

Specification for

**General requirements
for apparatus for
connection to public
switched telephone
networks run by
certain public
telecommunications
operators**

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Telecommunications Standards Policy Committee (TCT/-) to Technical Committee TCT/2, upon which the following bodies were represented:

- British Approvals Board for Telecommunications
- British Facsimile Industry Consultative Committee
- British Radio and Electronic Equipment Manufacturers' Association
- British Telecommunications plc
- Cable and Wireless plc
- Communications Marketing and Servicing Association
- Computing Services Association
- Department of Trade and Industry (Telecommunications and Posts Division)
- EEA (the Electronics and Business Equipment Association)
- Electrical Installation Equipment Manufacturers' Association (BEAMA Ltd.)
- Engineering Equipment and Materials Users' Association
- Independent Broadcasting Authority
- Independent Telecommunications Suppliers' Association
- Institution of Electrical Engineers
- Kingston Communications (Hull) plc
- Mercury Communications Limited
- Mobile Radio Users' Association
- National Communications Union
- OFTEL (Office of Telecommunications)
- Telecommunication Engineering and Manufacturing Association
- Telecommunications Industry Association
- Telecommunications Managers' Association
- Telecommunications Users' Association (TUA)
- United Kingdom Offshore Operators' Association

This British Standard, having been prepared under the direction of the Telecommunications Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 1 April 1992

© BSI 03-1999

First published July 1982
Second edition April 1992

The following BSI references relate to the work on this standard:
Committee reference TCT/2
Draft for comment 87/61529 DC

ISBN 0 580 19974 6

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Cooperating organizations	Inside front cover
Foreword	iii
1 Scope	1
2 Abbreviations and definitions	1
3 Detection of bell tinkle	2
4 Electrical characteristics of apparatus	3
5 Marking	13
6 Information to be provided by the supplier	13
Appendix A Methods of test	15
Appendix B Physical network connection methods	22
Appendix C Electrical characteristics of a typical UK public switched telephone network	22
Appendix D Determination of ringer equivalence number	30
Figure 1 — Simplified circuit of apparatus suitable for 3-wire connection	3
Figure 2 — Simplified circuit of apparatus suitable for 2-wire connection	3
Figure 3 — Power level limit above 3.4 kHz of the output level from the apparatus	5
Figure 4 — D.C. characteristics	6
Figure 5 — Impedance reference network	7
Figure 6 — Limits of power level in a 10 Hz bandwidth of the output signal from the apparatus	8
Figure 7 — D.C. excited test circuit	11
Figure 8 — MF tone signal levels	12
Figure 9 — Typical network connection points	15
Figure 10 — Scheme of measurement circuit	16
Figure 11 — Pulse detection circuits	16
Figure 12 — Impedance balance test circuit	17
Figure 13 — Reference source	21
Figure 14 — Artificial line segment, 0.1 km length	21
Figure 15 — Distribution of insertion loss	30
Figure 16 — Distribution of relative group delay	31
Figure 17 — REN test circuit	32
Figure 18 — Loop-disconnect timing diagram	33
Figure 19 — Procedure for assignment of REN	34
Figure 20 — Dummy ringer	35
Table 1 — Coordinates of power level limit curve	4
Table 2 — Coordinates of d.c. characteristics upper limit curve	7
Table 3 — Coordinates of limit curves for power level in a 10 Hz bandwidth	10
Table 4 — MF coding frequencies	12
Table 5 — Coordinates of MF tone signal levels (areas A and B)	12
Table 6 — Classification	14
Table 7 — Tolerances of components and physical quantities	15
Table 8 — On-line direct current feeding conditions on exclusive lines	23

	Page
Table 9 — Standard network and terminal apparatus supervisory tones	24
Table 10 — Call arrival indication (ringing)	28
Table 11 — Howler	29
Publication(s) referred to	Inside back cover

Foreword

This British Standard has been prepared under the direction of the Telecommunications Standards Policy Committee. It forms one of a series of British Standards that are being produced following the commencement of liberalization in October 1981 of the supply of certain telecommunications apparatus within the United Kingdom. This edition supersedes BS 6305:1982, the withdrawal of which will be announced at a later date. BS 6305:1982 is at present specifically referred to in Designation No 84/003 S/R2 issued under Section 22(6) of the Telecommunications Act 1984. It is not possible to say on what date this revised edition will be designated but withdrawal of BS 6305:1982 will follow at the appropriate time.

NOTE Upon publication of this revised edition, BSI Sales Department will respond to purchase orders for BS 6305 by supply of copies of the 1992 edition. Copies of the 1982 edition may be obtained by quoting the number "BS 6305/82".

This edition introduces technical changes but it does not reflect a full review and revision of the standard, which will be undertaken in due course. The changes have been made in order to maintain alignment of the standard with the changing and developing aspects of the UK liberalized telecommunications environment, rectify errors and remedy deficiencies discovered during application of the standard. In particular, attention is drawn to the following:

The Telecommunications Apparatus (Bell Noise-Labelling) Order 1985.

BS 6305:1982 contained requirements for marking and labelling apparatus with respect to bell noise (bell tinkle). These requirements were included in the standard as an interim measure because legal requirements had not come into operation at the time the standard was published. However, the Order came into operation on 3 June 1985 and, consequently, it is only necessary to refer now to the Order because the requirements of the Order are mandatory.

This series of standards includes product and facility specifications giving particular requirements for individual items of apparatus and facilities, together with standards covering general requirements for the connection of apparatus to the various public telecommunication systems, i.e. any telecommunication system designated as a public telecommunication system by an order made under Section 9 of the Telecommunications Act 1984. At the present time, these systems include the public switched telephone networks, the telex networks, the packet switching services, and leased private circuits run by British Telecommunications plc, Kingston Communications (Hull) plc and Mercury Communications Limited.

The requirements specified in the standards are intended to ensure that apparatus complying with them, when connected to public telecommunications systems, will neither adversely affect any public system nor interfere with the service available to other users of public telecommunication systems. The standards include safety requirements only for the protection of personnel operating the public telecommunication system and for the protection of users from hazards that may arise from the connection of the apparatus to that system.

This British Standard has been prepared for designation under the Telecommunications Act 1984.

It is stipulated in the Telecommunications Act 1984 that apparatus within the scope of a designated standard may only be approved for connection to a telecommunication system if it complies with that standard. Exceptions may be determined by or under the designation, which may stipulate variations of, or additions to, the requirements of the standard and may also set conditions that have to be complied with as regards the apparatus, or its connection, or its use.

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

Some apparatus may incorporate facilities for which a mandatory standard is necessary, but for which no standard has yet been designated for approval purposes under the Telecommunications Act 1984. Other apparatus may incorporate innovative features not foreseen when the relevant standard was written and designated and for which that standard is not fully appropriate. The British Approvals Board for Telecommunications (BABT) can sometimes deal with these cases by writing a “Special investigation test schedule” (SITS), which has the effect of stating requirements where there is no designated standard or of supplementing or varying the requirements in the application of the designated standard. Information on any relevant SITS may be obtained from the Director, BABT, Claremont House, 34 Molesey Road, Hersham, Walton-on-Thames, Surrey KT12 4RQ.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations. In particular, attention is drawn to the Telecommunications Act 1984.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 36, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies general requirements for subscriber's apparatus for connection to public switched telephone networks run by certain licensed public telecommunications operators. This standard applies to apparatus for connection to exclusive lines. This standard applies to both speech and non-speech apparatus. This standard applies only to apparatus within the scope of a product standard approved by the Secretary of State under section 16(1) of the British Telecommunications Act (1981) or designated by the Secretary of State under Section 22(6) of the Telecommunications Act 1984.

This standard specifies those requirements for the apparatus necessary for correct interworking with a network in terms of the electrical characteristics of the apparatus and (in the main text and in Appendix A and Appendix D) corresponding tests for compliance. This standard describes in Appendix B the various methods available for physical connection of the apparatus to a network. This standard gives, as an example, some guidance in Appendix C on the conditions presented by a public switched telephone network for an exclusive line at its interface with the apparatus.

This standard applies to apparatus suitable for household, office and similar general indoor use.

The tests described in this standard are type tests as defined in BS 4778-2:1979. The general conditions for the tests, both in the main text and in Appendix A and Appendix D, are described in A.1.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Abbreviations and definitions

2.1 General

For the purposes of this British Standard the abbreviations given in 2.2 apply, the definitions given in 2.3 apply and the notation given in 2.4 applies.

2.2 Abbreviations

The following abbreviations apply:

BT	British Telecommunications
PSTN	Public switched telephone network
PTO	Public telecommunications operator
REN	Ringer equivalence number
MF	Multi-frequency
VA	Verbal announcement.

2.3 Definitions

2.3.1

exclusive line

an extension of the PSTN for application to apparatus that makes use of only one exchange connection, excluding shared service

2.3.2

basic network loop

the two wires, designated "A" and "B", that form the electrical extension from a public switched telephone network exchange equipment to the subscriber termination

2.3.3

reference instrument

a BT telephone No. 8746¹⁾ that is required to be used as part of some of the test circuits described in this standard and for which the relevant characteristics are specified in this standard

2.3.4

on-line

the state of the apparatus where the subscriber termination has an electrical configuration that enables the current in the basic network loop to be at its maximum steady state value

2.3.5

off-line

the state of the apparatus where the subscriber termination has an electrical configuration that enables the current in the basic network loop to be at its minimum steady state value

2.3.6

idle state

a condition of the apparatus when it is off-line, that is, not in use, but excluding the ringing state

2.3.7

loop-disconnect signalling

a form of signalling by the apparatus connected to the line, where the basic network loop is repeatedly interrupted by signalling pulses during which the current of the loop falls to a very low value

2.3.8

break period

in loop-disconnect signalling, the period during which the current in the basic network loop falls to the lower of the two values used to represent signalling pulses

¹⁾ For information on the availability of BT telephone No. 8746 write to Customer Information, BSI, Linford Wood, Milton Keynes MK14 6LE.

2.3.9 make period

in loop-disconnect signalling, the period during which the current in the basic network loop returns to the higher of the two values used to represent signalling pulses

2.3.10 total pulse period

in loop-disconnect signalling, the sum of one break period and one make period

2.3.11 pulse train

a series of consecutive pulse periods determining a digit signalled to the network

2.3.12 inter-digital pause

the interval between successive pulse trains or tone bursts in a series of digits

2.4 Notation

The following notations apply:

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

NOTE The notations dBm and dBmp and the descriptions are derived from CCITT Recommendation B.12²⁾.

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

3 Detection of bell tinkle

3.1 3-wire connection

NOTE A simplified circuit of apparatus suitable for 3-wire connection is shown in Figure 1.

3.1.1 For apparatus suitable for 3-wire connection, ringing detectors shall not operate during loop-disconnect dialling. A shunt shall be connected between the "A" wire and "shunt" wire during the dialling period but the shunt shall be removed when the apparatus is off-line.

Compliance shall be checked by the test of **A.2**.

During the test of **A.2**, bell tinkle shall not be detected.

NOTE The shunt referred to is typically a resistance of approximately 100 Ω .

3.1.2 When the apparatus is in the off-line condition, the additional capacitance between the "B" wire and "shunt" wire shall be not greater than $(25 \times \text{REN})$ nF where REN is the value of REN marked on the apparatus (see **5.3**).

Compliance shall be checked by the test of **A.3**.

For apparatus marked with a REN of 0 the capacitance between the A and B terminals shall be less than 5 nF.

Compliance is checked by measurement of the capacitance over the frequency range 300 Hz to 3 400 Hz.

3.2 2-wire connection

NOTE 1 A simplified circuit of apparatus suitable for 2-wire connection is shown in Figure 2.

NOTE 2 *Text deleted.*

NOTE 3 For apparatus with loop-disconnect signalling and suitable for 2-wire connection to an analogue interface and intended for use in an installation allowing for the parallel connection of a number of items of apparatus, attention is drawn to the provisions of the Telecommunications Apparatus (Bell Noise-Labeling) Order 1985.

Apparatus suitable for 2-wire connection, except for those types identified in the following list, shall be subject to the test of **A.2** and during the test bell tinkle shall not be detected.

Exceptions:

- a) apparatus that, if approved, would be subject to marking in accordance with the Telecommunications Apparatus (Bell Noise-Labeling) Order 1985;
- b) apparatus with a REN of 4;
- c) apparatus referred to in **B.3** of this standard.

For apparatus marked with a REN of 0 the capacitance between the A and B terminals shall be less than 5 nF.

Compliance is checked by measurement of the capacitance over the frequency range 300 Hz to 3 400 Hz.

²⁾ Published by the International Telecommunications Union: International Telegraph and Telephone Consultative Committee (CCITT), Geneva 1989.

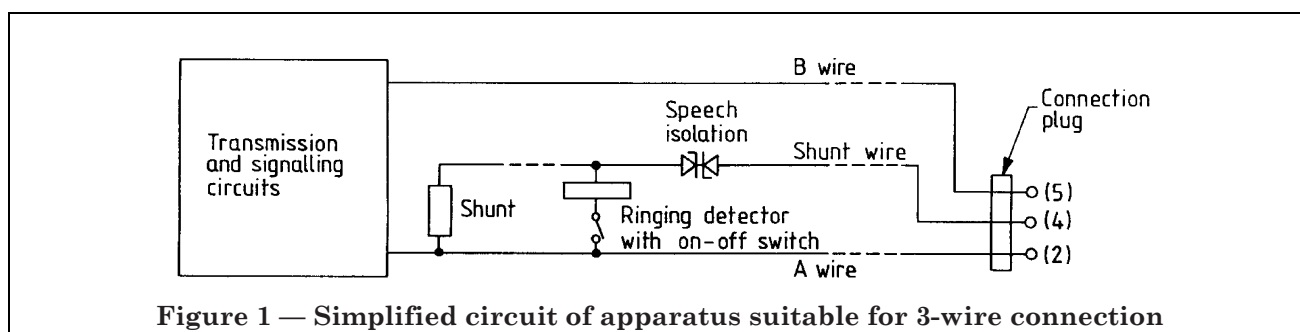


Figure 1 — Simplified circuit of apparatus suitable for 3-wire connection

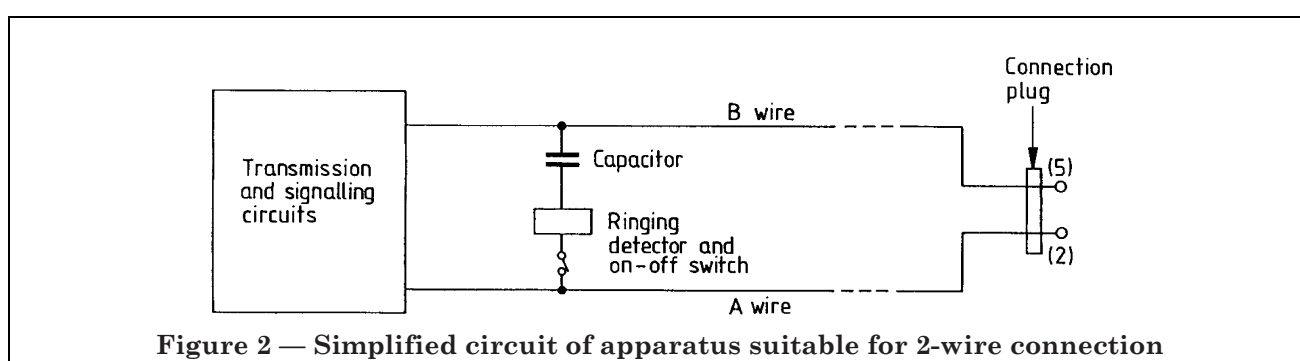


Figure 2 — Simplified circuit of apparatus suitable for 2-wire connection

4 Electrical characteristics of apparatus

NOTE Except where stated, the characteristics specified refer to a single item of apparatus connected to the network. Attention is drawn to 4.5 concerning polarity.

4.1 Apparatus off-line: idle state

4.1.1 Insulation resistance

For apparatus with earth terminals or leads, the resistance between these terminals or leads when connected together and each lead of the apparatus designated for connection to the basic network loop shall be not less than 5 MΩ.

Compliance shall be checked by measurement with a 100 V d.c. source applied.

4.1.2 Loop insulation resistance and bleed current

The current drawn by the apparatus in the off-line state from the network shall be not greater than $(30 \times \text{REN}) \mu\text{A}$, where REN is the value of REN marked on the apparatus (see 5.3).

For apparatus marked with a REN of 0 the current drawn shall be less than 5 μA.

Compliance shall be checked by measurement of the current flowing between the two leads designated for connection to the basic network loop, with a 50 V d.c. source applied in series with a 1 500 Ω resistor, the measurement being made with, where applicable, the idle state signalling conditions specified in 4.4.4 disabled.

NOTE There is no guarantee that it will be possible in all present or future circumstances to draw this current from a network.

4.1.3 Impedance

The impedance between the two leads designated for connection to the basic network loop shall be not less than 10 kΩ in the frequency range 300 Hz to 3 400 Hz.

For apparatus with earth terminals or leads, the impedance between these terminals or leads when connected together and each lead of the apparatus designated for connection to the basic network loop shall be not less than 30 kΩ in the frequency range 300 Hz to 3 400 Hz.

Compliance shall be checked by measurement, with a 1.0 V a.c. r.m.s. source applied.

4.1.4 Power level

The total idle state noise power level of the apparatus shall be not greater than -65 dBmp.

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 1, and shown in Figure 3, for the centre frequency of that band.

The limit curve shall be determined by straight lines joining successive coordinates given in Table 1 when power in dBm is plotted on a linear scale against frequency on a logarithmic scale.

Compliance shall be checked by measurement with the apparatus connected to a simulated network test circuit as described in A.6.

Table 1 — Coordinates of power level limit curve

Frequency	Power level
kHz	dBm
3.4	– 33
5.1	– 40
8.9	– 40
50	– 70
1 000	– 70
2 000	– 58
4 000	– 46
8 000	– 34

NOTE The curve is shown in Figure 3. It is recommended that suppression of signals to less than – 34 dBm should continue above 8 MHz.

4.2 Apparatus off-line: ringing state

4.2.1 Ringer equivalence number

For apparatus other than that marked with a REN of 0, the REN assigned to the apparatus when tested as described in Appendix D shall be not greater than the value marked on the apparatus (see 5.3). Where apparatus is marked with a REN of 0, the test described in Appendix D shall not be performed (but see 3.1.2 and 4.1.2).

NOTE 1 *Text deleted.*

NOTE 2 The REN relates to the performance of the apparatus when used in combination with other items of apparatus. The REN is a customer guide indicating approximately the maximum number of items of apparatus that should be connected simultaneously to the line.

To determine the maximum number of items of apparatus that should be connected simultaneously to an exclusive line, the total REN obtained by summing the REN values of each of the items of apparatus connected to the exclusive line should not exceed the maximum REN value of 4. This value includes any BT provided instrument each of which is assumed to have a REN value of 1.0 unless otherwise marked.

Because of the wide spread of ringing detector characteristics, a guarantee of successful operation in an installation of mixed types of ringing detectors may not be given by the supplier.

NOTE 3 The REN number marked on the apparatus may be a higher number than that assigned to the apparatus in Appendix D.

4.2.2 Restriction of signals sent to line

When a ringing detector is active the total psophometrically weighted voltage level measured at the line terminals or leads intended for connection to the basic network loop shall be not greater than – 10 dBV.

Compliance shall be checked by measurement as described in A.9.

4.3 Apparatus on-line: non-signalling state

4.3.1 D.C. characteristics

The steady-state voltage measured at the line terminals or leads intended for connection to the basic network loop for values of current in the range of 0 mA to 125 mA shall be not greater than the limit given in Table 2 and shown in Figure 4 and not less than zero.

NOTE 1 The duration of an undesignated interruption or random break in the d.c. path caused by the apparatus should not exceed 10 ms.

The limit curve shall be determined by straight lines joining successive coordinates given in Table 2.

Compliance shall be checked by measurement (starting at the lowest current) with the apparatus connected to a source capable of providing current up to the value obtained when the apparatus is connected to a voltage source of 50 V in series with a 400 Ω resistor.

NOTE 2 For some kinds of apparatus, it may be appropriate for the lower limit of voltage to be greater than zero, in which case the values would be specified in the relevant product specification.

NOTE 3 Under the conditions specified, the values of voltage and current obtained are limited in practice by the 400 Ω load line.

4.3.2 Impedance

4.3.2.1 For speech apparatus the return loss shall be not less than 12 dB in the frequency range 200 Hz to 4 000 Hz and the echo return loss shall be not less than 16 dB, both with respect to the network shown in Figure 5, in the apparatus current range described in the test of A.4.

Compliance shall be checked by determination of the return loss and echo return loss as described in A.4.

4.3.2.2 For non-speech apparatus, the impedance shall meet one of the following requirements.

- For non-speech apparatus in impedance class (a), the return loss shall be not less than 12 dB with respect to the network shown in Figure 5, in the frequency range 200 Hz to 4 000 Hz and in the apparatus current range described in the test of A.4.

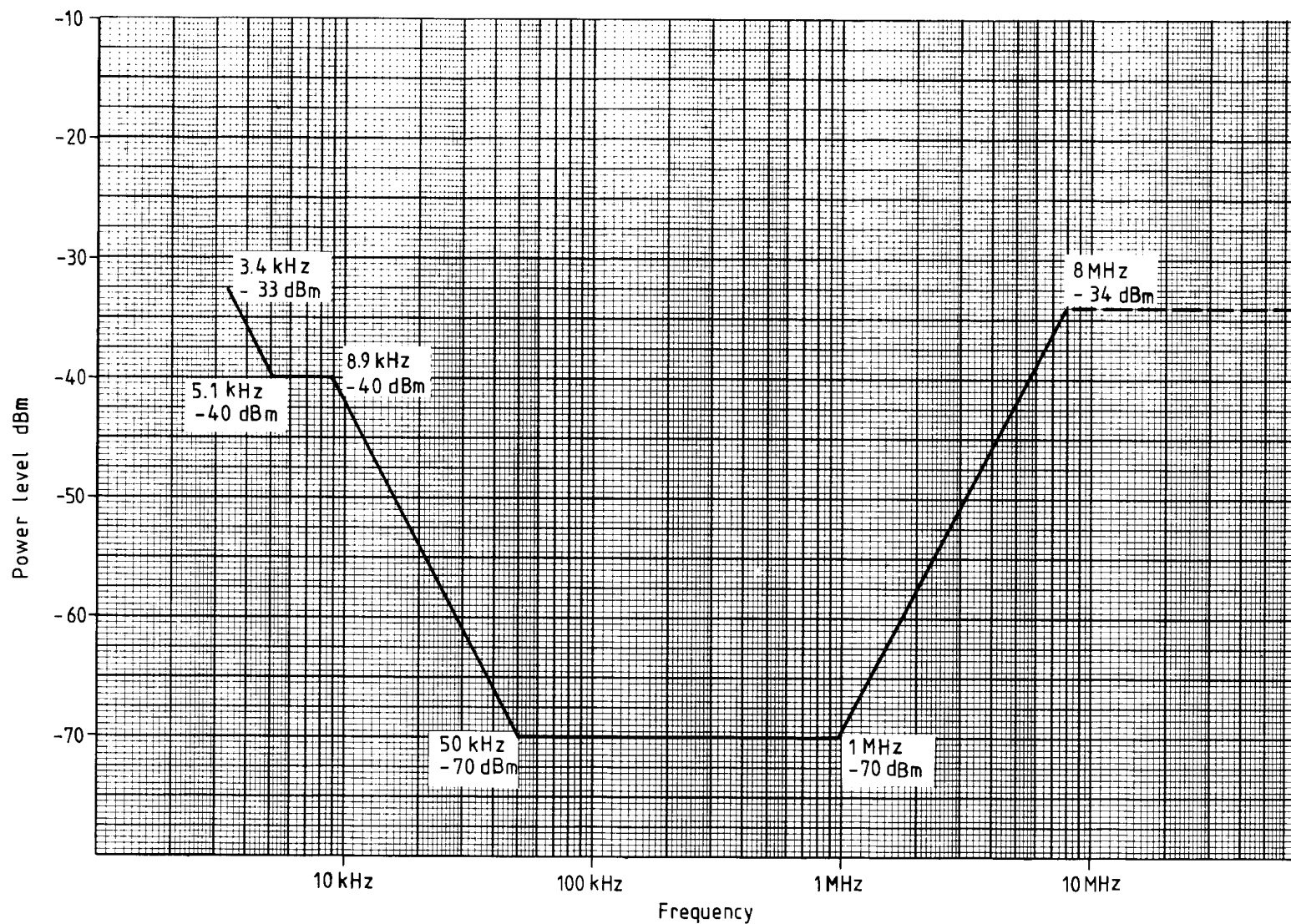


Figure 3 — Power level limit above 3.4 kHz of the output level from the apparatus

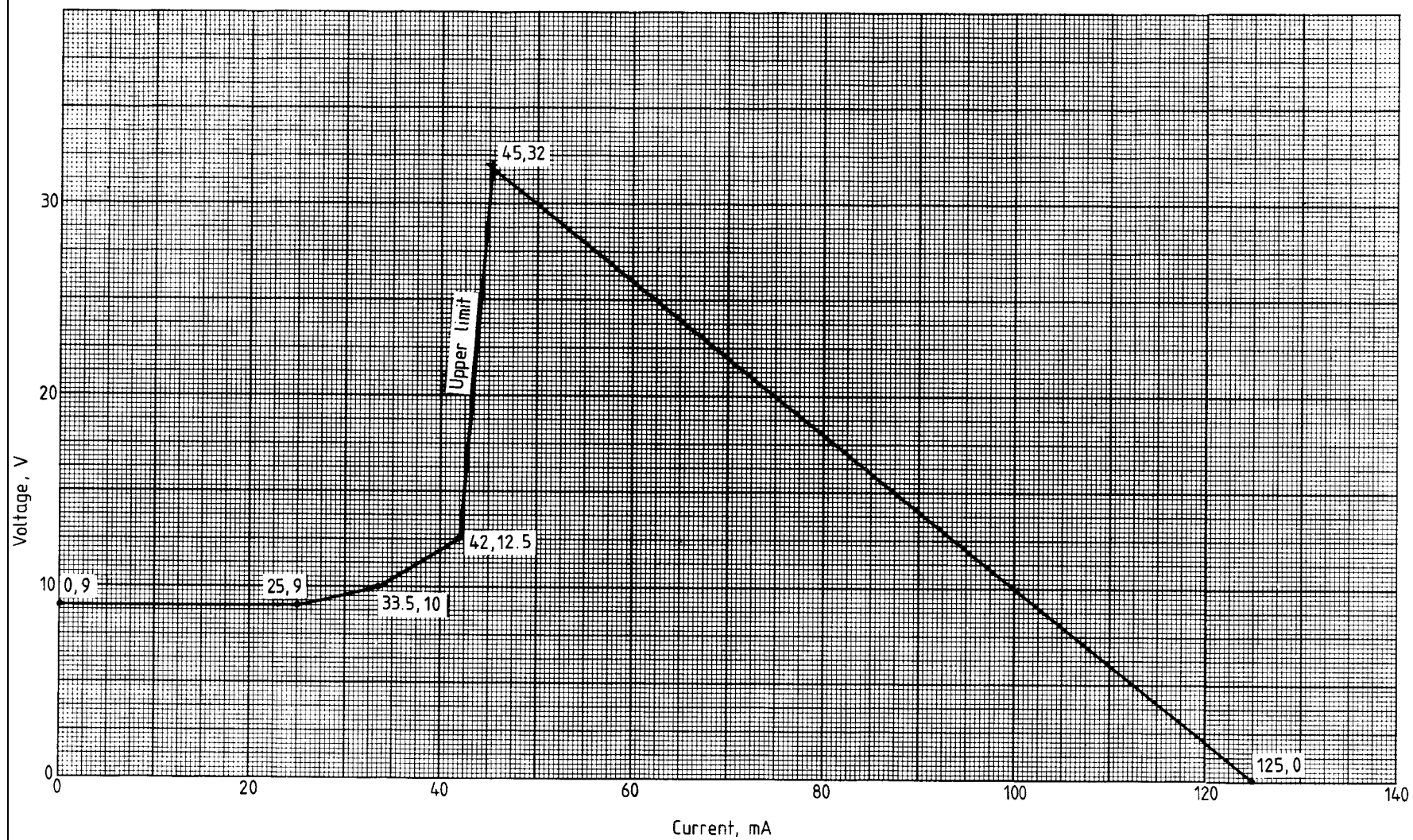


Figure 4 — D.C. characteristics

Table 2 — Coordinates of d.c. characteristics upper limit curve

Current	Voltage
mA	V
0	9
25	9
33.5	10
42	12.5
45	32
125	0

NOTE The curve is shown in Figure 4.

Compliance shall be checked by measurement of the return loss as described in A.4.

b) For non-speech apparatus in impedance class (b), the return loss shall be not less than 14 dB with respect to a 600 Ω resistive load, in the frequency range 200 Hz to 4 000 Hz and in the apparatus current range described in the test of A.4.

The impedance of the apparatus shall have a reactive component not greater than + 50 Ω , in the frequency range 200 Hz to 4 000 Hz and in the apparatus current range described in the test of A.4.

Compliance shall be checked by measurement of the impedance and return loss as described in A.4.

NOTE 1 Where a simple modem is used and where the apparatus is in impedance class (a), the return loss should be not less than 4 dB greater than the value specified in requirement a) in order to minimize data errors. Similarly, where a simple modem is used and where the apparatus is in impedance class (b), the return loss should be not less than 4 dB greater than the value specified in requirement b) in order to minimize data errors.

NOTE 2 Selection of the appropriate impedance requirements specified in 4.3.2.2 a) or 4.3.2.2 b) and the application of the corresponding compliance check by the approval authority is dependent upon the impedance classification determined by the supplier in accordance with clause 6.

4.3.2.3 For speech or non-speech apparatus that incorporates a special impedance facility where the apparatus is capable of being placed in an on-line state such that it has a nominal input impedance of 270 Ω , when this facility is invoked both of the following shall apply:

- the impedance presented by the apparatus shall be $(270 \pm 30) \Omega \pm j30 \Omega$ in the frequency range 200 Hz to 4 000 Hz over the current range described in the test of A.4;
- transmission to and from the PSTN shall be suppressed by at least 30 dB.

Compliance shall be checked by measurement of the impedance as described in A.4. The suppression of the transmission by 30 dB shall be checked by an appropriate functional test.

NOTE The above on-line state may be termed "line-hold" or "hold".

4.3.3 Earth impedance balance

For apparatus with an earth connection, the impedance balance about earth shall be not less than 46 dB in the frequency range 300 Hz to 3 400 Hz.

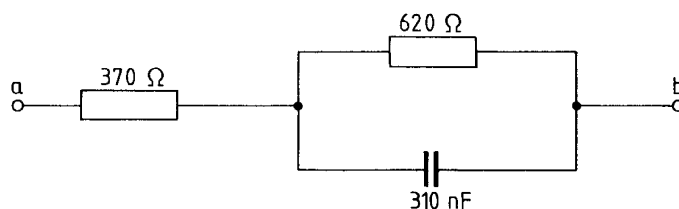
Compliance shall be checked by measurement as described in A.5.

4.3.4 Signal balance about earth

For apparatus with an earth connection, signalling activities shall not cause excessive voltage unbalance.

Compliance shall be checked by the test of A.7.

The signal balance about earth, calculated from the test measurements, shall be not less than 46 dB.

**Figure 5 — Impedance reference network**

4.3.5 Signal power presented to the network

- a) For fixed power level apparatus in adjustment class (0), the one minute mean power level shall be not greater than - 9 dBm.
- b) *Text deleted and incorporated in 4.3.5 c).*
- c) For apparatus where the power level is adjustable, the one minute mean power level shall be not greater than 0 dBm. The range of adjustment shall include the value - 13 dBm. The means of adjustment shall meet one of the following requirements.

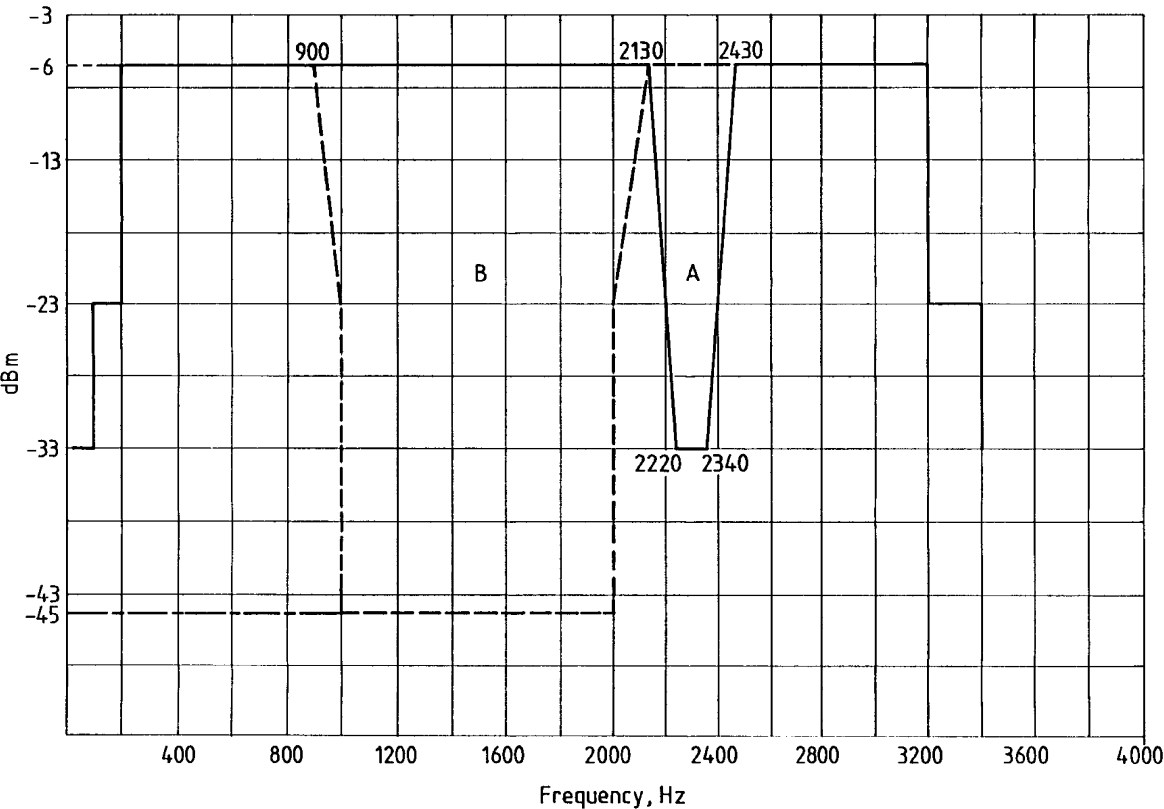
NOTE 1 For apparatus where the power level is adjustable, the level is set at the time of installation according to a procedure arranged with the PTO.

- 1) For adjustable power level apparatus in adjustment class (1), the means of adjustment, whereby levels could be set above those set at the time of installation, shall be inaccessible without the use of a tool.
- 2) For adjustable power level apparatus in adjustment class (2), the means of adjustment, whereby levels could be set above those set at the time of installation, shall be capable of being rendered inaccessible or inoperative by physical guards that are able to be released only by the use of a tool.

3) For adjustable power level apparatus in adjustment class (3), the means of adjustment, whereby levels could be set above those set at the time of installation, shall be capable of being operated only after the release of software locks, the operation of which requires skill and detailed knowledge not available to the user of the apparatus by means of information provided by the supplier.

- d) For apparatus where the power level is adjustable, the requirements for the total power level and instantaneous power level shall be determined with the power level adjusted for a one minute mean power level of - 9 dBm, or the nearest lower value for which a setting is practicable.

The total power level in a 10 Hz bandwidth contained wholly within the frequency range 0 Hz to 3 400 Hz shall be not greater than the upper limit given in Table 3 and shown by the full line in Figure 6, except for signals in area A as given in Table 3 and shown by additional dotted lines in Figure 6.



NOTE See Figure 3 for values over 3 400 Hz.

Figure 6 — Limits of power level in a 10 Hz bandwidth of the output signal from the apparatus