SLOVENSKI STANDARD
SIST EN 300 945 V6.0.1:2003

01-december-2003

Digitalni celiļ ni telekomunikacijski sistem (faza 2+) ï Prilagoditev hitrosti na mobilno postajo ï Vmesnik sistema baznih postaj (MS-BSS) (GSM 04.21, razliļ ica 6.0.1, izdaja 1997)

Digital cellular telecommunications system (Phase 2+) (GSM); Rate adaption on the Mobile Station - Base Station System (MS - BSS) Interface (GSM 04.21 version 6.0.1 Release 1997)

Ta slovenski standard je istoveten z: **EN 300 945 Version 6.0.1**

ICS:

33.070.50	Globalni sistem za mobilno telekomunikacijo (GSM)	Global System for Mobile Communication (GSM)

SIST EN 300 945 V6.0.1:2003 **en**

EN 300 945 V6.0.1 (1999-09)

European Standard (Telecommunications series)

Digital cellular telecommunications system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) Interface (GSM 04.21 version 6.0.1 Release 1997)

GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

Reference

DEN/SMG-040421Q6 (8r00300o.PDF)

Keywords

Digital cellular telecommunications system,
Global System for Mobile communications (GSM)

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Foreword

This European Standard (Telecommunications series) has been produced by the Special Mobile Group (SMG).

The present document defines the rate adaptation functions to be used in Mobile Stations (MS) for adapting terminal interface data rates to the Mobile Station - Base Station System (MS - BSS) interface data rates within the digital cellular telecommunications system.

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

Version 6.x.y

where:

6 indicates Release 1997 of GSM Phase 2+

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

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

Proposed national transposition dates	
Date of adoption of this EN:	3 September 1999
Date of latest announcement of this EN (doa):	31 December 1999
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 June 2000
Date of withdrawal of any conflicting National Standard (dow):	30 June 2000

1 Scope

The present document defines the rate adaptation functions to be used in GSM PLMN Mobile Stations (MS)s for adapting terminal interface data rates to the Mobile Station - Base Station System (MS-BSS) interface data rates in accordance with GSM 03.10 [3].

The provision of these functions will depend on the services a particular station is designed to support.

NOTE: The present document should be considered together with GSM 08.20 [9] (Rate Adaptation on the BSS-MSC Interface) to give a complete description of PLMN rate adaptation.

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.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.
- For this Release 1997 document, references to GSM documents are for Release 1997 versions (version 6.x.y).

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

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

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

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

[5] GSM 05.03: "Digital cellular telecommunications system (Phase 2+); Channel coding".

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

[7] GSM 07.02: "Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[8] GSM 07.03: "Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[9] GSM 08.20: "Digital cellular telecommunications system (Phase 2+); Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

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

[11] CCITT Recommendation X.30: "Support of X.21, X.21 bis and X.20 bis based terminal equipments (DTEs) by integrated services digital network (ISDN)".

2.1 Abbreviations and definitions

Abbreviations used in the present document are listed in GSM 01.04.

Overall data stream: The data stream in those parts of the network where the data flow is not split into multiple channels.

Substream: Stream of data with explicit or implicit numbering between splitter and combiner functions.

Channel: A physical full rate channel on the radio interface (TCH/F) independent of the contents

Multislot intermediate rate: Intermediate rate per substream in those parts of the network where the overall data stream is split into substreams.

Intermediate rate: Intermediate rate in the overall data stream.

Substream rate: The user rate including padding, if applicable, on one individual substream

3 General approach

GSM 03.10 defines the PLMN connection types necessary to support the GSM PLMN data and telematic services.

Within the MS there are several different data rate adaptation functions - and a Split/Combine-function in case of a multislot data configuration - which are combined as shown in GSM 03.10 as part of the connection type.

The rate adaptation functions are RA0, RA1, RA2, RA1', RA1'' and RA1/RA1'. The RA0, RA1 and RA2 are equivalent to those functions described in CCITT recommendation V.110 [11].

The RA1' function is similar to RA1 but has a reduced bit rate output compatible with the coding scheme proposed for data services on the radio interface.

The RA1'' function is used for converting between synchronous user rates of 48 and 56 kbit/s and the rate 64 kbit/s.

The RA1/RA1' is a relay function, used as indicated in GSM 03.10.

In multislot data-configurations the overall data stream is split into parallel substreams between the Split/Combine-functions.

3.1 Overview of the multislot data rates

For TCH/F9.6 and TCH/F4.8 channel codings, the multislot intermediate rates are 16 and 8 kbit/s per TCH/F, respectively.

For TCH/F14.4 channel coding, the multislot intermediate rate is 16 kbit/s per TCH/F.

Between the TE and the Split/Combine-function at the MS, where the overall data stream is not split, intermediate rates of 8, 16, 32 and 64 kbit/s are applicable

Table 1: AIUR/Multislot intermediate rates

Air interface user rate	DTE/DCE statuses	RA0	RA1/RA1'		RA1'	
			Multislot intermediate rate	Frame type	Radio interface rate	Padding
≤ 600 bit/s	X	X	8 kbit/s	80 bit frames	3,6 kbit/s	
1200 bit/s	X	X	8 kbit/s	80 bit frames	3,6 kbit/s	
2,4 kbit/s	X	X	8 kbit/s	80 bit frames	3,6 kbit/s	
4,8 kbit/s	X	X	8 kbit/s	80 bit frames	6 kbit/s	
9,6 kbit/s	X	X	16 kbit/s or 2×8 kbit/s	80 bit frames	12 kbit/s or 2×6 kbit/s	
14,4 kbit/s	X	X	2×16 kbit/s or 3×8 kbit/s	80 bit frames	2×12 kbit/s or 3×6 kbit/s	P (note 1)
			16 kbit/s Note 7		14,5 kbit/s	
19,2 kbit/s	X	X	2×16 kbit/s or 4×8 kbit/s	80 bit frames	2×12 kbit/s or 4×6 kbit/s	
28,8 kbit/s	X	X	3×16 kbit/s	80 bit frames	3×12 kbit/s	
			2 x 16 kbit/s Note 7		2×14,5 kbit/s	
38,4 kbit/s	X	X	4×16 kbit/s	80 bit frames	4×12 kbit/s	P (note 6)
			3 x 16 kbit/s Note7		3×14,5 kbit/s	
48 kbit/s	X		Note 2	Note 2	5×12 kbit/s	P (note 6)
			4 x 16 kbit/s Note7		4×14,5 kbit/s	
56 kbit/s			Note 2	Note 2	5×12 kbit/s (note 3)	P (note 6)
			4x16 kbit/s Note7		4×14,5 kbit/s	
64 kbit/s			Note 2	Note 2	6×12 kbit/s (note 3)	P (note 1) (note 6)
					5×14,5 kbit/s	

P=Padding used

Table 2: AIUR / Intermediate rates

Air interface user rate	DTE/DCE statuses	RA0	RA1		RA1'	
			Intermediate rate	Frame type	Radio interface rate	**Padding**
≤ 600 bit/s	X	X	8 kbit/s	80 bit frames	3,6 kbit/s	
1200 bit/s	X	X	8 kbit/s	80 bit frames	3,6 kbit/s	
2,4 kbit/s	X	X	8 kbit/s	80 bit frames	3,6 kbit/s	
4,8 kbit/s	X	X	8 kbit/s	80 bit frames	6 kbit/s	
9,6 kbit/s	X	X	16 kbit/s	80 bit frames	12 kbit/s or 2×6 kbit/s	
14,4 kbit/s	X	X	32 kbit/s	80 bit frames	2×12 kbit/s or 3×6 kbit/s 1x14,5 kbit/s	P (note 1)
19,2 kbit/s	X	X	32 kbit/s	80 bit frames	2×12 kbit/s or 4×6 kbit/s	
28,8 kbit/s	X	X	64 kbit/s	80 bit frames	3×12 kbit/s 2×14,5 kbit/s	
38,4 kbit/s	X	X	64 kbit/s	80 bit frames	4×12 kbit/s 3×14,5 kbit/s	P (note 6)
48 kbit/s	X		Note 4	Note 4	5×12 kbit/s 4×14,5 kbit/s	P (note 6)
56 kbit/s			Note 4	Note 4	5×12 kbit/s (note 3) 4×14,5 kbit/s	P (note 6)
64 kbit/s			Note 5	Note 5	6×12 kbit/s (note 3) 5×14,5 kbit/s	P (note 1) (note 6)

P=Padding used

NOTE 1: For information on the padding procedure, please refer to clause 10 of the present document.

NOTE 2: No multislot intermediate rate; substreams combined at the BSS when TCH/F9.6/4.8 channel coding is used.

NOTE 3: AIUR 11,2 kbit/s per channel

NOTE 4: For this rateGSM-specific rate adaptation function RA1'' rather than RA1is applied.

NOTE 5: For this rate RA1- and RA2- adaptations are not applied.

NOTE 6: Padding used as specified for TCH/F14.4 channel codings

NOTE 7: At the network side, RA1'/RA1 not applied; instead a TCH/F14,4-specific adaptation RA1'/RAA' used (GSM 08.20)

4 The RA0 Function

4.1 Asynchronous-to-Synchronous Conversion (RA0)

The RA0 Function is only used with asynchronous interfaces. Incoming asynchronous data is padded by the addition of stop elements to fit the nearest higher rate defined by 2 to the power n (where n≤ 6) times 600 bit/s or, if applicable, to either 14,4 or 28,8 kbit/s. Thus both 75 bit/s and 300 bit/s user data signalling rates shall be adapted to a synchronous 600 bit/s stream. The resultant synchronous stream is fed to RA1 or RA1'.

Asynchronous user rate	Synchronous user rate
≤ 0.6 kbit/s	0.6 kbit/s
1,2 kbit/s	1,2 kbit/s
2,4 kbit/s	2,4 kbit/s
4,8 kbit/s	4,8 kbit/s
9,6 kbit/s	9,6 kbit/s
14,4 kbit/s	14,4 kbit/s
19,2 kbit/s	19,2 kbit/s
28,8 kbit/s	28,8 kbit/s
38,4 kbit/s	38,4 kbit/s

4.2 Break signal

The RA0 shall detect and transmit the break signal in the following fashion:

If the converter detects 2M to 2M+3 bits, all of start polarity, where M is the number of bits per character in the selected format including start and stops bits, the converter shall transmit 2M+3 bits of start polarity.

If the converter detects more than 2M+3 bits all of start polarity, the converter shall transmit all these bits as start polarity.

The 2M+3 or more bits of start polarity received from the transmitting sides shall be output to the receiving terminal.

The terminal must transmit on circuit 103 at least 2M bits stop polarity after the start polarity break signal before sending further data character. The converter shall then regain character synchronism from the following stop to start transition.

4.3 Overspeed/Underspeed

A RA0 shall insert additional stop elements when its associated terminal is transmitting with a lower than nominal character rate. If the terminal is transmitting characters with an overspeed of up to 1 %, the asynchronous-to-synchronous converter may delete stop elements as often as is necessary to a maximum of one for every eight characters at 1 % overspeed. The converter on the receiving side shall detect the deleted stop elements and reinsert them in the received data stream (circuit 104).

The realization of overspeed handling, as described above, at the interface to the associated terminal is implementation dependent. Possible implementations are e.g. the reduction of the length of the stop elements according to V.110 [9] or increased data rates between the TA and terminal.

4.4 Parity Bits

Possible parity bits included in the user data are considered as data bits by the RA0 function (and RA1 function).

4.5 Flow Control

Where applicable, this function is as specified in the relevant terminal adaptation function Specification (see GSM 07 series).

5 The RA1 Function

This function is used to adapt between the synchronous user rates, or the output of the RA0 function and the intermediate rate of 8, 16, 32 or 64 kbit/s.

5.1 Adaptation of synchronous data rates up to 38,4 kbit/s

Synchronous user rate	Intermediate rate
≤ 2,4 kbit/s	8 kbit/s
4,8 kbit/s	8 kbit/s
9,6 kbit/s	16 kbit/s
14,4 kbit/s	32 kbit/s
19,2 kbit/s	32 kbit/s
28,8 kbit/s	64 kbit/s
38,4 kbit/s	64 kbit/s

A CCITT V.110 80 bits frame is constructed using the user data bits received (from the RA0 in the asynchronous case), the values of the S bits are deduced from the R interface.

Adaptation of 600 bit/s to 8Kbit/s is performed by 8 times consecutive duplication of each user data bit. (Figure 9)

Adaptation of 1200 bit/s to 8 Kbit/s is performed by 4 times consecutive duplication of each user data bit. (Figure 8)

Adaptation of 2400 bit/s to 8kbit/s is performed by 2 times consecutive duplication of each user data bit. (Figure 7)

Adaptation of 4800 bit/s to 8 Kbit/s is performed by transmitting the bit stream with no duplication. (Figure 3)

Adaptation of 9600 bit/s to 16 Kbit/s is performed by transmitting the bit stream with no duplication (the emitting period is halved with respect to the 4800 bit/s case). (Figure 3)

Adaptation of 14400 bit/s to 32 Kbit/s is performed as for 3600 bit/s to 8 kbit/s (the emitting period is divided by four with respect to the 3600 bit/s case).(Adaptation of 3600 bit/s to 8 kbit/s is performed by transmitting the bit stream with no duplication.) (Figure 12)

Adaptation of 19200 bit/s to 32 Kbit/s is performed as for 4800 bit/s to 8 kbit/s (the emitting period is divided by four with respect to the 4800 bit/s case). (Figure 3)

Adaptation of 28800 bit/s to 64 Kbit/s is performed as for 3600 bit/s to 8 kbit/s (the emitting period is divided by eight with respect to the 3600 bit/s case). (Figure 12)

Adaptation of 38400 bit/s to 64 Kbit/s is performed as for 4800 bit/s 8 kbit/s (the emitting period is divided by eight with respect to the 4800 bit/s case). (Figure 3)

The CCITT V.110 80 bit frames shown in Figures 3 and 12 are used. The D bits are used to convey the user data and the S and X bits are used to convey channel control information according to the relevant terminal adapter function Specification.

The E bits are used to convey the following information:

i) User Data Rate - E1, E2, E3 (for single slot operation see Figure 4, and for multislot operation Figure 4 and subclause 10.7)

ii) Network Independent Clocking - E4, E5, E6

iii) Multiframe Synchronisation - E7

The order of transmission of the 80 bit frame is from left to right and top to bottom.