

# ETSI TS 101 116 V7.0.1 (1999-07)

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*Technical Specification*

## **Digital cellular telecommunications system (Phase 2+); Specification of the 1.8 Volt Subscriber Identity Module - Mobile Equipment (SIM - ME) interface (GSM 11.18 version 7.0.1 Release 1998)**

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# Foreword

This Technical Specification (TS) has been produced by the Special Mobile Group (SMG).

The contents of the present document are subject to continuing work within SMG and may change following formal SMG approval. Should SMG modify the contents of the present document, it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 7.x.y

where:

- 7 indicates GSM Release 1998 of 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.

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# 1 Scope

The present document defines the aspects of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface which are based on 1.8V technology to be used in the Mobile Station (MS). It specifies the electrical and logical requirements necessary for the operation of the 1.8V SIM - ME interface where it differs from GSM 11.11 [1]. For all aspects of the SIM - ME interface which are not covered by the present document, GSM 11.11 [1] applies.

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# 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 1998 document, references to GSM documents are for Release 1998 versions (version 7.x.y).

[1] GSM 11.11: "Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

[2] GSM 11.12 (ETS 300 641): "Digital cellular telecommunications system (Phase 2); Specification of the 3V Subscriber Identity Module - Mobile Equipment (SIM - ME) interface".

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# 3 Definitions, abbreviations and symbols

## 3.1 Definitions

For the purposes of the present document, the following definitions apply.

**1.8V technology SIM:** A SIM operating at  $1.8V \pm 10\%$  and  $3V \pm 10\%$ .

**1.8V technology ME:** An ME operating the SIM - ME interface at  $1.8V \pm 10\%$  according to the present document and  $3V \pm 10\%$  according to GSM 11.12 [2].

**1.8V only ME:** An ME only operating the SIM - ME interface at  $1.8V \pm 10\%$  according to the present document.

## 3.2 Abbreviations

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

ATR	Answer To Reset
CLK	Clock
IC	Integrated Circuit
I/O	Input/Output
ME	Mobile Equipment
MS	Mobile Station
RST	Reset
SIM	Subscriber Identity Module

### 3.3 Symbols

For the purposes of the present document, the following symbols apply.

$t_F$	fall time
$t_R$	rise time
$V_{IH}$	Input Voltage (high)
$V_{IL}$	Input Voltage (low)
$V_{OH}$	Output Voltage (high)
$V_{OL}$	Output Voltage (low)

## 4 1.8V technology

### 4.1 1.8V technology SIM

The SIM shall operate on both  $3V \pm 10\%$  according to GSM 11.12 [2], and on  $1.8V \pm 10\%$  according to the present document. If the ME supplies 3V to the SIM, both the ME and the SIM shall operate according to GSM 11.12 (ETS 300 641) [2]. The logical operation of the 1.8V technology SIM shall be as defined in GSM 11.11 [1]. The 1.8V technology SIM shall not give an ATR if operated at a supply voltage of 1.4V or below.

A 1.8V technology SIM may operate at 5V. If the 1.8V technology SIM operates at 5V it shall meet the electrical specifications as defined in GSM 11.11 [1].

Clock stop mode shall be supported by the SIM. The SIM shall indicate "Clock Stop Allowed" in the file characteristics of the status information as specified in GSM 11.11 [1].

### 4.2 1.8V technology impact

When supplied with the supply voltage as specified in the present document the SIM shall be operated with a clock frequency of 1 to 4 MHz.

### 4.3 1.8V technology SIM Identification

The 1.8V technology SIM shall contain an identification. The identification is coded on bits 5-7 in byte 14 of the status information as follows:

**Table 0: SIM Supply Voltage Indication**

SIM Supply Voltage	Bit 7	Bit 6	Bit 5
5V only SIM	0 (RFU) <sup>1</sup>	0 (RFU) <sup>1</sup>	0 (RFU) <sup>1</sup>
3V Technology SIM	0 (RFU) <sup>1</sup>	0 (RFU) <sup>1</sup>	1
1.8V Technology SIM	0 (RFU) <sup>1</sup>	1	1
Future Class	1	1	1

NOTE 1 The bits marked (RFU) are set to '0' and reserved for future use in the SIMs. The coding schemes relies on the fact that RFU bits are set to '0'.

The procedure for deriving the identification bit shall be performed by the ME immediately after the Answer To Reset (ATR) and before issuing any other command. The procedure consists of the two commands "SELECT GSM" and "STATUS/GET RESPONSE"

## 4.4 1.8V technology ME

The 1.8V technology ME shall initially activate the SIM with 1.8V according to this specification.

If the ME detects a 1.8V technology SIM, the ME may operate the SIM at 1.8V according to this specification. If the ME detects a 3V SIM, the ME shall switch to 3V operation as defined in GSM 11.12 [2] using the procedure as defined in subclause 4.7. If switching is performed, it shall take place before issuing any further commands as defined in paragraph 4.3.

If a faulty ATR is received at 1.8V, the ME shall initiate the error handling procedure described in GSM 11.11 [1] with the supply voltage remaining at 1.8V. If the error handling does not result in an errorless ATR, the ME shall activate the SIM at 3V. Activation at 3V shall be performed in accordance with GSM 11.12 [2].

If no ATR is received at 1.8V, the ME shall deactivate the SIM and activate it at 3V according to GSM 11.12 [2]. If a correct ATR is not received at 3V or the ME detects a 5V only SIM the ME shall reject the SIM without issuing any further commands.

If a 1.8V technology ME detects a SIM that indicates a future class the ME shall not activate that SIM at 3V.

## 4.5 1.8V Only ME

The 1.8V only ME activates the SIM at 1.8V.

If the ME is able to detect a 3V technology SIM according to the procedure in subclause 4.3, or if the procedure cannot be completed, the ME shall deactivate and reject the SIM immediately (maximum of 5s) without issuing any further command.

If an ATR is corrupted or not received by the ME, error handling according to sub clause 5.10 of GSM 11.11 [1] shall apply.

## 4.6 Activation and deactivation

The ME shall connect, activate and deactivate the SIM in accordance with the operating procedures specified in GSM 11.11 [1] taking into account the electrical characteristics specified in clause 5 of the present document. In particular,  $V_{cc}$  is powered when it has a value between 1,62 V and 1,98 V.

## 4.7 Supply voltage switching

MEs supporting both 1,8V and 3V operation may switch between the two supply voltages. Switching shall always be performed by deactivating the SIM and activating it at the new supply voltage. Activation and deactivation of the SIM with 3V shall be according to GSM 11.12 [2], whereas activation and deactivation of the SIM with 1,8V shall be according to the present document.

## 4.8 Cross compatibility

Cross compatibility means that the ME supports 1,8V and 3V operation. This is, however, optional for the ME. In case of the 1,8V technology ME, cross compatibility is provided, whereas, a 1,8V only ME requires a 1,8V technology SIM for operation. However, the 1,8V technology SIM (see definitions and subclause 4.1) ensures cross compatibility.

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# 5 Electrical specifications of the SIM - ME interface

The electrical specification given in the present document covers the supply voltage range from 1,62V to 1,98V. The supply voltage range from 2,7V to 3,3V is specified in GSM 11.12 [2]. For each state ( $V_{OH}$ ,  $V_{IH}$ ,  $V_{IL}$  and  $V_{OL}$ ) a positive current is defined as flowing out of the entity (ME or SIM) in that state.  $V_{pp}$  is not supported by the 1,8V technology ME or the 1,8V technology SIM.

When the SIM is in idle state the current consumption of the card shall not exceed 200  $\mu\text{A}$  at 1 MHz at +25°C. When the SIM is in clock stop mode the current consumption shall not exceed 100  $\mu\text{A}$  at +25 °C.

The ME shall source the maximum current as defined in table 4. It shall also be able to counteract spikes in the current consumption of the card up to a maximum charge of 12 nAs with no more than 400 ns duration and an amplitude of at most 60 mA, ensuring that the supply voltage stays in the specified range.

The clock duty cycle shall be between 40 % and 60 % of the period during stable operation. A clock cycle is defined at 50% of  $V_{cc}$  from rising to rising edge or falling to falling edge. When switching clock frequencies MEs shall ensure that no pulse is shorter than 100 ns which is 40 % of the shortest allowed period.

The ME need not provide contact C6 (Vpp). Contact C6 shall not be connected in the ME if provided.

**Table 1: Electrical characteristics of I/O under normal operating conditions**

Symbol	Conditions	Minimum	Maximum	Unit
$V_{IH}$	$I_{IHmax} = \pm 20 \mu\text{A}$ (Note 2)	$0,7 \times V_{cc}$	$V_{cc}+0,3$	V
$V_{IL}$	$I_{ILmax} = + 1 \text{ mA}$	- 0,3	$0,2 \times V_{cc}$	V
$V_{OH}$ (Note 1)	$I_{OHmax} = + 20 \mu\text{A}$	$0,7 \times V_{cc}$	$V_{cc}$ (Note 3)	V
$V_{OL}$	$I_{OLmax} = - 1 \text{ mA}$	0 (Note 3)	0,3	V
$t_R t_F$	$C_{in} = C_{out} = 30 \text{ pF}$		1	$\mu\text{s}$
NOTE 1: It is assumed that a pull-up resistor is used on the interface device (recommended value: 20 k $\Omega$ ). NOTE 2: During static conditions (idle state) only the positive value can apply. Under dynamic operating conditions (transmissions) short term voltage spikes on the I/O line may cause a current reversal. NOTE 3: To allow for overshoot the voltage on I/O shall remain between -0,3V and $V_{cc}+0,3V$ during dynamic operation.				

**Table 2: Electrical characteristics of Clock (CLK) under normal operating conditions**

Symbol	Conditions	Minimum	Maximum	Unit
$V_{OH}$	$I_{OHmax} = + 20 \mu\text{A}$	$0,7 \times V_{cc}$	$V_{cc}$ (Note )	V
$V_{OL}$	$I_{OLmax} = - 20 \mu\text{A}$	0 (Note )	$0,2 \times V_{cc}$	V
$t_R t_F$	$C_{in} = C_{out} = 30 \text{ pF}$		50	ns
NOTE: To allow for overshoot the voltage on CLK should remain between -0,3V and $V_{cc}+0,3V$ during dynamic operations.				



**Table 3: Electrical characteristics of RESET (RST) under normal operating conditions**

Symbol	Conditions	Minimum	Maximum	Unit
$V_{OH}$	$I_{OHmax} = + 20 \mu A$	$0,8 \times V_{cc}$	$V_{cc}$ (Note)	V
$V_{OL}$	$I_{OLmax} = -200 \mu A$	0 (Note)	$0,2 \times V_{cc}$	V
$t_R t_F$	$C_{in} = C_{out} = 30 pF$		400	$\mu s$

NOTE: To allow for overshoot the voltage on RST should remain between  $-0,3V$  and  $V_{cc} + 0,3V$  during dynamic operations.

**Table 4: Electrical characteristics of Vcc under normal operating conditions**

Symbol	Minimum	Maximum	Unit
$V_{cc}$	1,62	1,98	V
$I_{cc}$		4 (Note)	mA

NOTE: The supply current at 1,8V refers to a clock frequency of 4 MHz.

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## Annex A (informative): Change history

This annex lists all change requests approved for this document since the the present document was approved by ETSI SMG.

SMG#	SMG tdoc	SMG9 tdoc	VERS	CR	RV	PH	CAT	SUBJECT	Resulting Version
s28	P-99-180	98p188	2.0.0			R98		Approval of final draft by SMG	7.0.0

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# History

<b>Document history</b>		
V7.0.1	July 1999	Publication