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Authority for Info-communications Technology Industry of Brunei Darussalam

Technical Specification for Terminal Equipment connecting to the Public Switched Telephone Network (PSTN)

**AITI-TS-PSTN
Issue 1**

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1 Scope

- 1.1 This Specification is applicable to all types of terminal equipment (TE) that can be approved for connection to the Public Switched Telephone Network (PSTN).
- 1.2 The technical requirements specified are intended to cover:
- (a) the protection of users and personnel operating the network from hazards that may arise from the connection of terminal equipment to public telecommunication network (section 3);
 - (b) the protection of public telecommunication network and service from interference and other adverse effects (sections 3, 5 to 8); and
 - (c) the assessment of compatibility of the terminal equipment with the network (sections 4 to 8).

2 General Requirements

2.1 Power Supply

- 2.1.1 The TE may be a.c. powered or d.c. powered. For an a.c. powered equipment, the technical requirements shall be complied with when operating from an a.c. mains supply of voltage, $230V \pm 10\%$ and frequency, $50 \text{ Hz} \pm 2\%$. Where external power supply is used, e.g. AC adaptor, it shall not affect the capability of the TE to meet the technical requirements.
- 2.1.2 Certain equipment may be allowed to be powered by d.c. from the exchange battery. In such cases, the current drawn by the equipment in the unlooped condition shall not be greater than 2 mA.

2.2 Polarity

The performance of the terminal equipment shall be independent of the line polarity i.e. the TE shall conform to the requirements of this Specification for both polarities of the line feeding (ETSI TBR 21, clause 4.3.1).

2.3 Identification of Equipment

The TE shall be marked with the supplier's or manufacturer's name or identification mark, and the supplier's or manufacturer's model or type reference. The markings required shall be legible, indelible and readily visible.

3 Electromagnetic Compatibility & Electrical Safety Requirements

- 3.1 The equipment shall comply with the limits for conducted disturbance at the mains terminals and telecommunication ports, and the limits for radiated disturbance defined in the IEC CISPR 22.
- 3.2 The equipment shall comply with the IEC 60950-1 safety standard¹. The requirements in IEC 60950-1 that are applicable to the equipment [e.g. class of equipment, type of telecommunication network voltage (TNV) circuit and types of components] shall be identified and complied with.

Note:

The following notations are used in the Specification:

CR	Conformance requirement defines features and functions which must be supported at minimum.
M	Mandatory requirements
O	Optional requirements
NA	Not Applicable
GID	General Information and Definitions

4 Method of Connection

4.1	Public Telecommunication Network Termination	CR	Remarks
	Public telecommunication network termination for the connection of the TE is a miniature 6-position socket shown in Figure 1.	GID	
4.1.1	Connection of the TE to the public telecommunication network termination is in accordance with Figure 1 (a).	○	
4.1.2	Connection of the TE to the public telecommunication network termination is in accordance with Figure 1 (b).	○	

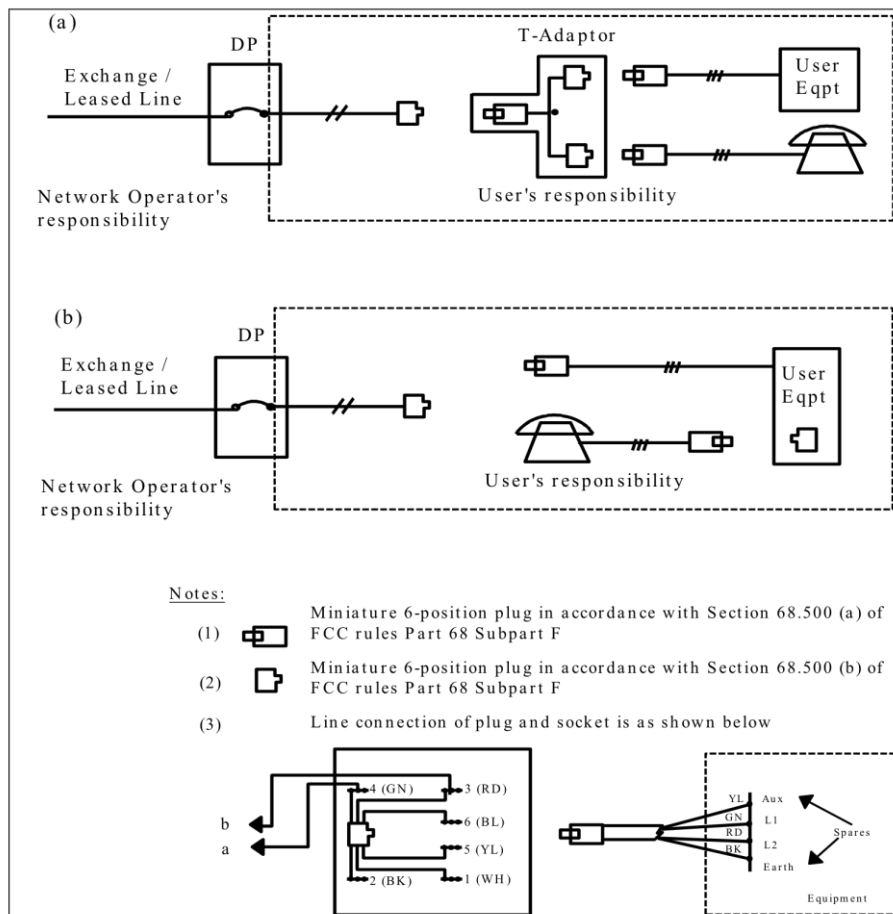


Figure 1: Methods of connection

5 General Operating Requirements

5.1	Ringling Signal and Service Tones	CR	Remarks
5.1.1	TE shall be able to work with the ringing signal from the public exchange as given in Table 1.	M	
5.1.2	TE shall be able to work with the service tones from the public exchange as shown in Table 1.	M	
5.2	Power-Fail Condition	CR	
5.2.1	In the event of failure of the power supply (back up supply included), the unattended TE shall immediately release the exchange line(s) and place it (them) in unlooped condition.	M	
5.2.2	Upon the restoration of power, the TE shall remain in the unlooped condition when not in use.	M	

Table 1: Ringling Signal and Service Tones in the Public Switched Telephone Network (PSTN)

Tone No.	Ringling Signal and Service Tones	Frequency (Hz)	Level at exchange MDF *	Periodicity
	Ringling Current	24	75 V nominal	0.4 s on 2.0 s off 0.4 s on 0.2 s off
1	Dial Tone	425	-15 dBm	continuous
2	Ringling Tone	425 x 24	-10 dBm	0.4 s on 2.0 s off 0.4 s on 0.2 s off
3	Busy Tone	425	-10 dBm	0.75 s on 0.75 s off
4	NU Tone	425	-10 dBm	2.5 s on 0.5 s off
5	Congestion Tone	425	-10 dBm	0.25 s on 0.25 s off
6	Intrusion Tone	425	-20 dBm	0.25 s on 2.0 s off
7	Acceptance Tone	425	-15 dBm	0.125s on 0.125s off
8A	Holding Tone A	425 x 24	-15 dBm	0.5 s on 0.5 s off
8B	Holding Tone B	425	-15 dBm	0.5 s on 2.5 s off
9	Call Waiting Tone	425 x 24	-15 dBm	0.3 s on 0.2 s off 0.3 s on 3.2 s off
10	Special Information Tone (not in use)	950 : 1400 : 1800	-10 dBm	0.33 s : 0.33 s : 0.33 s on 1.0 s off
11	End of Period Tone (Warning Tone)	425	-20 dBm	0.624 s on 4.376 s off
12	Stutter Dial Tone	425	-15 dBm	0.2 on 0.2 off 0.6 on 0.2 off 4 cycles followed by continuous tone

Notes:

- 1 $f_1 \times f_2 = f_1$ modulated by f_2 , depth of modulation is 100%
 $f_1 : f_2 = f_1$ followed by f_2
- 2 The maximum frequency deviation is as follows:
(a) 425 Hz \pm 20 Hz

(b) 24 Hz \pm 2 Hz

(c) Special Information Tone: \pm 50 Hz

Nominal values are given. The actual values may deviate from these in working exchanges.

6 Electrical Characteristics

6.1	Insulation Resistance	CR	Remarks
	The insulation resistance between any one of the line terminals and the earth terminal shall be $> 5 \text{ M}\Omega$ measured at 100 V d.c.	M	

6.2	Impedance Limits	CR	Remarks
6.2.1	Unlooped Condition	-	Heading
6.2.1.1	TE shall present to the exchange line a d.c resistance $> 1 \text{ M}\Omega$ measured at 100 V d.c.	M	Acceptable test method: ETSI TBR 21, A.4.4.1
6.2.1.2	TE shall present to the exchange line impedance, $Z > 6.66 \text{ k}\Omega$ in the frequency range of 300 to 3400 Hz, if no additional loading from parallel connections is intended. Z shall be $> 20 \text{ k}\Omega$ in the frequency range of 300 to 3400 Hz if additional loading from parallel connections is intended.	M	Acceptable test method: ETS 300 001, A.4.1.1
6.2.1.3	TE shall present to the exchange line an impedance $> 2 \text{ k}\Omega$ at 24 Hz.	M	Acceptable test method: ETS 300 001, A.4.4.2.1
6.2.1.4	TE shall be able to withstand sustained ringing voltages from the telephone line of 85 V r.m.s. at nominal frequency of 24 Hz.	M	
6.2.2	Looped Condition	-	Heading
6.2.2.1	A d.c. resistance of 80Ω to 450Ω for line currents between 20 mA to 110 mA.	M	Acceptable test method: ETSI TBR 21, A.4.7.1
6.2.2.2	For analogue TE supporting non-voice services only, the return loss calculated shall be $> 8 \text{ dB}$ with respect to 600Ω in the frequency range of 300 to 3400 Hz for line current up to 110 mA.	M Note 1	Acceptable test method: ETSI TBR 21, A.4.7.2
6.2.2.3	For analogue TE supporting handset telephony, the return loss calculated shall be $> 14 \text{ dB}$ with respect to 600Ω in the frequency range of 300 to 3400 Hz for line current up to 110 mA.	O Note 2	Acceptable test method: ETSI TBR 38, A.2.8
6.2.2.4	The equipment shall be capable of performing satisfactorily with continuous d.c. current between 20 mA and 110 mA from the public exchange.	M	Acceptable test method: ETSI TBR 21, A.4.7.1
6.2.3	In the case where the connection of the equipment introduces a resistance in series with PSTN and other terminal equipment, the additional resistance introduced shall be less than 50Ω .	M	Acceptable test method: ETS 300 001, A.2.5

6.3	Impedance Unbalance about Earth	CR	Remarks
	Impedance unbalance about earth expressed in Longitudinal Conversion Loss (LCL) shall be $\geq 40 \text{ dB}$ in the frequency range of 300 to 600 Hz and $\geq 46 \text{ dB}$ in the frequency range of 600 to 3400 Hz.	M	Acceptable test method: ETSI TBR 21, A.4.7.4

6.4	Signal Frequencies and Sending Levels	CR	Remarks
6.4.1	All signals transmitted to public telecommunication network line shall be nominally confined to the frequency range of 300 to 3400 Hz and the power level during any 10 second period shall not exceed -6 dBm when measured with 600 Ω termination. Note 3 Acceptable test method: ETSI	M	TBR 21, A.4.7.3.1
6.4.2	Any power transmitted above 3400 Hz shall be reduced progressively by at least 12 dB/octave.	M	Acceptable test method: ETSTBR 21, A.4.7.3.4
6.4.3	Any individual spectral component of the transmitted signals into the public telecommunication network line shall not exceed -33 dBm at frequencies above 3.4 kHz and -70 dBm at 50 kHz and above.	M	Acceptable test method: ETSI TBR 21, A.4.7.3.4
<p>Note 1 Requirements are applicable only to non-voice TE (without handset function) such as modems and some facsimile machines.</p> <p>Note 2 Requirement is mandatory if TE incorporates analogue handset function.</p> <p>Note 3 These requirements do not apply to MFPB (DTMF) signals.</p>			

7 Calling Function

TE that initiates calls to the public telephone exchange shall conform to the requirements of this section.

7.1	Line Signalling	CR	Remarks
	Each originating call shall begin with the establishment of looped condition. The TE shall be able to interwork with the d.c. loop start line signalling method of the public exchange as shown in Tables 2 and 3.	M	

7.2	Multifrequency Push-Button (MFPB or DTMF) signalling	CR	Remarks																														
7.2.1	<p>The equipment shall send the call address information to the public exchange by means of MFPB signalling codes as specified below.</p> <table border="1"> <thead> <tr> <th colspan="2"></th> <th colspan="3">Digit Codes</th> </tr> </thead> <tbody> <tr> <td></td> <td>697</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td></td> <td>770</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td></td> <td>852</td> <td>7</td> <td>8</td> <td>9</td> </tr> <tr> <td></td> <td>941</td> <td>*</td> <td>9</td> <td>#</td> </tr> <tr> <td></td> <td></td> <td>1209</td> <td>1336</td> <td>1477</td> </tr> </tbody> </table>			Digit Codes				697	1	2	3		770	4	5	6		852	7	8	9		941	*	9	#			1209	1336	1477	M	Acceptable test method: ETSI TBR 21, A.4.8.2.1
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		1209	1336	1477																													
7.2.2	Transmit signalling frequencies shall not deviate more than $\pm 1.5\%$ from the nominal values.	M	Acceptable test method: ETSI TBR 21, A.4.8.2.2																														
7.2.3	The sending level for low group frequencies into public telecommunication network line shall be -8 ± 2 dBm.	M	Acceptable test method: ETSI TBR 21, A.4.8.2.2																														
7.2.4	The sending level for high group frequencies into public telecommunication network line shall be -6 ± 2 dBm.	M	Acceptable test method: ETSI TBR 21, A.4.8.2.2																														
	The total power of unwanted frequency components during signalling shall be at least 20 dB below the power level of signal frequency.	M	Acceptable test method: ETSI TBR 21, A.4.8.2.3																														

7.3	Keypad Dialling	CR	Remarks
7.3.1	Keypads used in equipment for dialling shall be alphanumeric keypads and the relationships between the letters and the digits shall comply with ITU-T Rec. E.161 as shown in figure 2.	M	
7.3.2	The associated letters must not impair the legibility of the digit (§ 3.1.1, ITU-T Rec. E.161).	M	
7.3.3	The tactile identifier on the "5" button shall be provided (§ 3.6, ITU-T Rec. E.161)	M	

7.4	Automatic Dialling	CR	Remarks
	For equipment which carries out dialling automatically, (a) the sending length of the MFPB signal shall be at least 65 ms, and (b) the inter-digit pause between 2 MFPB signals shall not be less than 65 ms.	M	Acceptable test method: ETSI TBR 21, A.4.8.2.4 & A.4.8.2.5

7.5	Repeat Call Attempts	CR	Remarks
	For TE with automatic repeat dialling facility, every automatic redial operation shall be limited to a maximum of 10 call re-attempts with intervals of minimum 60 seconds between re-attempts.	M	

7.6	Automatic Calling	CR	Remarks
	Where automatic calling facility is provided in the equipment: (a) a dial tone detector shall be incorporated; (b) dialling digits shall be sent within 5 s of detecting the exchange dial tone.	M	

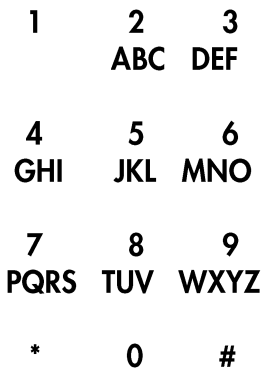


Fig.2: Alphanumeric Keypad Layout (ITU-T Rec. E.161)

Table 2: Subscriber Line Conditions for Originating Call

Signal State	Condition at the terminal equipment (Calling Subscriber)		Line Condition at exchange	Remarks
Idle	H	N		
Seizure	H to L	Dial Tone	N	Loop via subscriber terminal equipment
MFPB signalling	L		N	
Ringing	L	Ringing Tone	N	
Answer	L		N or N to R (*2)	
Conversation	L		N or R	
Register recall hooking (*1)	L to H to L		N or R	Loop break (*3)
Calling subscriber clears first (at any state)	L to H		N or R to N	Break in subscriber loop and return to idle state
Called subscriber clears before calling subscriber clears (line lock-out)	L	Busy Tone	N or R Time supervision	Line lock-out condition after time supervision
Calling subscriber subsequently clears	L to H		N or R to N	Return to idle condition

Legend: H = High ohmic unlooped state + ve = 0 V and - ve = - 48 V \pm 5 V
L = Low ohmic looped state
N = Battery feed with a lead - ve and b lead + ve
R = Battery feed with a lead + ve and b lead - ve

Notes:

- (*1) Register recall is only applicable to subscriber line that has services such as 3 way calling, call waiting service or malicious call tracing.
- (*2) Line reversal may be sent as answer signal depending on the category of calling subscriber and type of call. For lines requiring a reversal of line potentials as an answer signal for proper working, such facility can be arranged.
- (*3) Loop break is at a value of 600 \pm 300 ms.

Table 3: Subscriber Line Conditions for Terminating Call

Signal State	Line Condition at Terminating Exchange	Condition at the terminal equipment (Called Subscriber)		Remarks
Idle	N		H	
Ringing	N	Ringing Current	H	Ringing current on A lead
Answer	N		H to L	
Conversation	N		L	
Register recall hooking (*1)	N		L to H to L	Loop break (*2)
Called subscriber clears first	N		L to H	Return to idle after expiry of time supervision or after calling subscriber clears
Calling subscriber clears before called subscriber clears (line lock-out)	N	Busy Tone	L	
Called subscriber subsequently clears	N		L to H	Return to idle condition

Legend: H = High ohmic unlooped state + ve = 0 V and - ve = - 48 V \pm 5 V
 L = Low ohmic looped state
 N = Battery feed with a lead - ve and b lead + ve
 R = Battery feed with a lead + ve and b lead - ve

Notes:
 (*1) Register recall is only applicable to subscriber line that has services such as 3 way calling, call waiting service or malicious call tracing.
 (*2) Loop break is at a value of 600 \pm 300 ms.

8. Automatic Answering

8	Automatic Answering	CR	Remarks
8.1	TE shall have a ringing signal detector and answer an incoming call by looping the line within 9 seconds from the start of the ringing signal.	Note 1	
8.2	The maximum duration of looped condition for the automatic transmission of prerecorded message shall not exceed 2 minutes.	Note 1	
8.3	The maximum duration of looped condition for the automatic recording of incoming message shall not exceed 30 minutes.	Note 1	
8.4	<p>TE shall restore the exchange line to unlooped condition:</p> <p>(a) after the detection of busy tone sent by the exchange to indicate that the calling party has cleared first; or</p> <p>(b) alternatively, for equipment with a timer, after the time pre-set for the automatic transmission or recording of message.</p>	Note 1	
<p>Note 1: Requirement is 'M' if TE incorporates features with telephone answering capability e.g. Direct Inward System Access (DISA), voice message system etc.</p>			

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