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## Telecommunication Industry Standard Of the People's Republic of China

YD/T 1763.1-2008

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### TD-SCDMA/WCDMA Digital Cellular Mobile Telecommunication Network Test methods for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics

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## Preface

This Standard is one of the serial standards of TD-SCDMA/WCDMA Digital Cellular Mobile Telecommunication Network USIM-ME (Cu) Interface. The names of this series of specifications and parts are as follows:

1. TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics
2. TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 2: Application Characteristics of USIM
3. TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 3: Characteristics of USAT
4. TD-SCDMA/WCDMA Digital Cellular Mobile Telecommunication Network Test Methods for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics
5. TD-SCDMA/WCDMA Digital Cellular Mobile Telecommunication Network Test Methods for USIM-ME (Cu) Interface Part 2: Application Characteristics of USIM
6. TD-SCDMA/WCDMA Digital Cellular Mobile Telecommunication Network Test Methods for USIM-ME (Cu) Interface Part 3: USAT Characteristics
7. TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Test Methods for USIM-ME (Cu) Interface Part 4: USIM Conformance

This Standard is part 1 of TD-SCDMA/WCDMA Digital Cellular Mobile Telecommunication Network Test Methods for USIM-ME (Cu) Interface. This Standard shall be used together with TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics.

This Standard is developed based on ETSI TS 102 230 V4.5.0.

Annex A of this Standard is a normative annex.

This Standard is proposed and managed by China MII Telecommunication Institute.

This Standard is drafted by: China MII Telecommunication Institute, Datang Mobile, and ZTE.

This Standard is written by: Panjuan, Di Zhiwen, Wang Wenqing, Guanhe, Peng Hongli and Zhanghui.

## **TD-SCDMA/WCDMA Digital Cellular Mobile Telecommunication**

### **Network Test Methods for USIM-ME (Cu) Interface**

#### **Part 1: Physical, Electrical and Logical Characteristics**

##### **1 Scope**

This Standard defines the test methods and expected test results of the physical, electrical and logical characteristics of USIM-ME Cu interface. The present document specifies the tests of: physical characteristics of Cu interface, electrical characteristics of Cu interface, initial communication establishment and the transport protocols as well as the application independent procedures.

This Standard applies not only for tests of Cu interface between USIM and TD-SCDMA ME, but also for tests of Cu interface between USIM and WCDMA ME.

##### **2 Quoted Standards**

The following standards contribute to the stipulation of this Standard after being quoted. All the revision versions (excluding correction version) of the quoted standards specified with date are not applicable for this part. Users are encouraged to explore the possibility to use the latest version of the following standards. The latest version of the quoted documents without date specified is applicable for this part.

TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics

ISO/IEC 7816-3 (1997): Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols

ISO/IEC 7816-6 (2004): Identification cards - Integrated circuit cards - Part 6: Inter-industry data elements for interchange



#### **5.1.5.2.4 Method of test**

##### **Initial conditions:**

The ME shall be connected to a USIM simulator simulating a 1.8V technology USIM with nominal test conditions according to Section 5.2.1. All elementary files shall be coded as default.

The ME shall be powered on.

##### **Test procedure:**

The USIM simulator shall send an ATR indicating a 1.8V technology USIM.

The USIM-ME interface shall be monitored for at least 1 minute until the UE is switched off.

#### **5.1.5.2.5 Expected test result**

1) The initial activation of the USIM-ME interface shall be performed with 3V supply voltage.

2) The ME proceeds with the card session without switching to another supply voltage.

#### **5.1.5.3 Reaction of 1.8V technology MEs on type recognition of 1.8V technology USIMs**

##### **5.1.5.3.1. Definition and applicability**

When a 1.8V technology ME detects a 1.8V technology USIM during the ATR analysis, the ME may either switch to 3V operation or stay in 1.8V operation.

This test applies to 1.8V technology MEs supporting class A and class B operating conditions.

##### **5.1.5.3.2 Conformance requirement**

1) A 1.8V technology ME shall initially activate the USIM with 1.8V.

2) The ME shall analyze the ATR and identify the voltage class supported by the USIM.

3) If a 1.8V technology ME identifies a 1.8V technology USIM, the ME may switch to 3V operation. Switching from 1.8V to 3V shall only be performed by deactivating the USIM-ME interface and activating the USIM with 3V supply voltage immediately after the analysis of the ATR without issuing any commands.

Refer to Section 6.2 in TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics.

##### **5.1.5.3.3 Test purpose**

1) To verify that a 1.8V technology ME initially activates the USIM with 1.8V.

2) To verify that a 1.8V technology ME correctly identifies the voltage class indicated by ATR.

3) To verify that a 1.8V technology ME deactivates the USIM-ME interface immediately

b-2) The rise and the fall time of the clock signal shall not exceed 50ns when the ME is in 3V operation mode.

b-3) The cycle ratio of the clock signal shall be between 40% and 60% of the period, in steady state when the ME is in 3V operation mode.

b-4) The frequency of the clock signal shall be between 1MHz and 5MHz when the ME is in 3V operation mode.

b-5) The voltage on contact C3 of the USIM-ME interface shall be between  $-0.3V$  and  $0.2 \times V_{cc}$  for a current of  $-20\mu A$  in low state and the voltage on contact C2 of the USIM-ME interface shall be between  $0.7 \times V_{cc}$  and  $V_{cc} + 0.3V$  for a current of  $+20\mu A$  in high state when the ME is in 1.8V operation mode.

b-6) The rise and the fall time of the clock signal shall not exceed 50ns when the ME is in 1.8V operation mode.

b-7) The cycle ratio of the clock signal shall be between 40% and 60% of the period, in steady state when the ME is in 1.8V operation mode.

b-8) The frequency of the clock signal shall be between 1MHz and 5MHz when the ME is in 1.8V operation mode.

Refer to Section 5.1, Section 5.2 and Section 5.3 in TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics.

#### **5.2.4.3 Test purpose**

To verify that the ME can keep the voltage, the rise and fall time, the cycle ratio and the frequency on contact C3 of the USIM-ME interface within the ranges specified in Section 5.2.4.2.

#### **5.2.4.4 Method of test**

##### **Initial condition:**

The ME shall be connected to a USIM simulator. The UE shall be activated. The remaining contacts of the USIM-ME interface shall be held in nominal test conditions (see Section 5.2.1).

##### **Test procedure:**

The voltage, the rise/fall time, the clock cycle ratio and the frequency on contact C3 (CLK) of the USIM-ME interface shall be measured.

#### **5.2.4.5 Expected test result**

The voltage, the rise and fall time, the cycle ratio and the frequency on contact C3 of the USIM-ME interface shall be within the ranges specified in Section 5.2.4.2.

### **5.2.5 Electrical tests on contact C7 (I/O)**

#### **5.2.5.1. Definition and applicability**

When the user equipment is activated, the ME shall keep the voltage, the current and the rise/fall time of the signal on contact C7 of the USIM-ME interface within the specified range in order to ensure correct operation and to prevent any damage to the USIM.

This test applies to:

- a) 3V technology ME supporting class A and class B operating conditions.
- b) 1.8V technology ME supporting class B and class C operating conditions.

#### 5.2.5.2 Conformance requirement

a-1) ME receiving State A;

With an imposed voltage of 0V the current flowing out of the ME shall not exceed 1mA when the ME is in 5V operation mode.

a-2) ME transmitting State A;

The voltage shall be between -0.3V and  $0.15 \times V_{CC}$  when a current of 1mA flowing into the ME is applied when the ME is in 5V operation mode.

a-3) ME transmitting or receiving State Z

The voltage shall be between  $+3.8V(V_{OH})/0.7 \times V_{CC}(V_{IH})$  and  $V_{CC} + 0.3V$  when a current of 20 $\mu$ A flowing out of the ME is applied when the ME is in 5V operation mode.

a-4) The rise and the fall time of the I/O signal shall not exceed 1 $\mu$ s when the ME is in 5V operation mode.

a-5) ME receiving State A;

With an imposed voltage of 0V the current flowing out of the ME shall not exceed 1mA when the ME is in 3V operation mode.

a-6) ME transmitting State A;

The voltage shall be between -0.3V and  $0.2 \times V_{CC}$  when a current of 1mA flowing into the ME is applied when the ME is in 3V operation mode.

a-7) ME transmitting or receiving State Z

The voltage shall be between  $0.7 \times V_{CC}$  and  $V_{CC} + 0.3V$  when a current of 20 $\mu$ A flowing out of the ME is applied when the ME is in 3V operation mode.

a-8) The rise and the fall time of the I/O signal shall not exceed 1 $\mu$ s when the ME is in 3V operation mode.

b-1) ME receiving State A;

With an imposed voltage of 0V the current flowing out of the ME shall not exceed 1mA when the ME is in 3V operation mode.

b-2) ME transmitting State A;

The voltage shall be between -0.3V and  $0.2 \times V_{CC}$  when a current of 1mA flowing into the ME is applied when the ME is in 3V operation mode.

b-3) ME transmitting or receiving State Z

The voltage shall be between  $0.7 \times V_{CC}$  and  $V_{CC} + 0.3V$  when a current of 20 $\mu$ A flowing out of the ME is applied when the ME is in 3V operation mode.

b-4) The rise and the fall time of the I/O signal shall not exceed 1 $\mu$ s when the ME is in 3V operation mode.

b-5) ME receiving State A;

With an imposed voltage of 0V the current flowing out of the ME shall not exceed 1mA when the ME is in 1.8V operation mode.

b-6) ME transmitting State A;

b-2) The USIM simulator shall send error status bytes ('6xxx' except '6Cxx' '61xx', '62xx' and '63xx').

#### **7.2.5.5 Expected test result**

After step a-2), the ME shall send a GET RESPONSE command with Le='00'.

After step b-2), the ME shall send discontinue processing of the command.

### **7.2.6 Error correction**

#### **7.2.6.1 Definition and applicability**

The error detection and correction procedure is mandatory for T=0 protocol except for the ME during the ATR procedure.

If the USIM as receiver detects a parity error within  $11 \pm 0.2$ etu starting from edge of the start bit, in a character just received, it shall set I/O to state L to indicate the error to the ME.

#### **7.2.6.2 Conformance requirement**

The error detection and correction procedure is mandatory for T=0 protocol except for the ME during the ATR procedure.

Refer to Section 7.2.2.4 in TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics.

#### **7.2.6.3 Test purpose**

To verify the error handling during the data transmission from the ME to the USIM.

#### **7.2.6.4 Method of test**

##### **Initial conditions:**

The ME shall be connected to a USIM simulator, and powered on.

##### **Test procedure:**

The USIM simulator shall transmit an error signal in response to a received character by setting the I/O line to state L for a maximum of 2etu and a minimum of 1etu,  $10.5 \pm 0.2$ etu after the leading edge of the start bit of the received character.

#### **7.2.6.5 Expected test result**

The ME shall repeat the disputed character after a minimum delay of 2etu.

### **7.2.7 Error detection**

#### **7.2.7.1 Definition and applicability**

The error detection and correction procedure is mandatory for T=0 protocol except for the ME during the ATR procedure.

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If the ME as receiver detects a parity error within  $11 \pm 0.2 \text{ etu}$  starting from edge of the start bit, in a character just received, it shall set I/O to state L to indicate the error to the USIM.

#### **7.2.7.2 Conformance requirement**

The error detection and correction procedure is mandatory for T=0 protocol except for the ME during the ATR procedure.

Refer to Section 7.2.2.4 in TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics.

#### **7.2.7.3 Test purpose**

To verify the error handling during the data transmission from the USIM to the ME.

#### **7.2.7.4 Method of test**

##### **Initial conditions:**

The ME shall be connected to a USIM simulator, and powered on.

##### **Test procedure:**

The USIM simulator shall send a response with a parity error and check that the ME correctly handles it.

#### **7.2.7.5 Expected test result**

The ME shall detect the parity error by setting the I/O line to state L for a maximum of  $2 \text{ etu}$  and a minimum of  $1 \text{ etu}$ ,  $10.5 \pm 0.2 \text{ etu}$  after the leading edge of the start bit of the erroneous character.

### **7.3 T=1 Protocol**

#### **7.3.1 Character Waiting Time**

##### **7.3.1.1 Definition and applicability**

CWT is defined as the maximum delay between the leading edges of two consecutive characters in the block.

##### **7.3.1.2 Conformance requirement**

CWI is used to calculate CWT and shall be in the range from 0 to 5. The value is set in bits b4 to b1 in TB3. The value of CWT may be calculated from the following equation:  $CWT = (11 + 2^{CWI}) \text{ etu}$ .

Refer to Section 7.2.3.1 in TD-SCDMA/WCDMA Digital Cellular Mobile Communication Network Technical Specification for USIM-ME (Cu) Interface Part 1: Physical, Electrical and Logical Characteristics and Section 9.5.3 in ISO/IEC 7816-3.

##### **7.3.1.3 Test purpose**

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Pause width	0.1ms to 500ms, randomly varied
Adjustable step size	0.1ms
Uncertainty	<±0.1ms

### A.2.3 Contact C7

Voltage setting uncertainty:	<±25mV
Rise and fall time setting uncertainty:	<±100ns
Jitter measurement uncertainty:	<±5×10E-3etu
Jitter setting uncertainty:	<±5×10E-3etu

Note: the Elementary Time Unit (etu) refers to the nominal bit duration on the I/O line.

### A.2.4 Contact C3

Frequency measurement uncertainty:	<±0.5%
Voltage measurement uncertainty:	<±50mV
Rise and fall time measurement uncertainty:	<±5ns
Duty cycle	
Measurement range:	35% to 65%
Measurement uncertainty:	<±2.5%

### A.3 Definition of timing

It shall be possible to define all timings relative to the clock. The USIM simulator shall be able to calculate and to use the absolute values automatically, even if the ME changes the frequency during the communication.

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