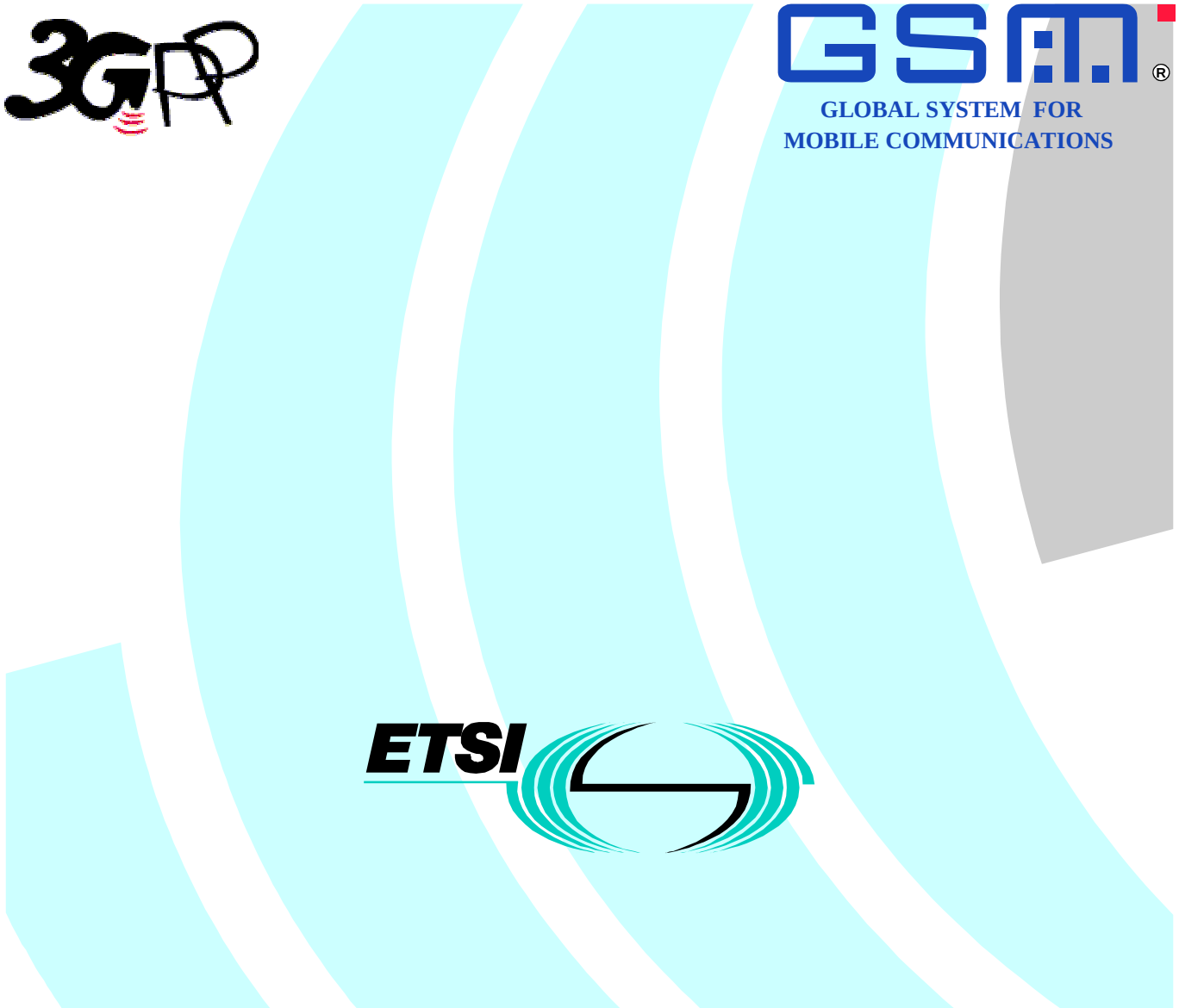
ETSI TS 123 038 V4.3.0 (2001-09)

Technical Specification

**Digital cellular telecommunications system (Phase 2+) (GSM);
Universal Mobile Telecommunications System (UMTS);
Alphabets and language-specific information
(3GPP TS 23.038 version 4.3.0 Release 4)**



Reference
RTS/TSGT-0223038Uv4R1

Keywords
GSM, 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

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 (http://www.etsi.org/legal/home.htm).

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 www.etsi.org/key .

Contents

Foreword

This Technical Specification has been produced by the 3rd 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 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 specification;

1 Scope

The present document defines the character sets, languages and message handling requirements for SMS, CBS and USSD and may additionally be used for Man Machine Interface (MMI) (3GPP TS 22.030 [2]).

The specification for the Data Circuit terminating Equipment/Data Terminal Equipment (DCE/DTE) interface (3GPP TS 27.005 [8]) will also use the codes specified herein for the transfer of SMS data to an external terminal.

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] GSM 01.04: "Digital cellular telecommunication system (Phase 2+); Abbreviations and Acronyms".

[2] 3GPP TS 22.030: "Man-Machine Interface (MMI) of the User Equipment (UE)".

[3] 3GPP TS 23.090: "Unstructured Supplementary Service Data (USSD) - Stage 2".

[4] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS) ".

[5] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[6] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[7] 3GPP TS 24.012: "Cell Broadcast Service (CBS) support on the mobile radio interface".

[8] 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)".

[10] ISO/IEC 10646: "Information technology; Universal Multiple-Octet Coded Character Set (UCS)".

[11] 3GPP TS 24.090: "Unstructured Supplementary Service Data (USSD); Stage 3".

[12] ISO 639: "Code for the representation of names of languages".

[13] 3GPP TS 23.042: "Compression algorithm for text messaging services".

[14] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[15] "Wireless Datagram Protocol Specification", Wireless Application Protocol Forum Ltd.

[16] ISO 1073-1 and ISO 1073-2 Alphanumeric character sets for optical recognition – Parts 1 and 2: Character sets OCR-A and OCR-B, respectively - Shapes and dimensions of the printed image.

3 Abbreviations

For the purposes of the present document, the abbreviations used in the present document are listed in GSM TR 01.04 [1] and 3GPP TR 21.905 [14].

4 SMS Data Coding Scheme

The TP-Data-Coding-Scheme field, defined in 3GPP TS 23.040 [4], indicates the data coding scheme of the TP-UD field, and may indicate a message class. Any reserved codings shall be assumed to be the GSM 7 bit default alphabet (the same as codepoint 00000000) by a receiving entity. The octet is used according to a coding group which is indicated in bits 7..4. The octet is then coded as follows:

Coding Group Bits 7..4	Use of bits 3..0
00xx	General Data Coding indication Bits 5..0 indicate the following: Bit 5, if set to 0, indicates the text is uncompressed Bit 5, if set to 1, indicates the text is compressed using the compression algorithm defined in 3GPP TS 23.042 [13] Bit 4, if set to 0, indicates that bits 1 to 0 are reserved and have no message class meaning Bit 4, if set to 1, indicates that bits 1 to 0 have a message class meaning:: Bit 1 Bit 0 Message Class 0 0 Class 0 0 1 Class 1 Default meaning: ME-specific. 1 0 Class 2 (U)SIM specific message 1 1 Class 3 Default meaning: TE specific (see 3GPP TS 27.005 [8]) Bits 3 and 2 indicate the character set being used, as follows : Bit 3 Bit2 Character set: 0 0 GSM 7 bit default alphabet 0 1 8 bit data 1 0 UCS2 (16bit) [10] 1 1 Reserved NOTE: The special case of bits 7..0 being 0000 0000 indicates the GSM 7 bit default alphabet with no message class
01xx	Message Marked for Automatic Deletion Group This group can be used by the SM originator to mark the message (stored in the ME or (U)SIM) for deletion after reading irrespective of the message class. The way the ME will process this deletion should be manufacturer specific but shall be done without the intervention of the End User or the targeted application.The mobile manufacturer may optionally provide a means for the user to prevent this automatic deletion. Bit 5..0 are coded exactly the same as Group 00xx
1000..1011	Reserved coding groups
1100	Message Waiting Indication Group: Discard Message The specification for this group is exactly the same as for Group 1101, except that: - after presenting an indication and storing the status, the ME may discard the contents of the message. The ME shall be able to receive, process and acknowledge messages in this group, irrespective of memory availability for other types of short message.
1101	Message Waiting Indication Group: Store Message This Group defines an indication to be provided to the user about the status of types of message waiting on systems connected to the GSM/UMTS PLMN. The ME should present this indication as an icon on the screen, or other MMI indication. The ME shall update the contents of the Message Waiting Indication Status on the USIM (see 3GPP TS 31.102) when present or otherwise should store the status in the ME. The contents of the Message Waiting Indication Status should control the ME indicator. For each indication supported, the mobile may provide storage for the Origination Address. The ME may take note of the Origination Address for messages in this group and group 1100.

Coding Group Bits 7..4	Use of bits 3..0
	Text included in the user data is coded in the GSM 7 bit default alphabet. Where a message is received with bits 7..4 set to 1101, the mobile shall store the text of the SMS message in addition to setting the indication. The indication setting should take place irrespective of memory availability to store the short message. Bits 3 indicates Indication Sense: Bit 3 0 Set Indication Inactive 1 Set Indication Active Bit 2 is reserved, and set to 0 Bit 1 Bit 0 Indication Type: 0 0 Voicemail Message Waiting 0 1 Fax Message Waiting 1 0 Electronic Mail Message Waiting 1 1 Other Message Waiting* * Mobile manufacturers may implement the "Other Message Waiting" indication as an additional indication without specifying the meaning. The meaning of this indication is intended to be standardized in the future, so Operators should not make use of this indication until the standard for this indication is finalized.
1110	Message Waiting Indication Group: Store Message The coding of bits 3..0 and functionality of this feature are the same as for the Message Waiting Indication Group above, (bits 7..4 set to 1101) with the exception that the text included in the user data is coded in the uncompressed UCS2 character set.
1111	Data coding/message class Bit 3 is reserved, set to 0. Bit 2 Message coding: 0 GSM 7 bit default alphabet 1 8-bit data Bit 1 Bit 0 Message Class: 0 0 Class 0 0 1 Class 1 default meaning: ME-specific. 1 0 Class 2 (U)SIM-specific message. 1 1 Class 3 default meaning: TE specific (see 3GPP TS 27.005 [8])

GSM 7 bit default alphabet indicates that the TP-UD is coded from the GSM 7 bit default alphabet given in clause 6.2.1. When this character set is used, the characters of the message are packed in octets as shown in clause 6.1.2.1.1, and the message can consist of up to 160 characters. The GSM 7 bit default alphabet shall be supported by all MSs and SCs offering the service. If the GSM 7 bit default alphabet extension mechanism is used then the number of displayable characters will reduce by one for every instance where the GSM 7 bit default alphabet extension table is used. 8-bit data indicates that the TP-UD has user-defined coding, and the message can consist of up to 140 octets.

UCS2 character set indicates that the TP-UD has a UCS2 [10] coded message, and the message can consist of up to 140 octets, i.e. up to 70 UCS2 characters. The General notes specified in clause 6.1.1 override any contrary specification in UCS2, so for example even in UCS2 a <CR> character will cause the MS to return to the beginning of the current line and overwrite any existing text with the characters which follow the <CR>.

When a message is compressed, the TP-UD consists of the GSM 7 bit default alphabet or UCS2 character set compressed message, and the compressed message itself can consist of up to 140 octets in total.

When a mobile terminated message is class 0 and the MS has the capability of displaying short messages, the MS shall display the message immediately and send an acknowledgement to the SC when the message has successfully reached the MS irrespective of whether there is memory available in the (U)SIM or ME. The message shall not be automatically stored in the (U)SIM or ME.

The ME may make provision through MMI for the user to selectively prevent the message from being displayed immediately.

If the ME is incapable of displaying short messages or if the immediate display of the message has been disabled through MMI then the ME shall treat the short message as though there was no message class, i.e. it will ignore bits 0 and 1 in the TP-DCS and normal rules for memory capacity exceeded shall apply.

When a mobile terminated message is Class 1, the MS shall send an acknowledgement to the SC when the message has successfully reached the MS and can be stored. The MS shall normally store the message in the ME by default, if that is possible, but otherwise the message may be stored elsewhere, e.g. in the (U)SIM. The user may be able to override the default meaning and select their own routing.

When a mobile terminated message is Class 2 ((U)SIM-specific), an MS shall ensure that the message has been transferred to the SMS data field in the (U)SIM before sending an acknowledgement to the SC. The MS shall return a "protocol error, unspecified" error message (see 3GPP TS 24.011 [6]) if the short message cannot be stored in the (U)SIM and there is other short message storage available at the MS. If all the short message storage at the MS is already in use, the MS shall return "memory capacity exceeded". This behaviour applies in all cases except for an MS supporting (U)SIM Application Toolkit when the Protocol Identifier (TP-PID) of the mobile terminated message is set to "(U)SIM Data download" (see 3GPP TS 23.040 [4]).

When a mobile terminated message is Class 3, the MS shall send an acknowledgement to the SC when the message has successfully reached the MS and can be stored, irrespectively of whether the MS supports an SMS interface to a TE, and without waiting for the message to be transferred to the TE. Thus the acknowledgement to the SC of a TE-specific message does not imply that the message has reached the TE. Class 3 messages shall normally be transferred to the TE when the TE requests "TE-specific" messages (see 3GPP TS 27.005 [8]). The user may be able to override the default meaning and select their own routing.

The message class codes may also be used for mobile originated messages, to provide an indication to the destination SME of how the message was handled at the MS.

The MS will not interpret reserved or unsupported values but shall store them as received. The SC may reject messages with a Data Coding Scheme containing a reserved value or one which is not supported.

5 CBS Data Coding Scheme

The CBS Data Coding Scheme indicates the intended handling of the message at the MS, the character set/coding, and the language (when applicable). Any reserved codings shall be assumed to be the GSM 7 bit default alphabet (the same as codepoint 00001111) by a receiving entity. The octet is used according to a coding group which is indicated in bits 7..4. The octet is then coded as follows:

Coding Group Bits 7..4	Use of bits 3..0
0000	Language using the GSM 7 bit default alphabet Bits 3..0 indicate the language: 0000 German 0001 English 0010 Italian 0011 French 0100 Spanish 0101 Dutch 0110 Swedish 0111 Danish 1000 Portuguese 1001 Finnish 1010 Norwegian 1011 Greek 1100 Turkish 1101 Hungarian 1110 Polish 1111 Language unspecified
0001	0000 GSM 7 bit default alphabet; message preceded by language indication. The first 3 characters of the message are a two-character representation of the language encoded according to ISO 639 [12], followed by a CR character. The CR character is then followed by 90 characters of text. 0001 UCS2; message preceded by language indication The message starts with a two GSM 7-bit default alphabet character representation of the language encoded according to ISO 639 [12]. This is padded to the octet boundary with two bits set to 0 and then followed by 40 characters of UCS2-encoded message. An MS not supporting UCS2 coding will present the two character language identifier followed by improperly interpreted user data. 0010..1111 Reserved
0010..	0000 Czech 0001 Hebrew 0010 Arabic 0011 Russian 0100 Icelandic 0101..1111 Reserved for other languages using the GSM 7 bit default alphabet, with unspecified handling at the MS
0011	0000..1111 Reserved for other languages using the GSM 7 bit default alphabet, with unspecified handling at the MS

Coding Group Bits 7..4	Use of bits 3..0
01xx	General Data Coding indication Bits 5..0 indicate the following: Bit 5, if set to 0, indicates the text is uncompressed Bit 5, if set to 1, indicates the text is compressed using the compression algorithm defined in 3GPP TS 23.042 [13] Bit 4, if set to 0, indicates that bits 1 to 0 are reserved and have no message class meaning Bit 4, if set to 1, indicates that bits 1 to 0 have a message class meaning: Bit 1 Bit 0 Message Class: 0 0 Class 0 0 1 Class 1 Default meaning: ME-specific. 1 0 Class 2 (U)SIM specific message. 1 1 Class 3 Default meaning: TE-specific (see 3GPP TS 27.005 [8]) Bits 3 and 2 indicate the character set being used, as follows: Bit 3 Bit 2 Character set: 0 0 GSM 7 bit default alphabet 0 1 8 bit data 1 0 UCS2 (16 bit) [10] 1 1 Reserved
1000..1101	Reserved coding groups
1110	Defined by the WAP Forum [15]
1111	Data coding / message handling Bit 3 is reserved, set to 0. Bit 2 Message coding: 0 GSM 7 bit default alphabet 1 8 bit data Bit 1 Bit 0 Message Class: 0 0 No message class. 0 1 Class 1 user defined. 1 0 Class 2 user defined. 1 1 Class 3 default meaning: TE specific (see 3GPP TS 27.005 [8])

These codings may also be used for USSD and MMI/display purposes.

See 3GPP TS 24.090 [11] for specific coding values applicable to USSD for MS originated USSD messages and MS terminated USSD messages. USSD messages using the default alphabet are coded with the GSM 7-bit default alphabet given in clause 6.2.1. The message can then consist of up to 182 user characters.

Cell Broadcast messages using the default alphabet are coded with the GSM 7-bit default alphabet given in clause 6.2.1. The message then consists of 93 user characters.

If the GSM 7 bit default alphabet extension mechanism is used then the number of displayable characters will reduce by one for every instance where the GSM 7 bit default alphabet extension table is usedCell Broadcast messages using 8-bit data have user-defined coding, and will be 82 octets in length.

UCS2 character set indicates that the message is coded in UCS2 [10]. The General notes specified in clause 6.1.1 override any contrary specification in UCS2, so for example even in UCS2 a <CR> character will cause the MS to return to the beginning of the current line and overwrite any existing text with the characters which follow the <CR>. Cell Broadcast messages encoded in UCS2 consist of 41 characters.

Class 1 and Class 2 messages may be routed by the ME to user-defined destinations, but the user may override any default meaning and select their own routing.

Class 3 messages will normally be selected for transfer to a TE, in cases where a ME supports an SMS/CBS interface to a TE, and the TE requests "TE-specific" cell broadcast messages (see 3GPP TS 27.005 [8]). The user may be able to override the default meaning and select their own routing.

6 Individual parameters

6.1 General principles

6.1.1 General notes

Except where otherwise indicated, the following shall apply to all character sets:

1: The characters marked "1)" are not used but are displayed as a space.

2: The characters of this set, when displayed, should approximate to the appearance of the relevant characters specified in ISO 1073 [16]and the relevant national standards.

3: Control characters:

Code	Meaning
LF	Line feed: Any characters following LF which are to be displayed shall be presented as the next line of the message, commencing with the first character position.
CR	Carriage return: Any characters following CR which are to be displayed shall be presented as the current line of the message, commencing with the first character position.
SP	Space character.

4: The display of characters within a message is achieved by taking each character in turn and placing it in the next available space from left to right and top to bottom.

6.1.2 Character packing

6.1.2.1 SMS Packing

6.1.2.1.1 Packing of 7-bit characters

If a character number α is noted in the following way:

b7 b6 b5 b4 b3 b2 b1
αa αb αc αd αe αf αg

The packing of the 7-bitscharacters in octets is done by completing the octets with zeros on the left.

For examples, packing: α

- one character in one octet:
  - bits number:

7 6 5 4 3 2 1 0
0 1a 1b 1c 1d 1e 1f 1g

- two characters in two octets:
  - bits number:

7 6 5 4 3 2 1 0
2g 1a 1b 1c 1d 1e 1f 1g
0 0 2a 2b 2c 2d 2e 2f

- three characters in three octets:

  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
0	0	0	3a	3b	3c	3d	3e

- seven characters in seven octets:

  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
4e	4f	4g	3a	3b	3c	3d	3e
5d	5e	5f	5g	4a	4b	4c	4d
6c	6d	6e	6f	6g	5a	5b	5c
7b	7c	7d	7e	7f	7g	6a	6b
0	0	0	0	0	0	0	7a

- eight characters in seven octets:

  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
4e	4f	4g	3a	3b	3c	3d	3e
5d	5e	5f	5g	4a	4b	4c	4d
6c	6d	6e	6f	6g	5a	5b	5c
7b	7c	7d	7e	7f	7g	6a	6b
8a	8b	8c	8d	8e	8f	8g	7a

The bit number zero is always transmitted first.

Therefore, in 140 octets, it is possible to pack (140x8)/7=160 characters.

6.1.2.2 CBS Packing

6.1.2.2.1 Packing of 7-bit characters

If a character number α is noted in the following way:

b7	b6	b5	b4	b3	b2	b1
αa	αb	αc	αd	αe	αf	αg

the packing of the 7-bits characters in octets is done as follows:

bit number

	7	6	5	4	3	2	1	0
octet number								
1	2g	1a	1b	1c	1d	1e	1f	1g
2	3f	3g	2a	2b	2c	2d	2e	2f
3	4e	4f	4g	3a	3b	3c	3d	3e
4	5d	5e	5f	5g	4a	4b	4c	4d
5	6c	6d	6e	6f	6g	5a	5b	5c
6	7b	7c	7d	7e	7f	7g	6a	6b
7	8a	8b	8c	8d	8e	8f	8g	7a
8	10g	9a	9b	9c	9d	9e	9f	9g
	.							
	.							
81	93d	93e	93f	93g	92a	92b	92c	92d
82	0	0	0	0	0	93a	93b	93c

The bit number zero is always transmitted first.

Therefore, in 82 octets, it is possible to pack (82x8)/7 = 93.7, that is 93 characters. The 5 remaining bits are set to zero as stated above.

6.1.2.3 USSD packing

6.1.2.3.1 Packing of 7 bit characters

If a character number α is noted in the following way:

b7	b6	b5	b4	b3	b2	b1
αa	αb	αc	αd	αe	αf	αg

The packing of the 7-bit characters in octets is done by completing the octets with zeros on the left.

For example, packing: α

- one character in one octet:
  - bits number:

7	6	5	4	3	2	1	0
0	1a	1b	1c	1d	1e	1f	1g

- two characters in two octets:
  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
0	0	2a	2b	2c	2d	2e	2f

- three characters in three octets:
  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
0	0	0	3a	3b	3c	3d	3e

- six characters in six octets:

  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
4e	4f	4g	3a	3b	3c	3d	3e
5d	5e	5f	5g	4a	4b	4c	4d
6c	6d	6e	6f	6g	5a	5b	5c
0	0	0	0	0	0	6a	6b

- seven characters in seven octets:

  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
4e	4f	4g	3a	3b	3c	3d	3e
5d	5e	5f	5g	4a	4b	4c	4d
6c	6d	6e	6f	6g	5a	5b	5c
7b	7c	7d	7e	7f	7g	6a	6b
0	0	0	1	1	0	1	7a

The bit number zero is always transmitted first.

- eight characters in seven octets:

  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
4e	4f	4g	3a	3b	3c	3d	3e
5d	5e	5f	5g	4a	4b	4c	4d
6c	6d	6e	6f	6g	5a	5b	5c
7b	7c	7d	7e	7f	7g	6a	6b
8a	8b	8c	8d	8e	8f	8g	7a

- nine characters in eight octets:

  - bits number:

7	6	5	4	3	2	1	0
2g	1a	1b	1c	1d	1e	1f	1g
3f	3g	2a	2b	2c	2d	2e	2f
4e	4f	4g	3a	3b	3c	3d	3e
5d	5e	5f	5g	4a	4b	4c	4d
6c	6d	6e	6f	6g	5a	5b	5c
7b	7c	7d	7e	7f	7g	6a	6b
8a	8b	8c	8d	8e	8f	8g	7a
0	9a	9b	9c	9d	9e	9f	9g

- fifteen characters in fourteen octets:

  - bits number:

```
7   6   5   4   3   2   1   0
2g  1a  1b  1c  1d  1e  1f  1g
3f  3g  2a  2b  2c  2d  2e  2f
4e  4f  4g  3a  3b  3c  3d  3e
5d  5e  5f  5g  4a  4b  4c  4d
6c  6d  6e  6f  6g  5a  5b  5c
7b  7c  7d  7e  7f  7g  6a  6b
8a  8b  8c  8d  8e  8f  8g  7a
10g   9a  9b  9c  9d  9e  9f  9g
11f11g    10a   10b   10c   10d   10e   10f
12e   12f12g    11a   11b   11c   11d   11e
13d   13e   13f13g    12a   12b   12c   12d
14c   14d   14e   14f14g    13a   13b   13c
15b   15c   15d   15e   15f15g    14a   14b
0   0   0   1   1   0   1   15a
```

- sixteen characters in fourteen octets:

  - bits number:

```
7   6   5   4   3   2   1   0
2g  1a  1b  1c  1d  1e  1f  1g
3f  3g  2a  2b  2c  2d  2e  2f
4e  4f  4g  3a  3b  3c  3d  3e
5d  5e  5f  5g  4a  4b  4c  4d
6c  6d  6e  6f  6g  5a  5b  5c
7b  7c  7d  7e  7f  7g  6a  6b
8a  8b  8c  8d  8e  8f  8g  7a
10g   9a  9b  9c  9d  9e  9f  9g
11f11g    10a   10b   10c   10d   10e   10f
12e   12f12g    11a   11b   11c   11d   11e
13d   13e   13f13g    12a   12b   12c   12d
14c   14d   14e   14f14g    13a   13b   13c
15b   15c   15d   15e   15f15g    14a   14b
16a   16b   16c   16d   16e   16f16g    15a
```

The bit number zero is always transmitted first.

Therefore, in 160 octets, is it possible to pack (160*8)/7 = 182.8, that is 182 characters. The remaining 6 bits are set to zero as stated above.

Packing of 7 bit characters in USSD strings is done in the same way as for SMS (clause 6.1.2.1). The character stream is bit padded to octet boundary with binary zeroes as shown above.

If the total number of characters to be sent equals (8n-1) where n=1,2,3 etc. then there are 7 spare bits at the end of the message. To avoid the situation where the receiving entity confuses 7 binary zero pad bits as the @ character, the carriage return or <CR> character (defined in clause 6.1.1) shall be used for padding in this situation, just as for Cell Broadcast.

If <CR> is intended to be the last character and the message (including the wanted <CR>) ends on an octet boundary, then another <CR> must be added together with a padding bit 0. The receiving entity will perform the carriage return function twice, but this will not result in misoperation as the definition of <CR> in clause 6.1.1 is identical to the definition of <CR><CR>.

The receiving entity shall remove the final <CR> character where the message ends on an octet boundary with <CR> as the last character.

6.2 Character sets and coding

This section provides list of character sets and codings to be supported by SMS, CBS and USSD. Implementation of the GSM 7 bit default alphabet is mandatory. Support of other character sets is optional.

It should be noted that support of Latin and non-Latin languages by GSM 7 bit default alphabet is limited. It is therefore essential to introduce UCS 2 character set in mobile stations, SCs and systems handling SMSs, CBSs and USSDs, especially in cases where users of such systems are expected to communicate in languages with characters not supported by GSM 7 bit default alphabet. Where implementation of the complete repertoire of the UCS 2 is not yet possible it is recommended to implement all character subsets encompassing reasonable potential users needs and frequently used characters.

6.2.1 GSM 7 bit Default Alphabet

Bits per character: 7

CBS/USSD pad character: CR

Character table:

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	@	Δ	SP	0	¡	P	¿	p
0	0	0	1	1	£	_	!	1	A	Q	a	q
0	0	1	0	2	$	Φ	"	2	B	R	b	r
0	0	1	1	3	¥	Γ	#	3	C	S	c	s
0	1	0	0	4	è	Λ	¤	4	D	T	d	t
0	1	0	1	5	é	Ω	%	5	E	U	e	u
0	1	1	0	6	ù	Π	&	6	F	V	f	v
0	1	1	1	7	ì	Ψ	'	7	G	W	g	w
1	0	0	0	8	ò	Σ	(	8	H	X	h	x
1	0	0	1	9	Ç	Θ	)	9	I	Y	i	y
1	0	1	0	10	LF	Ξ	*	:	J	Z	j	z
1	0	1	1	11	Ø	1)	+	;	K	Ä	k	ä
1	1	0	0	12	ø	Æ	,	<	L	Ö	l	ö
1	1	0	1	13	CR	æ	-	=	M	Ñ	m	ñ

1	1	1	0	14	Å	ß	.	>	N	Ü	n	ü
1	1	1	1	15	å	É	/	?	O	§	o	à
NOTE 1): This code is an escape to an extension of the GSM 7 bit default alphabet table. A receiving entity which does not understand the meaning of this escape mechanism shall display it as a space character.												

6.2.1.1 GSM 7 bit default alphabet extension table

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0					|			
0	0	0	1	1								
0	0	1	0	2								
0	0	1	1	3								
0	1	0	0	4		^						
0	1	0	1	5							2)	
0	1	1	0	6								
0	1	1	1	7								
1	0	0	0	8			{					
1	0	0	1	9			}					
1	0	1	0	10	3)							
1	0	1	1	11		1)						
1	1	0	0	12				[				
1	1	0	1	13				~				
1	1	1	0	14				]				
1	1	1	1	15			\					

In the event that an MS receives a code where a symbol is not represented in the above table then the MS shall display the character shown in the main GSM 7 bit default alphabet table in clause 6.2.1.

NOTE 1): This code value is reserved for the extension to another extension table. On receipt of this code, a receiving entity shall display a space until another extension table is defined. It is not intended that this extension mechanism should be used as an alternative to UCS2 to enhance the 7bit default alphabet character repertoire for national specific character sets.

NOTE 2): This code represents the EURO currency symbol. The code value is that used for the character ‘e’. Therefore a receiving entity which is incapable of displaying the EURO currency symbol will display the character ‘e’ instead.

NOTE 3): This code is defined as a Page Break character and may be used for example in compressed CBS messages. Any mobile station which does not understand the GSM 7 bit default alphabet table extension mechanism will treat this character as Line Feed.

6.2.2 8 bit data

8 bit data is user defined

Padding: CR in the case of an 8 bit character set

Otherwise - user defined

Character table: User Specific

6.2.3 UCS2

Bits per character: 16

CBS/USSD pad character: CR

Character table: ISO/IEC 10646 [10]

Annex A (informative): Document change history

TSG#	TDoc	VERS	NEW_ VERS	CR	REV	Rel	CAT	WORK ITEM	SUBJECT
T#4			3.0.0	New					Creation of 3GPP TS 23.038 v1.0.0 out of GSM 03.38 v7.1.0
T#4	TP-99124	3.0.0	3.1.0	001		R99	A	MExE	Data Coding Scheme for WAP over USSD and CB
T#5	TP-99177	3.1.0	3.2.0	002		R99	B	TEI	Language codes for Hebrew,Arabic and Russian
T#6	TP-99237	3.2.0	3.3.0	003		R99	F	TEI	Adaptations for UMTS
T#8	TP-000074	3.3.0	4.0.0	004		Rel4	B	TEI	Automatic removal of ‘read’ SMS
T#10	TP-000195	4.0.0	4.1.0	005		Rel4	B	TEI	Data coding scheme value for the Icelandic language
T#11	TP-010029	4.1.0	4.2.0	006		Rel4	C	UICC1-CPHS	Message Waiting Indication Status storage on the USIM
T#13	TP-010194	4.2.0	4.3.0	007		Rel4	F	TEI4	Support to UCS2 and editorial corrections

History

Document history		
V4.2.0	March 2001	Publication
V4.3.0	September 2001	Publication