exception of SREJ conditions, information frames are transmitted in numerical order of their N(S). Normal information transfer is halted when the number of outstanding, unacknowledged frames is equal to the currently established window size. Refer to table 6.3 for recommended values for GMR-1 satellite applications.

6.2.3.2 Receive Sequence Number, N(R)

The N(R) field is used in ABM to designate the next information frame to be sent by the other RLP entity and to confirm that all frames up to and including N(R) – 1 have been properly received. An exception to this is that in the case of SREJ (selective reject), N(R) designates the information frame that is selectively rejected and thus requested for retransmission. In this case, no previously received frames are confirmed.

N(R) provides for a modulus of 480, thereby allowing for a maximum window size of 479, i.e., a maximum of 479 information frames may be outstanding at any time. Refer to table 6.3 for recommended values for GMR-1 satellite applications.

6.2.3.3 Receive Ready, RR (00)

Same as clause 5.2.3.3 of GSM 04.22 [4].

6.2.3.4 Reject, REJ (01)

The REJ encoding can be used either as command or response. It is used by an RLP entity to indicate that in numbered information transfer, one or more out-of sequence frames have been received. Frames up to and including N(R)-1 have been received correctly, frames N(R) and following are requested to be retransmitted. Following retransmission of those frames, further frames awaiting initial transmission may be sent. With respect to each direction of transmission, only one REJ condition may exist at any given time.

A REJ condition is cleared:

- receipt of the frame numbered N(R);
- on timeout;
- reset (SABM).

An REJ shall be sent at the earliest opportunity. On timeout, REJ frames will not be repeated. An RLP-entity receiving an REJ frame with the same N(R) that has already been the starting frame of a retransmission sequence due to P/F-bit checkpointing, will inhibit the retransmission due to that particular REJ frame. For GMR-1 satellite applications, REJ will be used if the number of missing frames exceeds a border-limit parameter that is configurable in the system. However, the recommended value for the border limit is 30.

6.2.3.5 Receive Not Ready, RNR (10)

Same as clause 5.2.3.5 of GSM 04.22 [4].

6.2.3.6 Selective Reject, SREJ (11)

The SREJ encoding can be used either as command or response. The SREJ command/response is used to request retransmission of a single frame, thus, under certain circumstances, providing more efficient error recovery than by REJ. No acknowledgment of received I frames is indicated by an SREJ frame, which allows an RLP entity to transmit one or more SREJ frames with a different N(R) before earlier SREJ conditions have been cleared.

An SREJ condition shall be cleared:

- on receipt of an information frame with N(S) equal N(R) of the SREJ;
- on timeout;
- on reset (SABM).

No SREJ should be issued during a pending REJ condition. For each frame, only one SREJ condition may exist at any time.

SREJ frames should be sent at the earliest possibility. On timeout, SREJ frames may be repeated.

6.3 Error Recovery

6.3.1 Improper Frames

Same as clause 5.3.1 of GSM 04.22 [4].

6.3.2 N(S) Sequence Error

Same as clause 5.3.2 of GSM 04.22 [4].

6.3.3 Timeout and checkpointing

All frames requiring a response or acknowledgement shall be guarded by timeout (Timer T1). Specifically, this guarding applies to those frames that contain:

- SABM;
- DISC;
- REJ;
- SREJ;
- numbered information (see note);
- any frame with the P-bit set to "one" in ABM, i.e., checkpointing.

NOTE: T1 is started, or restarted if already running, on the transmission of every numbered information frame.

6.3.3.1 Treatment of errors during link establishment, link reset and link disconnect

Same as clause 5.3.3.1 of GSM 04.22 [4].

6.3.3.2 Treatment of errors during numbered information transfer

Same as clause 5.3.3.2 of GSM 04.22 [4].

6.3.4 Contentious situations

Same as clause 5.3.4 of GSM 04.22 [4].

6.4 List of system parameters

The system parameters are as follows.

6.4.1 Timer T1

Same as clause 5.4.1 of GSM 04.22 [4].

6.4.2 Maximum number of retransmissions N2

Same as clause 5.4.2 of GSM 04.22 [4].

6.4.3 Maximum number of outstanding I frames k

The maximum number (k) of sequentially numbered I frames that may be outstanding (i.e., unacknowledged) at any given time is a system parameter which can never exceed 479. The window size can however be negotiated using XID frame to a mutually agreeable number. Table 6.3 provides recommended values. It shall be agreed for a period of time.

Table 6.3: RLP parameter values

Name	Recommended Value
k for UT-> IWF	128 on 12 kbps Radio Interface Rate (RIR) 64 on 6 kbps Radio Interface Rate (RIR)
k for IWF-> UT	128 on 12 kbps Radio Interface Rate (RIR) 64 on 6 kbps Radio Interface Rate (RIR)
T1	1,5 seconds
T2	80 ms
N2	6

NOTE: T2 < T1 – (2 * transmission delay).

6.5 Support for Discontinuous Transmission (DTX)

In both ADM and ABM, whenever the RLP entity has no numbered or unnumbered supervisory commands/responses and no information transfer frames awaiting transmission, the RLP entity shall indicate to the lower layer that the DTX function may be invoked. Support for DTX is not mandatory.

NOTE: When DTX is invoked, in ADM a NULL-frame will be sent, and in ABM an RR or RNR S-frame will be sent.

7 Service definitions

7.1 Introduction

Same as clause 6.1 of GSM 04.22 [4].

7.2 Conventions

Same as clause 6.2 of GSM 04.22 [4].

7.3 Queue model

Same as clause 6.3 of GSM 04.22 [4].

7.4 List of primitives

Same as clause 6.4 of GSM 04.22 [4].

7.5 Possible RLP Time Sequence Diagrams

Same as clause 6.5 of GSM 04.22 [4].

Annex A (informative): RLP SDL Diagrams

This annex describes a model implementation of an RLP entity.

The description should help to clarify the RLP service and protocol definition.

However, the description is not intended to restrict any implementation of an RLP entity in any way, if the implementation shows the correct behaviour at the RLP protocol level.

The model implementation consists of three processes. Process "SEND_PDU" adds the CRC to a given PDU and hands it to the lower layer entity for transmission. Process "RECEIVE_PDU" gets a received PDU block and checks the value of the CRC and the bits of the PDU header. If the CRC has the right value and if the header is syntactically correct, the receipt event is signalled to the "RLP_KERNEL" process, the protocol handling automaton.

Each process is described as an extended finite state machine (using SDL-Diagrams).

Each state of the automaton is described by a (main-)state number and a corresponding (main-)state name. The state may further be distinguished by the value of other state variables. This scheme is used because not every state variable needs to be defined in every state. The states are defined in clause A.1.

The RLP machine reacts on events, which may be classified as:

- lower-layer interface events;
- upper-layer interface events;
- station management or internal events.

The events of the RLP-Kernel are described in clause A.2.

A.1 List of RLP entity states

A.1.1 (Main) States

state number	state symbol	state name
0	S0	ADM and detached
1	S1	ADM and attached
2	S2	Pending connect request
3	S3	Pending connect indication
4	S4	ABM and connection established
5	S5	Disconnect initiated
6	S6	Pending reset request
7	S7	Pending reset indication

A.1.2 State variables

The main states are further distinguished by the values of the state variables.

However, not every state variable is used (evaluated/defined) in every state.

First, some constants shall be defined:

M = 62 for versions 0&1, 481 for version 2 — number of different sequence numbers (modulus);

Nmin = 0 for versions 0, 1 and 2 — smallest sequence number;

Nmax = 61 for versions 0&1, 480 for version 2 — largest sequence number (= M – 1);

N2 = 6 for versions 0, 1 and 2 — maximum number of retransmissions.

Variable name	Variable type and range	Semantic
Ackn_Fbit	(0, 1)	Value of the F-Bit used in the next acknowledging PDU.
Ackn_State	(idle, send)	Ackn_State = send means, an acknowledging PDU (Supervisory or Data) shall be sent.
C	(0, 1)	To store the C/R-Bit value of a received S- or I-frames.
Data	char(25)	To store temporarily the information part (user data) of a received I-frame.
DISC_Count	(0, 1,…, N2)	To count the transmissions of DISC.
DISC_Pbit	(0, 1)	The value of the P-bit in the next DISC commands PDU.
DISC_State	(idle, send, wait)	If (DISC_State = send) the DISC command PDU shall be sent at the next possible opportunity.
		If (DISC_State = wait) the RLP entity waits for the corresponding response.
DM_Fbit	(0, 1)	Value of the F-Bit used in the next DM response PDU.
DM_State	(idle, send)	If (DM_State = send) the PDU DM shall be sent.
DTX_SF	(N, RR, RNR)	To store the last supervisory frame for DTX (only RR or RNR can be suppressed).
DTX_VR	(0, 1,.., Nmax)	To store the last transmitted value of VR (used to decide the DTX condition).
F	(0, 1)	To store temporarily the F-bit of a received response PDU.
NR	(0, 1,…, Nmax)	To store temporarily the receive sequence number of a received S- or I-frame.
NS	(0, 1,…, Nmax)	To store temporarily the send sequence number of a received I-frame.
P	(0, 1)	To store temporarily the P-bit of a received command PDU.
P_F	(0, 1)	To store temporarily the P- or F-bit of received command or response PDUs.
Poll_Count	(0, 1,…, N2)	To count the transmissions of poll requests.
Poll_State	(idle, send, wait)	(Poll_State = send) means, a supervisory PDU with P-bit set to one shall be sent.
		(Poll_State = wait) means, the RLP entity waits for the response with F-bit set to one.
Poll_xchg	(idle, wait)	(Poll_xchg = idle) means, sending of a frame with P-bit set is allowed.
		(Poll_xchg = wait) means, an acknowledgement of a previous P-bit is outstanding.
R[M]	record array	Receiver slots (M slots, numbered 0 to M-1).
R[n].Data	char(25)	to store user information.
R[n].State	(idle, rcvd, ackn, srej, wait)	(R[n].State = rcvd) means, data has been received (with sequence number n).
		(R[n].State = ackn) means, data has been received and acknowledged. (R[n].State = srej) means, the retransmission of data shall be requested using srej(n). (R[n].State = wait) means the entity waits for the requested retransmitted data.
REJ_State	(idle, send, wait)	The REJ_State is send if, and only if, a REJ PDU shall be sent.
Returncode	Integer	Used in procedures to report a result.
RRReady	Boolean	Remote Receiver Ready.
SABM_Count	(0, 1,…, N2)	To count the transmissions of SABM.
SABM_State	(idle, send, wait)	If (.._State = send) the SABM PDU has to be sent. If (.._State = wait) the RLP entity waits for the UA response.
S[M]	record array	Sender Slots (M slots, numbered 0 to M-1).

Variable name	Variable type and range	Semantic
S[n].Data	char(25)	User information to be sent.
S[n].State	(idle, send, wait)	(S[n].State = send) means data has to be sent (with sequence# n).
SF	(RR,RNR,REJ,SREJ)	To store the last superv. PDU type.
T	Timer	Used by the data sender if waiting for I-frame acknowledgments or F-bits.
TEST_Count	(0, 1,…,N2)	To count the transmissions of TEST.
TEST_C_Data	char(25)	Data to be sent in the next TEST command PDU.
TEST_C_Pbit	(0, 1)	Value of the P-Bit used in the next TEST command PDU.
TEST_C_State	(idle, send, wait)	If (.._State = send) the TEST command PDU shall be sent.
		If (.._State = wait) the RLP entity waits for the next TEST response.
TEST_R_Data	char(25)	Data to be sent in the next TEST response PDU.
TEST_R_Fbit	(0, 1)	Value of the P-Bit used in the next TEST response PDU.
TEST_R_State	(idle, send)	If (.._State = send) the TEST response PDU has to be sent.
T_RCVR	Timer	Used by the receiver to timeout a REJ condition.
T_RCVS(n)	Timer	Used by the receiver to timeout a SREJ condition for Slot n.
T_TEST	Timer	Used by the sender of a TEST frame if waiting for a TEST response.
T_XID	Timer	Used by the sender of a XID frame if waiting for the XID response.
UA_Fbit	(0, 1)	Value of the F-Bit used in the next UA response.
UA_State	(idle, send)	If (UA_State = send) an UA PDU shall be sent.
UI_Data	char(25)	Data to be sent in the next UI PDU.
UI_Pbit	(0, 1)	Value of the P-Bit used in the next UI PDU.
UI_State	(idle, send)	If (UI_State = send) a UI PDU shall be sent.
VA	(0, 1,…, Nmax)	Frame sequence number of oldest not yet acknowledged I-frame (if VA = VS then there are no unacknowledged frames).
VD	(0, 1, …, Nmax)	Slot number used in the next Data_Req.
VR	(0, 1, …, Nmax)	Receiver sequence number (the next received I-frame is expected to carry this sequence number).
VS	(0, 1, …, Nmax)	Sender sequence number (under normal operating conditions the next I-frame is assigned this number).
XID_Count	(0, 1,…,N2)	To count the transmissions of XID commands.
XID_C_Data	char(25)	Data to be sent in the next XID command PDU.
XID_C_Pbit	(0, 1)	Value of the P-Bit used in the next XID command PDU.
XID_C_State	(idle, send, wait)	If (.._State = send) the XID command PDU shall be sent.
		If (.._State = wait) the RLP entity waits for the next XID response.
XID_R_Fbit	(0, 1)	Value of the P-Bit used in the next XID response PDU.
XID_R_State	(idle, send)	If (.._State = send) the XID response PDU shall be sent.

A.2 List of RLP entity events

Same as Appendix A.2 of GSM 04.22 [4].

Annex B (informative): Bibliography

ITU-T Recommendation I.440 (Redbook): "ISDN User-Network Interface Data Link Layer – General Aspects".

ITU-T Recommendation I.441 (Redbook): "ISDN User-Network Interface, Data Link".

ITU-T Recommendation Q.920 (Redbook): "ISDN User-Network Interface Data Link Layer – General Aspects".

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ISO/IEC 8509: "Information processing systems – Open Systems Interconnection – Service conventions".

ISO/IEC 8885: "Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures - General purpose XID frame information field content and format".

History

Document history		
V1.1.1	March 2001	Publication