

Essential requirements for terminal equipment intended for connection to analogue interfaces of the PSTN using direct dialling in

Committees responsible for this Published Document

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Foreword

This Published Document has been prepared by project teams under the direction of the Telecommunications Standards Policy Committee (TCT/-) and at the request of the DTI Telecommunications and Posts Division.

It forms one of a series of Published Documents that are being produced to record the essential requirements, consistent with Directive 91/263/EEC, for the connection of apparatus to the various public telecommunication systems (i.e. designated as a public telecommunications systems by an order made under Section 9 of the Telecommunications Act 1984).

The requirements specified in this Published Document were drawn from the following document.

Reference number	Title	Published by
BS 6450 : Section 3.1 : 1993	<i>Private branch exchanges for connection to public switched telephone networks run by certain public telecommunications operators</i> Section 3.1 <i>Specification for direct dialling in on private branch exchanges with terminating stations treated as an entirety</i>	BSI

This Published Document is presented for designation under Section 22 of the Telecommunications Act 1984.

The document is submitted to the DTI for designation as the National Technical Requirement for the approval of the equipment defined in the scope.

A copy of any designation will be included when available with all copies of this Published Document. Any further information on, or details of, the designation may be obtained from the Office of Telecommunications (OFTEL), 50 Ludgate Hill, London, EC4M 7JJ.

BSI waives copyright in respect of Annex B.

Compliance with a Published Document does not itself confer immunity from legal obligations. Attention is drawn to the Telecommunications Act 1984.

This Publication is not to be regarded as a British Standard.

1 Scope

This Published Document specifies the technical requirements under Section 22 of the Telecommunications Act 1984 for terminal equipment intended for connection to analogue interfaces of the public switched telephone network using direct dialling in signalling. These technical requirements are aligned with Articles 4(c) to 4(f) of Directive 91/263/EEC. This Published Document does not contain any essential requirements for terminal-to-terminal interworking via the public network.

This Published Document applies to all terminal equipment that is intended for connection to the form of access referred to above, irrespective of whether the terminal equipment provides additional interfaces, telecommunication services or functions.

2 Normative references

This Published Document incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Published Document only when incorporated in it by updating or revision.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this Published Document, the following definitions apply.

3.1.1 *A-wire, B-wire*

Individual wires comprising the connection point to the PSTN.

3.1.2 *backward busy state*

A state in which the TE is unable to accept incoming calls from the PSTN.

3.1.3 *direct dialling in (DDI)*

Mode of operation of a TE that enables incoming PSTN calls to a TE to be routed, by use of information provided by the PSTN during the call set-up phase, to individual destinations without the intervention of the TE operator.

NOTE. The last two or more PSTN routeing digits are utilized within the TE rather than in the public exchange, thus the DDI TE therefore becomes part of the public exchange (PE) numbering plan.

3.1.4 *idle state*

A state in which no call exists.

3.1.5 *interdigital pause (IDP)*

Interval between successive digit signals.

3.1.6 *loop-disconnect signalling*

Form of signalling where the basic network loop is repeatedly interrupted by signalling pulses during which the current of the loop falls to a very low value.

NOTE. There are 10 discrete digits designated, 1 to 9 and 0. Each digit comprises the requisite number of pulses with each pulse consisting of a break period followed by a make period. The digit 0 is represented by 10 pulses.

Successive digits are separated by an interdigital pause.

3.1.7 *multi-frequency tone signalling*

Signals comprising two groups of four single frequency tones with each digit represented by a combination of two tones, one from each group, as given in table 1. Successive tone signals are separated by an interdigital pause.

Table 1. MF coding frequencies

				Low frequency band values, Hz
Digit to be encoded	1	2	3	697
	4	5	6	770
	7	8	9	852
	not used	0	not used	941
High frequency band values, Hz	1209	1336	1477	1633

3.1.8 *on-line answered state*

A state in which the incoming PSTN call has been answered by the TE.

3.1.9 *on-line seized, not answered state*

A state in which the PSTN line has been seized for an incoming call, but the TE has not answered the call.

3.1.10 *terminal equipment*

Equipment intended to be connected to the public telecommunications network, i.e.:

- a) to be connected directly to the termination of a public telecommunication network; or
- b) to interwork with a public telecommunications network, being connected directly or indirectly to the termination of a public telecommunications network, in order to send, process, or receive information.

3.2 Abbreviations

For the purposes of this Published Document, the following abbreviations apply.

DDI	direct dialling in
IDP	interdigital pause
PBX	private branch exchange
PE	public exchange
PSTN	public switched telephone network
PTO	public telecommunications operator
SUT	system under test
TE	terminal equipment
TDU	transmission decoupling unit

3.3 Notation

For the purposes of this Published Document the following notations apply.

3.3.1 *dBm*

Absolute power level with respect to 1 mW, expressed in decibels.

3.3.2 *dBmp*

Absolute psophometric power level (weighted for telephony) with respect to 1 mW, expressed in decibels.

3.3.3 *dBV*

Absolute voltage level with respect to 1 V, expressed in decibels.

NOTE. Further information on all expressions for power levels used in this standard is given in CCITT recommendation B.12.

4 Conformance principles

4.1 Requirements

4.1.1 *General*

Each requirement in this Published Document is either applicable to all terminal equipment within the scope of this document, or only applicable to certain terminal equipment, depending on the functions implemented within the terminal equipment. Annex A specifies the relationship between the requirements and the terminal. The supplier shall provide information on the functions implemented in the terminal and this information shall be used to determine which requirements apply and the manner in which the tests are performed.

NOTE. This information may be provided by completing the tables in annex B.

This Published Document does not specify any additional requirements to cover the case of terminal equipment that can be connected to direct dialling in exchange lines by means of multiple interfaces. Where there is more than one interface on the terminal equipment and these interfaces are implemented in the same manner, the tests shall be applied to only one of these interfaces.

4.1.2 *d.c. potentials*

All direct current (d.c.) potentials shall be measured with respect to the earth reference point of the TE unless otherwise specified.

4.2 Tests

4.2.1 Tests shall be performed in accordance with the information provided by the supplier for the selection of the appropriate adjustments and/or options at the PSTN line interface.

4.2.2 Where the number, type and value of resistance of resistors is not specified the tests in this Published Document shall be performed with three non-reactive 50 k Ω resistors, one between the relevant A- and B-wires and one between each wire and earth.

NOTE. These resistances simulate the worst conditions present on the PSTN.

4.2.3 For the purposes of performing tests of the requirements in clause 6, the PSTN connection point is a point specified by the supplier.

5 Connection point

5.1 Each circuit of the connection between the terminal equipment and the PSTN shall be capable of terminating a solid copper conductor of diameter in the range 0.4 mm to 0.6 mm.

Conformity is determined by inspection.

5.2 Each circuit of the connection between the terminal equipment and the PSTN shall be a solid copper conductor of diameter in the range 0.4 mm to 0.6 mm.

Conformity is determined by inspection.

6 Electrical characteristics

6.1 Idle state

6.1.1 *D.C. characteristics*

When a DDI line is in the idle state the TE shall extend to the PSTN a negative d.c. potential not less than 46 V and not exceeding 57 V on the B-wire and earth (0 V $\pm$ 1 V) on the A-wire. Conformity is determined by measurement when terminated in a resistance of 10 k Ω .

6.1.2 *Idle state psophometric power level*

The total idle state noise power level of the TE shall be not greater than – 30 dBmp.

Conformity is determined by measurement.

6.1.3 *Idle state power levels above 5.1 kHz*

The total power level in any 3 kHz bandwidth contained wholly above 5.1 kHz shall be not greater than the limit given in table 2 and shown in figure 1, for the centre frequency of that band. The limit curve shall be determined by straight lines joining successive coordinates given in table 2 when power in dBm is plotted on a linear scale against frequency on a logarithmic scale.

Conformity is determined by the test described in D.1.6.

Table 2. Coordinates of power level limit curve

Frequency kHz	Power level dBm
5.5	-40
8.9	-40
50	-70
1000	-70
2000	-58
4000	-46
8000	-34

6.1.4 Impedance balance about earth

For TEs with an earth connection, the impedance balance about earth shall be not less than 46 dB in the frequency range 300 Hz to 3400 Hz.

Conformity is determined by the test described in D.2.

6.2 On-line seized, not answered state**6.2.1 D.C. characteristics**

The TE shall apply a negative d.c. potential not exceeding 57 V on the B-wire and earth $0\text{ V} \pm 1\text{ V}$ on the A-wire, and shall restrict the current fed into the DDI exchange line, within the range of 100 mA to 17 mA for values of loop resistance of $0\ \Omega$ to $2020\ \Omega$ respectively. Such a loop shall be detected as a seize signal by the TE.

Conformity is determined by measurement.

6.2.2 Operation in the presence of longitudinal voltages

The TE shall operate in accordance with 6.3 and 6.5 in the presence of a longitudinal a.c. voltage of 50 Hz and up to 1.22 V r.m.s. applied between the earth reference point of the TE and the mid-point of the PSTN loop condition. Conformity is determined by the tests described D.6.7.

6.2.3 Impedance balance about earth

The impedance balance about earth shall be not less than 46 dB in the frequency range 300 Hz to 3400 Hz.

Conformity is determined by the test described in D.2.

6.3 Response to an incoming call attempt**6.3.1 Action on receipt of sufficient digits to complete the call connection**

Within 3 s of receipt of the last digit necessary to complete the call connection, the TE shall either:

- send an answer signal in accordance with 6.4.1; or
- return awaiting answer indication as described in 6.3.3.1 to the PSTN. The awaiting answer indication may be followed by an answer signal in accordance with 6.4.1.

c) return to the PSTN any other PSTN supervisory tone as described in 6.3.3.2 or 6.3.3.3 to the PSTN. The PSTN supervisory tone shall not be followed by an answer signal in accordance with 6.4.1.

Different responses may be provided according to the digits received and according to the configuration and internal state of the TE. The correct operation of each response supported by the TE shall be tested.

NOTE. It is advisable for terminal equipment which automatically answers an incoming call to return at least one burst of awaiting answer indication before answering the call.

Conformity is determined by the tests described in D.3.1 to D.3.3.

6.3.2 Action on receipt of insufficient digits to complete the call connection

Within 180 s of receipt of the last digit, where that digit is insufficient to complete the call connection, the TE shall either:

- send an answer signal in accordance with 6.4.1; or
- return awaiting answer indication as described in 6.3.3.1 to the PSTN. The awaiting answer indication may be followed by an answer signal in accordance with 6.4.1; or
- return to the PSTN any other PSTN supervisory tone as described in 6.3.3.2 or 6.3.3.3 to the PSTN. The PSTN supervisory tone shall not be followed by an answer signal in accordance with 6.4.1.

Different responses may be provided according to the digits received and according to the configuration and internal state of the TE. The correct operation of each response supported by the TE shall be tested.

NOTE. It is advisable for terminal equipment which automatically answers an incoming call to return at least one burst of awaiting answer indication before answering the call.

Conformity is determined by the tests described in D.3.4.

6.3.3 PSTN supervisory tones**6.3.3.1 Awaiting answer indication**

Awaiting answer indication shall have a frequency and cadence as described in table 3 and shall have a power level conforming to 6.3.3.4.

Awaiting answer indication shall persist for at least 6 min or until the call is answered, or until the call is cleared by the PSTN, whichever is the sooner. Conformity is determined by inspection and measurement.

NOTE. It is recommended that the tone should be sent for as long a period as possible until the PE returns to the idle state or the call is answered.

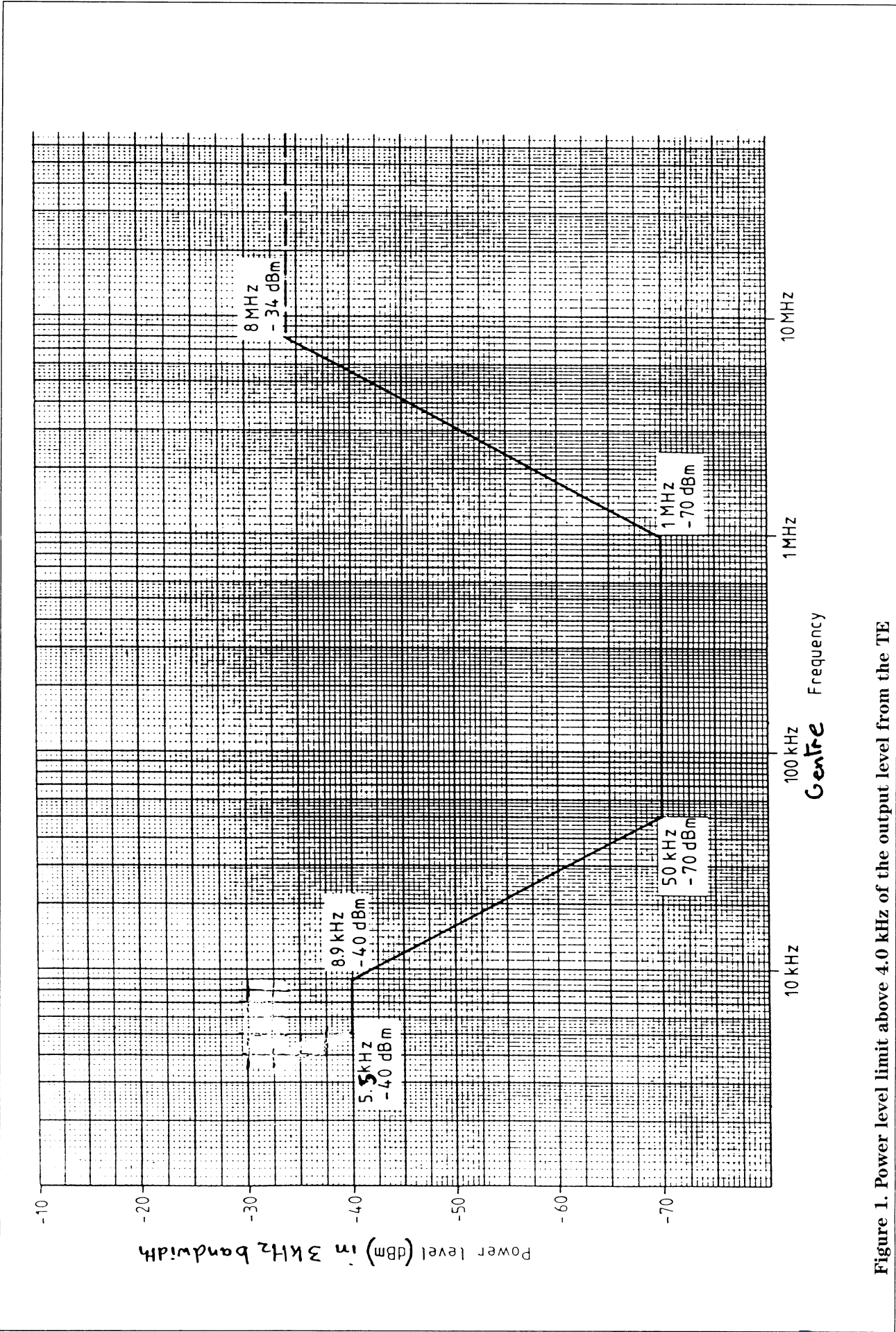


Figure 1. Power level limit above 4.0 kHz of the output level from the TE

Table 3. Frequency and cadences for supervisory tones		
Tone	Frequency ($\pm 20\%$ unless indicated) Hz	Cadence ($\pm 25\%$ unless indicated)¹⁾
Number engaged indication (engaged or busy tone)	400	0.375 s on, 0.375 s off
Path engaged indication (equipment engaged tone)	400	0.4 s on, 0.35 s off, 0.225 s on, 0.525 s off ²⁾
Connection not admitted indication (number unobtainable tone)	400	Continuous
Special information tone	950 $\pm$ 50, 1400 $\pm$ 50, 1900 $\pm$ 50	Each frequency sent for 330 ms $\pm$ 70 ms in the order given and with silent periods of up to 30 ms between adjacent signals. ³⁾
Awaiting answer indication (ring tone)	400 or 450 modulated by 17 to 50, or 400 plus 450 at approximately the same level.	0.4 s on, 0.2 s off, 0.4 s on, 2.0 s off, or 0.35 s on, 0.22 s off, then start at any point in 0.4 s on, 0.2 s off, 0.4 s on, 2.0 s off
¹⁾ The tone may start at any point within the cadence. ²⁾ The longer tone may have a power level up to 6 dB below the limits of 6.3.3.4. ³⁾ The special information tone shall be followed by a recorded announcement. See 6.3.3.2.		

6.3.3.2 Special information tone

Special information tone shall have a frequency and cadence as described in table 3 and shall have a power level conforming to 6.3.3.4.

Where special information tone is returned to the PSTN, it shall be followed by a recorded voice announcement in the following form:

'The (name of the Company) telephone system is out of service, please try later; you have not been charged for this call.'

Conformity is determined by inspection and measurement.

6.3.3.3 Other PSTN supervisory tones

Any PSTN supervisory tone other than those described in 6.3.3.1 and 6.3.3.2 shall have a frequency and cadence as described in table 3 and shall have a power level conforming to 6.3.3.4.

The tone shall persist for at least 30 s or until the call is cleared by the PSTN, whichever is the sooner.

Conformity is determined by inspection and measurement.

NOTE. It is recommended that the tone should be sent for as long a period as possible until the PE returns to the idle state.

6.3.3.4 Power level of PSTN supervisory tones

Supervisory tones from the TE at the PSTN connection point shall have a frequency and cadence as described in table 3, and shall have a power level which conforms to either a) or b).

a) The absolute signalling power levels shall be as given in table 4.

Conformity shall be checked by measurement, with the TE connected to the circuit shown in figure 3 with a direct current of 25 mA flowing through the milliammeter.

b) The absolute signalling power levels shall be within the marked area of figure 4. Conformity is determined by measurement, with the TE connected to the circuit shown in figure 5.

Table 4. Absolute signalling power levels of supervisory tones

Impedance Z_L (see figure 5)	Send level	
	Minimum	Maximum
Figure 2	-14 dBV	-8 dBV
600 Ω non-reactive resistor	-12 dBm	-6 dBm