COMMUNICATIONS ALLIANCE LTD

AUSTRALIAN STANDARD

AS/CA S002:2010

Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network

Australian Standard – *Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network*

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FOREWORD

General

This Standard was prepared by the *CECRP/WC5 : General Standards for Customer Equipment* Working Committee and most recently revised by the *WC23 : PSTN Customer Equipment Revision* Working Committee. It is one of a series of Telecommunication Standards developed under the Memorandum of Understanding between the Australian Communications Authority (ACA) and the Australian Communications Industry Forum.

Note: On 1 July 2005 the ACA became the Australian Communications and Media Authority (ACMA) and the Memorandum of Understanding continues in effect as if the reference to the ACA were a reference to ACMA.

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This Standard is a revision of the AS/ACIF S002:2005 *Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network*.

This Standard is the result of a consensus among representatives on the Communications Alliance Working Committee to produce it as an Australian Standard.

The requirements in this Standard are consistent with the aims of s376 of the *Telecommunications Act 1997*. Specifically these aims are—

(a) protecting the integrity of a telecommunications network or facility;

(b) protecting the health and safety of persons;

(c) ensuring access to emergency services; and

(d) ensuring interoperability with a standard telephone service.

It should be noted that some Customer Equipment (CE) may also need to comply with requirements in other Standards.

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Milsons Point NSW 1565

Regulatory notice

This document will be submitted to the ACMA, for making as a technical standard under s376 of the *Telecommunications Act 1997*. Until it is made by the ACMA compliance with this Standard is voluntary.

The Standard as made by the ACMA will commence on the day after it registered under the *Legislative Instruments Act 2003* (LIA) and it will be a disallowable instrument within the meaning of s46A of the *Acts Interpretation Act 1901*.

The ACMA is a Commonwealth authority with statutory powers to impose requirements concerning telecommunications Customer Equipment and Customer Cabling.

The ACMA requires Australian manufacturers and importers, or their Australian agents, of specified items of Customer Equipment and Customer Cabling to establish compliance with Standards such as this. Items are required to be labelled in accordance with the applicable labelling notices.

Details on current compliance arrangements can be obtained from the ACMA website at http://www.acma.gov.au or by contacting the ACMA below at:

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Introduction

This introduction for the AS/ACIF S002:2010 ***Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network*** Standard is not an authoritative section of this Standard and is only provided as guidance for the user of the Standard to outline its objectives and the factors that have been taken into account in its development and to list the principal differences between the new and the previous edition.

The reader is directed to the clauses of this Standard for the specific requirements and to the Australian Communications and Media Authority (ACMA) for the applicable telecommunications labelling and compliance arrangements.

Note: Further information on the telecommunications labelling and compliance arrangements can be found in *The Telecommunications Labelling (Customer Equipment and Customer Cabling) Notice* (the TLN). The TLN can be obtained from the Australian Communications and Media Authority (ACMA) website at www.acma.gov.au.

The objective of this Standard is to provide the requirements and test methods for customer equipment (CE) and in the case of compound CE the parts of the compound CE that are designed or intended for connection to an analogue PSTN two-wire service in order to meet the regulatory arrangements for such equipment in Australia.

The objective of this revision is to bring the Standard into alignment with other Customer Equipment Standards and with the services provided on Australian telecommunications networks.

The principal differences between this edition of AS/ACIF S002 and the previous edition are:

(a) the references to other Standards have been updated.

(b) a new recommendation has been added for keypad locks (Clause 5.1.8.5).

(c) the table in Appendix A specifying PSTN service tone characteristics has been updated in line with technology changes.

(d) the frequency range over which the voltage is specified for insertion loss has been reduced to 15.3 to 50 Hz (Clause 5.2.3.3.).

(e) the 50 Hz meter signal detection requirements (Clause 5.5.1.3) and associated test methods have been removed.

(f) the Loop-in PSTN line requirements (the former Clause 5.5.2 in the 2005 edition) and associated test methods have been removed.

(g) the upper frequency limit of the Power Spectral Density mask has been extended to 30.175 MHz to align with other Customer Equipment Standards to cater for VDSL2 services (Clause 5.4.2.4).

(h) new longitudinal power level requirements (Clause 5.4.6) and associated test methods have been added, now aligning with other Customer Equipment Standards.

(i) a clarification to Clause 5.5.1.8 has been added noting that the implementation of decadic signalling in CE is not recommended; and

(j) the Multifrequency Code (MFC) signalling scheme and transmission criteria have been removed (the former Appendix A in the 2005 edition).

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1 INTERPRETATIVE GUIDELINES

1.1 Categories of requirements

This Standard contains mandatory requirements as well as provisions that are recommendatory only. Mandatory requirements are designated by the words '**shall**' or '**shall not**'.

Clauses referring to STS CE identify requirements that are mandatory only for Customer Equipment (CE) interfaced to a Standard Telephone Service (STS) as defined by the *Telecommunications (Consumer Protection and Service Standards) Act 1999*.

All other provisions are voluntary.

1.2 Compliance statements

Compliance statements, in italics, suggest methodologies for demonstrating CE's compliance with the requirements.

1.3 Definitions, expressions and terms

If there is any conflict between the definitions used in this Standard and the definitions used in the *Telecommunications Act 1997*, the definitions in the Act take precedence.

1.4 Notes

Text denoted as 'Note' is for guidance in interpretation and is shown in smaller size type.

1.5 References

(a) Applicable editions (or versions) of other documents referred to in this Standard are specified in Section 3: REFERENCES.

(b) If a document refers to another document, the other document is a sub-referenced document.

(c) Where the edition (or version) of the sub-referenced document is uniquely identified in the reference document, then that edition (or version) applies.

(d) Where the edition (or version) of the sub-referenced document is not uniquely identified in the reference document, then the applicable edition (or version) is that which is current at the date the reference document is legislated under the applicable regulatory framework, or for a non- legislated document, the date upon which the document is published by the relevant standards organisation.

(e) A number in square brackets '[ ]' refers to a document listed in Section 3: REFERENCES.

(f) In the event of a discrepancy between this Standard and a referenced or sub-referenced document, this Standard **shall** take precedence.

1.6 Units and symbols

In this Standard the International System (SI) of units and symbols is used in accordance with Australian Standard AS ISO 1000 [1].

2 SCOPE

2.1 This Standard specifies the technical requirements for CE and in the case of compound CE the parts of the compound CE that are designed or intended for connection to an analogue PSTN two-wire service.

2.2 This Standard does not apply to CE or the parts of compound CE that are designed or intended for connection to a DSL service operating over a shared metallic local loop with an analogue PSTN two-wire service.

2.3 CE is not excluded from the scope of this Standard by reason only that it is capable of performing functions additional to those described in this Standard.

Note 1: For the purposes of this scope ADSL modems and filters are examples of CE designed or intended for connection to a DSL service operating over a shared metallic local loop with an analogue PSTN two-wire service.

Note 2: AS/ACIF S041 [8] specifies the technical requirements for ADSL modems and filters.

Note 3: AS/ACIF S040 [7] specifies the technical requirements for CE for use by persons with a disability.

3 REFERENCES

	Publication	Title
	Australian Standards	
[1]	AS ISO 1000-1998	The international System of Unit (SI) and its application.
[3]	AS/NZS 3080:2003	Telecommunications installations - Generic cabling for commercial premises (ISO/IEC 11801:2002, MOD)
[3]	AS/NZS 60950.1:2003	Information technology equipment - Safety - General requirements
	AS/ACIF and AS/CA Standards	
[4]	AS/CA S003:2010	Requirements for Customer Access Equipment for connection to a Telecommunications Network
[5]	AS/ACIF S004:2008	Voice frequency performance requirements for Customer Equipment
[6]	AS/CA S008:2010	Requirements for customer cabling products
[7]	AS/ACIF S040:2001	Requirements for general use Customer Equipment for use with the Standard Telephone Service— Features for special needs of persons with disabilities
[8]	AS/ACIF S041:2009	Requirements for DSL Customer Equipment for connection to the Public Switched Telephone Network
	ANSI Standards	
[9]	ANSI/TIA-968-A-2002	Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network
[10]	T1.601:1998	ISDN Basic Access Interface for Use on Metallic Loops for Application at the Network Side of NT, Layer 1 Specification
	IEC Standard	
[11]	IEC 60603-7 Ed 3.0 (2008-07)	Connectors for electronic equipment - Part 7: Detail specification for 8-way, unshielded, free and fixed connectors

	Publication	Title
	ITU–T and CCITT Recommendations	
[12]	Annex to ITU Operational Bulletin Nr. 781 – 1.II.2003	Various tones used in national networks (According to ITU-T Recommendation E.180)(03/1998)
[13]	E.161 (02/2001)	Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network
[14]	E.164 (02/2005)	The international public telecommunication numbering plan
[15]	G.122 (03/1993)	Influence of national systems on stability, talker echo, and listener echo in international connections
[16]	G.223 (11/1988)	Assumptions for the calculation of noise on hypothetical reference circuits for telephony
[17]	O.9 (03/1999)	Measuring arrangements to assess the degree of unbalance about earth
[18]	O.41 (10/1994)	Psophometer for use on telephone-type circuits
[19]	O.71 (11/1988)	Impulsive noise measuring equipment for telephone-type circuits
[20]	Q.23 (11/1988)	Technical features of push-button telephone sets
[21]	V.18 (11/2000)	Operational and interworking requirements for DCEs operating in the text telephone mode
[22]	V.25 (10/1996)	Automatic answering equipment and/or parallel automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls

4 ABBREVIATIONS AND DEFINITIONS

For the purposes of this Standard, the following abbreviations and definitions apply:

4.1 Abbreviations

AC	Alternating Current
ACA	Australian Communications Authority
ACIF	Australian Communications Industry Forum
ACMA	Australian Communications and Media Authority
ACTE	Automatic Call Transfer Equipment
ADSL	Asymmetric Digital Subscriber Line
AGC	Automatic Gain Control
AS	Australian Standard
CE	Customer Equipment
CLI	Call Line Identification
CSS	Customer Switching System
DC	Direct Current
DSL	Digital Subscriber Line
DTMF	Dual Tone Multifrequency
DUT	Device Under Test
EMC	Electromagnetic Compatibility
ITU–T	International Telecommunications Union – Telecommunications
NU	Number unobtainable
NZS	New Zealand Standard
PCM	Pulse Code Modulation
PE	Protective Earth
PSD	Power Spectral Density
PSTN	Public Switched Telephone Network
REN	Ringer Equivalence Number
RMS	Root Mean Square
RVA	Recorded Voice Announcement
SI	International System
STS	Standard Telephone Service
STS CE	Standard Telephone Service Customer Equipment
TRC	Telecommunications Reference Conductor
TTY	Telephone Typewriter
VF	Voice Frequency
VU	Volume Unit
TN12	Termination Network 12

4.2 Definitions

4.2.1 Automatic call transfer equipment

Equipment associated with two or more exchange lines which, on detecting an incoming call on one exchange line, automatically originates a call, using another line, to a predetermined number.

4.2.2 Carrier

Refer to the *Telecommunications Act 1997*.

4.2.3 Carriage Service Provider

Refer to the *Telecommunications Act 1997*.

4.2.4 Compound CE

For the purposes of this standard Compound CE means CE that is designed and intended for connection to:

(a) an analogue PSTN Ring-In/Loop Out two wire service; and

(b) a DSL service that shares the metallic local loop with an analogue PSTN Ring-In/Loop Out two wire service.

4.2.5 Customer Equipment

Refer to the *Telecommunications Act 1997*.

4.2.6 Customer Switching System

A switching system for use on the customer side of the boundary of a Telecommunications Network that can switch voice, digital data, images, video or any other information.

Note 1: A CSS connection is established under user control using some form of access signalling.

Note 2: Examples include, but are not limited to, a PABX or Key system.

4.2.7 Decadic signalling

A system for transmitting address information by a succession of loop-disconnect pulses which momentarily interrupt the established direct current in a PSTN line.

4.2.8 Dialling

The terms ‘dials’ and ‘dialling’ refer to the generation of Decadic Pulse or DTMF address information and the transmission of those signals to line by the CE.

4.2.9 DTMF (Dual-tone multifrequency signalling)

A system for transmitting address and other information using dual tone voice frequency signals.

4.2.10 Emergency call person

Refer to the *Telecommunications Act 1997*.

4.2.11 Facility

Refer to Section 374(2) of the *Telecommunications Act 1997*.

4.2.12 Fleeting test reversal

A short duration (40 ms to 200 ms) reversal of line potential that may be applied at any time during outgoing call set-up.

4.2.13 Hold state

CE is in the 'hold' state at any time from the completion of seizure state (following the application of a loop) until release (removal of the loop), provided that no other DC signalling activity is occurring.

4.2.14 Line Terminating Equipment

Line terminating equipment incorporates circuitry that applies an Online condition to the PSTN line.

4.2.15 OFF-LINE

The state of the CE when it has an electrical configuration that enables the current in the basic network loop to be at its minimum steady-state value.

4.2.16 ON-LINE

The state of the CE when it has an electrical configuration that enables the current in the basic network loop to be at its maximum steady-state value.

4.2.17 Post dialling delay

The delay period between completion of dialling and receipt of a service tone.

4.2.18 Public Switched Telephone Network (PSTN)

That part of the Telecommunications Network which enables any customer to establish a connection for voice frequency communication with any other customer either automatically or with operator assistance.

Note: The PSTN has a nominal transmission bandwidth of 3 kHz.

4.2.19 Relative level

An indication of the power handling capacity at a particular point of a connection. Relative level is denoted by dBr. The nominal mean absolute power level at a zero relative level point of –15 dBm (or 31.6 µW) is specified in ITU–T Rec. G.223 [16].

Note: Relative level is not a definition of the level of test tone which should be applied or measured at the point.

4.2.20 Ring-in/Loop-out PSTN line

A both-way call set-up line connection with the PSTN. Incoming signalling to CE is by the application of a ring signal at the PSTN exchange. Outgoing signalling from CE is by the application of a DC loop at the CE.

4.2.21 Ringer Equivalence Number (REN)

An approximate value of loading presented to the line during the ringing state, and based on the capacitance applied to the line when the CE is OFF-LINE.

4.2.22 Seizure state

The initial period after the CE enters the ON-LINE condition.

4.2.23 Standard Telephone Service

Refer to Section 6 of the Telecommunications (Consumer Protection and Service Standards) Act 1999.

4.2.24 Standard Telephone Service Customer Equipment

Customer Equipment designed or intended to interface with a standard telephone service.

4.2.25 Tandem operation

Tandem operation refers to the ability of CE to present an interface modelling a PSTN interface to third party CE (referred to as terminating CE).

4.2.26 Telecommunications Network

Refer to Section 374(1) of the *Telecommunications Act 1997*.

4.2.27 Telecommunications Reference Conductor (TRC)

A conductor that can be used for signalling and other functional purposes which may include equipment reliability. Integral surge suppression devices within Customer Equipment may be connected to the TRC.

4.2.28 Telephone typewriter

Customer Equipment primarily used by people who are deaf or hearing impaired to communicate using text. Also known as TTY or text telephone.

4.2.29 Twist

The greatest loss differential between any two frequencies within one of the bands (upper and lower) of a tone signalling scheme.

4.2.30 Voice Frequency (VF)

Those frequencies in the range of 300 Hz to 3.4 kHz.

5 REQUIREMENTS

5.1 General

5.1.1 Fail-safe operation

5.1.1.1 CE **shall not** cause harm or damage to a Telecommunications Network or Facility if any of the following events occur:

(a) Failure of any mechanical or electrical component in the CE.

(b) Failure of any power supplies resulting in total or partial loss of power to the CE.

(c) Discharge or partial discharge of any battery supply associated with the CE.

(d) Incorrect manual operation of the CE.

5.1.1.2 CE should not cause harm or damage to a Telecommunications Network or Facility when CE is operated outside the range of operating voltage and environmental conditions specified by the manufacturer.

5.1.1.3 The power fail mechanism of the CE should cause the CE to revert to the OFF-LINE condition and remain in that condition for the duration of the failure. In addition, the CE may incorporate an automatic line change-over facility as a response to power failure.

5.1.1.4 On restoration of power after a power failure, the CE **shall** remain in the OFF-LINE condition until another call sequence is commenced. This requirement applies following the first 30 seconds after power is restored.

Compliance with Clause 5.1.1 should be checked using the method described in Clause 6.3.

5.1.2 Line polarity

5.1.2.1 The operation of CE **shall** be independent of exchange line conductor polarity.

5.1.2.2 CE **shall** be unaffected by—

(a) a permanent line reversal; or

(b) a short term line reversal of 40 to 200 ms;

which occur while the CE is in either the OFF-LINE or the ON-LINE states.

Compliance with Clause 5.1.2 should be checked by applications of polarity reversals.

5.1.3 Transmitted voltages

Voltages transmitted to a Telecommunications Network from CE, in any line condition, are not to exceed the limits for Telecommunications Network Voltages (TNV), as specified in AS/NZS 60950.1 [3].

Note: AS/NZS 60950.1 [3] specifies applicable safety requirements of CE.

5.1.4 Line-powered CE

The current drawn by CE when connected to a source of—

(a) 100 V d.c.; and

(b) 50 V d.c.

shall not exceed that which would be drawn by 1 MΩ resistor replacing the CE. This requirement applies 30 seconds after voltage has been applied.

Note: On some carrier network equipment, CSS and other CE, the nominal OFF-LINE feedbridge voltage may be as low as 24 V.

Compliance with Clause 5.1.4 should be checked by using the test circuit of Figure 2 with the CE in the OFF-LINE condition with the battery voltage set as above.

5.1.5 Line connection

CE should terminate on and be supplied with—

(a) an insulation displacement system frame, internal or external to the CE;

(b) a cable complying with AS/CA S008 [6] and which is able to be terminated on an insulation displacement system frame;

(c) a socket on the CE complying with AS/CA S008 [6]; or

(d) a plug on the end of a line cord, where both the plug and cord comply with the requirements of AS/CA S008 [6] and the plug is one of the following types:

(i) Plug Type 605;

(ii) Plug Type 606;

(iii) ANSI/TIA-968-A-2002 [9] (six-position); or

(iv) ANSI/TIA-968-A-2002 [9] (eight-position).

Note 1: The PSTN is normally terminated on one of the following connectors:

(i) Insulation displacement or solder termination MDF; or

(ii) Compliant sockets including:

a. Socket Type 610.

b. Socket Type 611.

c. Socket Type 612.

d. Miniature 6-position socket as specified in ANSI/TIA 968 A 2002 [9].

e. Miniature 8-position socket as specified in ANSI/TIA 968 A 2002 [9].

The PSTN allocations for the various socket types are shown in Figure 3.

Note 2: The miniature 8-position socket specified in ANSI/TIA 968 A 2002 [9] is also specified in IEC 60603 7 [11]

Compliance with Clause 5.1.5 should be checked by inspection.

5.1.6 Keypads and dials

5.1.6.1 The requirements of Clause 5.1.6 only apply to CE with a keypad or rotary dial where the keypad or rotary dial has the primary function of dialling for the purposes of call set-up.

5.1.6.2 CE intended for connection to a CSS may have other alpha characters or alphanumeric relationships associated with the keypad digits. Such CE are also exempt from the requirements of Clause 5.1.6 but the CE **shall** carry markings which clearly indicate that the CE may only be connected to the extension or system integral ports of a CSS.

5.1.6.3 The arrangement of numerals (and/or */#, if used), appearing on keypads or rotary dials, **shall** be in accordance with the layouts in ITU–T Rec. E161 [13].

Table 1 and Table 2 are taken from ITU-T Recommendation E.161 [13] and are the preferred arrangements for keypads.

TABLE 1

Standard ten-pushbuttons keypad arrangement and numbering

1	2	3
4	5	6
7	8	9
	0	

TABLE 2
Standard ten-pushbuttons keypad arrangement and numbering

1	2	3
4	5	6
7	8	9
*	0	#

Note: The '*' and '#' symbols are commonly known as 'star' and 'hash' respectively.

5.1.6.4 Where letters, in addition to numerals, appear on a keypad or rotary dial, or its surround, the Letters and numerals **shall**—

(a) conform to the associations given in Table 3;

(b) be unambiguously associated with the relevant keys; and

(c) have a distinct difference in style between the numeric zero and the letter 'O'.

Note: The inclusion of a slash across numeric zero is optional.

Compliance with Clause 5.1.6 should be checked by inspection.

TABLE 3
Alphanumeric mapping

1	2 ABC	3 DEF
4 GHI	5 JKL	6 MNO
7 PQRS	8 TUV	9 WXYZ
*	0	#

Note: Inclusion of alphabetic characters on keypads/dials is optional.

5.1.7 Insulation resistance of ring-in/loop-out PSTN lines

5.1.7.1 CE in the OFF-LINE state, except as provided for in Clauses 5.1.7.2 and 5.1.7.3, **shall** have an insulation resistance of not less than 1 MΩ between—

(a) the two line conductors;

(b) each line conductor and TRC terminal, if equipped; and

(c) each line conductor and PE terminals, if equipped

when tested with 250 V d.c. of each polarity, in series with a 600 kΩ resistance.

Compliance should be checked by measuring the DC resistance between the line conductors and between each line conductor and the TRC terminal and the power supply protective earth

*termination separately, if provided. Any internal protective devices **shall** remain connected for each test.*

5.1.7.2 CE incorporating a message wait indicator that is intended for connection to a customer switching system are to comply with the requirements of Appendix B.

5.1.7.3 CSS are to comply with the requirements of AS/CA S003 [4].

5.1.8 Emergency services access

5.1.8.1 General

The following requirements apply to CE used to establish connections for voice communication or to establish TTY communication in accordance with ITU-T Recommendation V.18 [21]:

(a) CE with a dialling capability and used for voice communication **shall** support the dialling of emergency service number '000'.

(b) CE with a handset and with a dialling capability **shall** support the dialling of emergency service numbers '000' and '106'.

(c) TTY terminals that can be connected to a Telecommunications Network **shall** support the dialling of emergency service number '106'.

(d) Data modems that can be used in conjunction with a Data Terminal Equipment to provide the functionality of a TTY terminal **shall** support the dialling of emergency service number '106'.

5.1.8.2 Access barring

CE should not support access barring of emergency service numbers '000' and '106'.

5.1.8.3 Loss of mains power

Mains-powered CE should continue to support the dialling of emergency service numbers for at least 30 minutes following the loss of mains power.

5.1.8.4 Provision of power-fail advice

CE that does not continue to support emergency dialling for at least 30 minutes after loss of mains power, **shall** have an appropriately worded warning notice included in or with the CE documentation. The warning notice should also be placed on the outside surface of the CE's packaging. A suggested wording for the warning notice is as follows:

Warning **This equipment will not operate when mains power fails**

Compliance with Clause 5.1.8 should be checked by using the method described in Clause 6.4.

5.1.8.5 Keypad Locks

CE for voice communications incorporating a keypad lock for the purpose of minimizing accidental dialling of the emergency number 000 should be provided with clear instruction for the user, either via electronic display or labelling on the CE to unlock the keypad when required to make an emergency call.

5.2 Classification of CE

5.2.1 General

5.2.1.1 CE intended for connection to the PSTN is classified as one or more of the following types:

(a) Line terminating equipment.

(b) Series equipment.

(c) Bridging equipment.

Note: All CE effectively performs a bridging function when in the OFF-LINE state and is subject to the bridging requirements found in Clause 5.2.4.

5.2.1.2 Line terminating equipment may be used either singularly or in conjunction with series or bridging equipment.

Note: CE may incorporate both series and bridging elements which function alternatively for DC/AC and OFF-LINE/ON-LINE modes.

5.2.2 Line terminating equipment

5.2.2.1 Line terminating equipment incorporates circuitry that applies an Online condition to the PSTN line. CE with this function may be associated with the line as—

(a) the only line terminating equipment connected to a line, to provide the sole termination of that line; or

(b) one or more parallel items of line terminating equipment, one or all of which can be used to terminate the line; or

(c) one of a number of items of line terminating equipment, which can be used alternatively to terminate the line, e.g. for alternative voice/data applications.

5.2.2.2 The following tandem operation requirements apply to CE operating in tandem mode with other STS CE that complies with this Standard:

(a) If the CE applies ring to the terminating STS CE, then the CE **shall** meet the requirements for Ring signal of Standard analogue telephone Local Port (On Premises and Off Premises) in AS/CA S003 [4].

(b) If the CE provides local DC feed to the terminating STS CE, then the CE **shall** meet the requirements for Answer/Seizure/Hold signals and Idle/Release signals of Standard analogue telephone Local Port (On Premises and Off Premises) in AS/CA S003 [4].

(c) If the CE allows voice frequency signals to pass from the terminating STS CE to the PSTN port when the PSTN port is in the ON-LINE condition, then the CE **shall** meet—

(i) the relevant Transmission Requirements of AS/CA S003 [4] between the port of the CE, to which the terminating CE connects, and the PSTN connection of the CE; or

(ii) the requirements of Clause 5.2.3.2.

5.2.3 Series equipment

5.2.3.1 Series equipment is CE that is connected to the line in series with line-terminating equipment.

5.2.3.2 The following requirements apply to series equipment which is connected and operates with another CE which is either in the ON-LINE condition, or which remain in the circuit at all times:

(a) There **shall** be DC continuity between the input and output connections of the equipment.

(b) CE with linear electrical characteristics **shall** have a maximum total DC resistance of 55 Ω.

(c) For CE with ON-LINE electrical characteristics, the total DC voltage drop across the line connections **shall not** exceed—

(i) 3 V with line currents up to 30 mA; and

(ii) 6 V for all line currents greater than 30 mA.

(d) The insertion loss of the equipment on lines of all lengths **shall not** exceed 0.5 dB over the range 300 Hz to 3.4 kHz when measured with source and load impedances as shown in Figure 5.

Compliance with Clause 5.2.3.2 should be checked by measuring the DC resistance, the DC voltage drop and the insertion loss (see Clause 6.7.4), as appropriate.

5.2.3.3 Series equipment which is connected to and operates with another CE which is in the OFF-LINE condition **shall not** reduce ring voltage with frequency in the range 15.3 Hz to 50 Hz, to below 50 V r.m.s, for a connection configuration as shown in Figure 24.

Compliance with Clause 5.2.3.3 should be checked by using the method described in Clause 6.7.1.2 and Figure 24.

5.2.4 Bridging equipment

5.2.4.1 Bridging equipment, including line termination equipment in the OFF-LINE state, is high impedance equipment connected in parallel with the line terminating equipment. It does not provide an ON-LINE termination. In general, it remains in the circuit irrespective of whether the line terminating equipment is in the ON-LINE or OFF-LINE condition. Usually it does not perform any line control function and is used, for example, for monitoring and detecting incoming calls.

5.2.4.2 Bridging equipment **shall** have a modulus of impedance of greater than 10 kΩ over the frequency range 300 Hz to 3400 Hz.

Compliance with Clause 5.2.4 should be checked by using the method described in Clause 6.7.1.1

5.3 Functional requirements

5.3.1 Number storage facility

5.3.1.1 CE **shall not** be pre-programmed with, or default to, numbers beginning with either '000' or '106' in any storage location for automatically dialled numbers, unless the functionality associated with that automated dialling is specifically intended for establishing a voice or TTY call as appropriate to an emergency call person.

5.3.1.2 CE should not be pre-programmed with, or default to, any network recognisable number in any storage location for automatically dialled numbers, unless the functionality associated with that automated dialling is specifically intended for establishing a call to that particular network number.

Note: ITU–T Recommendation E.164 [14] provides guidance to the minimum digit storage required for national and international numbers.

5.3.2 Interconnection of PSTN lines

5.3.2.1 The interconnection of PSTN lines **shall** be in accordance with the requirements of AS/CA S003 [4] for conference bridges or Clause 5.7 of this Standard for ACTE.

5.3.2.2 Metallic interconnection of PSTN lines **shall not** be used.

Compliance with Clause 5.3.2 should be checked by inspection or measurement as appropriate.

5.3.3 Intrusion tones

5.3.3.1 Any CE which provides for the connection of a third party into an established conversation should provide to each party either of the intrusion tones specified in Clause 5.3.3.2—

(a) as soon as the intrusion facility is enabled; and

(b) with the addition of each new party to the connection.

5.3.3.2 The specifications of the intrusion tone alternatives at the PSTN interface port (+3 dBr relative level point) are—

(a) an initial burst of 425 Hz ±10 Hz for 80 ms to 800 ms at a level in the range –7 dBm to –13 dBm, repeated at intervals of 15 s ±3 s; or

(b) an initial burst of 425 Hz ±10 Hz for 800 ms ±10% at a level in the range –7 dBm to –13 dBm.

Note 1: Absolute levels at other ports are dependent on the relative levels assigned to those ports, for example, see AS/CA S003 [4] for CSS.

Note 2: The frequency and power level should be measured during the 'on' period with the CE terminated in the nominal 600 Ω resistive impedance.

5.3.3.3 The return loss requirements of Clause 5.4.3 **shall** be met during intrusion tone connection.

5.3.3.4 The intrusion tone facility should not be capable of being disabled by the user.

Compliance with Clause 5.3.3 should be checked by measurement as described in Clause 6.7.9.1.

Note: There is other Commonwealth and State legislation relating to the recording of and listening to communications over the Telecommunications Network. Compliance with this Standard should not be taken to mean that any subsequent use of the equipment complies with other relevant legislation.

5.3.4 Supervisory tones

5.3.4.1 Pre-answer tones

Pre-answer supervisory tones transmitted to the PSTN at the PSTN interface port (+3 dBr) **shall** be as specified below:

(a) Ring Tone A

(i) Frequency 425 Hz ±10 Hz, amplitude modulated in the range 90% to 99% by a frequency of 25 Hz ±1 Hz with carrier unsuppressed.

(ii) Cadence 0.4 s on, 0.2 s off, 0.4 s on, 2 s off, ±10%.

(b) Ring Tone B

(i) Frequency A combined signal of 450 Hz ±10 Hz and 400 Hz ±10 Hz of equal amplitude.

(ii) Cadence 0.4 s on, 0.2 s off, 0.4 s on, 2 s off, ±10%.

(c) Busy Tone

(i) Frequency 425 Hz ±10 Hz.

(ii) Cadence 0.375 s on, 0.375 s off, ±10%.

(d) Number Unobtainable (NU) Tone

(i) Frequency 425 Hz ±10 Hz.

(ii) Cadence 2.5 s on, 0.5 s off, ±10%.

5.3.4.2 Pre-answer levels

The level of audible supervisory tone (as specified in Clause 5.3.4.1) measured during the 'on' period of the cadence when terminated in a 600 Ω resistive impedance **shall** be in the range of –7 dBm to –13 dBm, with a zero line length.

5.3.4.3 Post-answer tones

Tones transmitted after a call has been acknowledged by operator intervention, or in accordance with Clause 5.3.5.3.2, by the CE should be audibly and unambiguously dissimilar from PSTN pre-answer tones (as described in Appendix A), unless the same information is to be conveyed.

5.3.4.4 Return loss

The return loss requirements of Clause 5.4.3 **shall** be met when supervisory tones, as specified in Clauses 5.3.4.1 and 5.3.4.2, are applied to the line.

Note: A list of standard service tones is attached as Appendix A.

Compliance with Clause 5.3.4 should be checked by using the method described in Clause 6.7.9.1.

5.3.5 Automatic operation

The requirements of Clauses 5.3.5.1 to 5.3.5.7 (inclusive) apply to CE designed or intended to perform automatic functions or operations (i.e. functions or operations which are not manually initiated, performed or monitored).

5.3.5.1 Automatically seizing the line

CE **shall not** automatically seize the line for any purpose, other than to—

(a) originate a call;

(b) answer a call;

(c) force a line into a busy state;

(d) detect the presence or absence of a distinctive dial tone in accordance with the requirements specified in Appendix C; or

(e) automatically detect the state of the line as detailed under Automatic Guard in AS/CA S003 [4].

Note: This Clause does not apply to CE during the initial 30 seconds of a power up sequence or initial connection to the line.

Compliance with Clause 5.3.5.1 should be checked by operation and inspection.

5.3.5.2 Recognition of Telecommunications Network service tones

CE which relies on the detection of specific pre-answer service tones for automatic operation **shall** operate normally on receipt of those service tones as transmitted from the Telecommunications Network over the range –9 dBm to –24 dBm and for nominal frequency and cadence as detailed in Appendix A. CE for use on international connections should respond to the tones described in the Annex to ITU Operational Bulletin Nr. 781 [12].

Note 1: The public network post dialling delay will rarely exceed 12 s, but may in extreme cases be up to 20 s. This does not include any delay that may occur within a private network or as a result of a call redirected from a private network/CE into the PSTN.

Note 2: CE suppliers should nominate to the test house the response or responses (if any) expected from the CE when service tones are applied to the CE.

Note 3: The levels encountered in the Telecommunications Network may be outside the test levels specified above and are indicated in Appendix A.

Compliance with Clause 5.3.5.2 should be checked by using the method described in Clause 6.7.13 and Figure 23.

5.3.5.3 Answering of incoming calls

5.3.5.3.1 CE incorporating automatic answering facilities which answer an incoming call, for a Ring-in/Loop-out PSTN line interface, should apply a loop (Answer) to the line in not less than 2 s from the commencement of the ring signal being applied by the PSTN.

Note 1: Where CE is intended to receive carrier supplied calling number identity signals, it is recommended that Answer is not applied prior to 5.5 s.

Note 2: It is recommended that where Distinctive Ring cadence recognition is performed by CE, that the CE examines at least one complete cadence cycle before any decision is made.

Note 3: A maximum time limit of 15 s to answer is recommended.

Compliance with Clause 5.3.5.3.1 should be checked by inspection.

5.3.5.3.2 CE incorporating automatic answering facilities **shall** acknowledge the answering of incoming calls from the PSTN by—

(a) the transmission of an appropriately worded stored voice or synthesised voice message; or

(b) the transmission of one burst of answering tone of 2100 Hz ±15 Hz for a minimum of 2.6 s up to a maximum of 6.0 s, if a calling tone (CNG) as defined in ITU-T Recommendation V.25 [22] has not been received from the originating CE within

2.5 s. The answering tone should be in the range from –7 dBm to –13 dBm; or

(c) a post-answer tone dissimilar from a PSTN dial tone, PSTN ring tone, busy tone, or NU tone, as described in Appendix A.

Compliance with Clause 5.3.5.3.2 should be checked by using the method described in Clause 6.7.9 as appropriate.

5.3.5.4 Commencement of dialling

5.3.5.4.1 CE which is not able to detect dial tone **shall not** commence dialling earlier than 2.7 seconds after the seizure state as specified in Clause 5.5.1.4 has been established.

Note: A time delay not exceeding 6 seconds is recommended.

5.3.5.4.2 CE which is able to detect dial tone may commence dialling after the presence of dial tone has been detected.

Compliance with Clause 5.3.5.4 should be checked by operation and inspection.

5.3.5.5 Automatically repeated call attempts

5.3.5.5.1 CE **shall** provide a minimum OFF-LINE period of 5 s following the termination of an unsuccessful call attempt before automatically initiating a subsequent call attempt in a repeated call attempt sequence.

5.3.5.5.2 CE **shall not** automatically initiate more than 15 call attempts, including the initial call, in a repeated call attempt sequence.

5.3.5.5.3 If the call attempt sequence described in Clauses 5.3.5.5.1 and 5.3.5.5.2 is unsuccessful, CE **shall** not automatically re-initiate the call attempt sequence to the same number.

5.3.5.5.4 CE should provide a minimum OFF-LINE period of 5 s following the termination of an unsuccessful call attempt sequence before automatically initiating a new call attempt sequence to a different number.

Note 1: The interval between repeat call attempts in most practical applications should be set to a value considerably greater than the minimum allowed value so as to provide an appropriate compromise between the rate of redialling and the likelihood of the repeat call attempt being successful, taking into account the typical holding time for calls.

Note 2: It is highly recommended that CE which provides the automatic repeat call function should incorporate service tone detectors which meet the requirements of Clause 5.3.5.2, in order to improve functionality and reduce loop holding times for unsuccessful call attempts.

Compliance with Clause 5.3.5.5 should be checked by operation and inspection.

5.3.5.6 Calling message

If a CE transmits a voice message after an automatically initiated call is answered, then that CE should include, in the voice message itself, a stored or synthesised message which identifies the calling party.

Compliance with Clause 5.3.5.6 should be checked by operation and inspection.

5.3.5.7 Call supervision

CE which automatically originates or answers calls should be designed to release the PSTN exchange line in less than 30 s after the conclusion of the transfer of information to or from the other CE in the connection.

Note: Failure to incorporate a clearing signal after the completion of information transfer in either direction can result in PSTN call lockup and continuation of call charging.

Compliance with Clause 5.3.5.7 should be checked by timing and inspection.

5.4 Transmission requirements

5.4.1 Operational interference for transmission other than speech and music

CE **shall not** transmit single frequency tones of power greater than –47 dBm and duration greater than 40 ms in the frequency range 2450 Hz to 2850 Hz (to avoid possible interference with 'in-band' VF signalling).

Note: CE should not transmit single frequency tones of power greater than –47 dBm and duration greater than 40 ms in the band 1900 Hz to 2350 Hz except for the purpose of disabling echo control devices.

Compliance with Clause 5.4.1 should be checked by using the method described in Clause 6.7.9.

5.4.2 Power and voltage limits of transmissions other than speech and music

5.4.2.1 Clauses 5.4.2.2 and 5.4.2.3 do not apply to CE which is a transmission medium for voice frequency signals that are generated by other CE.

5.4.2.2 The peak-to-peak level of signals transmitted to line, under all user accessible gain control settings and with all DC line conditions, **shall not** exceed 5.0 V when measured across a 600 Ω resistive termination.

Compliance with Clause 5.4.2.2 should be checked by using the method described in Clause 6.7.9.4 with R in Figure 23 set to 600 Ω.

5.4.2.3 Voice frequency transmissions

The one-minute mean power level of signals transmitted to line within the frequency range 300 Hz to 3.4 kHz except for DTMF signals, supervisory tones, speech and music **shall not** exceed –10 dBm.

Compliance with Clause 5.4.2.3 should be checked by using the methods described in Clauses 6.7.9.1, 6.7.9.2, and 6.7.9.3 with R in Clause 6.7.9.2 and Figure 23 set to 600 Ω.

5.4.2.4 Signals greater than 3.4 kHz

5.4.2.4.1 The power spectral density (PSD) of signals beyond 3.4 kHz **shall not** exceed the limit shown in Figure 4 when measured using a noise power bandwidth of 10 kHz.

Note: For compatibility with 12 kHz Meter Pulse detector circuitry, any signal components generated in the 11 kHz to 13 kHz band should not exceed 10 mV r.m.s. when measured with a 135 Ω termination or open circuit.

Compliance with Clause 5.4.2.4.1 should be checked by using the methods described in Clauses 6.7.9.1, 6.7.9.2, and 6.7.9.5(a) with R in 6.7.9.2 and Figure 23 set to 135 Ω.

5.4.2.4.2 The PSD of signals between 300 kHz and 30.175 MHz **shall** be either—

(a) less than –120 dBm/Hz; or

(b) less than the PSD limit minus 10dB (this is represented in Figure 4 by the dashed line limit).

when measured as the total average power within a 1 MHz sliding window (1 MHz bandwidth) which is described in Table 4.

TABLE 4
1 MHz sliding window

Parameter	Value
Bandwidth of sliding window	1 MHz
Reference frequency	Lower edge
Step size	10 kHz
Start frequency	300 kHz
Stop frequency	30.175 MHz

Note 1: The Power Spectral Density requirements contained in Clause 5.4.2.4 are the same as in ANSI Standard T1.601 [10], and have been included to ensure spectral compatibility of CE with DSL CE.

Note 2: The purpose of the sliding window measurement is to ensure that CE does not generate noise up to the allowable limit across the entire band.

Compliance with Clause 5.4.2.4.2 should be checked by using the methods described in Clauses 6.7.9.1, 6.7.9.2, and 6.7.9.5(b) with R in Clause 6.7.9.2 and Figure 23 set to 135 Ω.

5.4.3 Impedance

5.4.3.1 OFF-LINE state

The impedance presented by the CE in the OFF-LINE state should be greater than 15 kΩ over the range 300 Hz to 3400 Hz.

5.4.3.2 Hold state

The impedance presented by the CE in the hold state **shall** have a return loss greater than 10 dB over the range 300 Hz to 600 Hz and greater than 15 dB over the range 600 Hz to 3.4 kHz against the test network shown in Figure 5.

Note 1: It is recommended that CE requiring a higher level of impedance matching may additionally incorporate a 600 Ω network as a switchable option.

Note 2: It is recommended that CE presents this value of impedance as early as possible after the application of a loop, but no later than 1 s. This will allow Carrier or carriage service provider network equipment that adapts to the CE/line impedance to do so in a timely manner.

Compliance with Clause 5.4.3 should be checked by using the method described in Clause 6.7.2.

5.4.4 Impedance balance

The impedance balance about earth of the CE **shall** be greater than 46 dB over the frequency range 50 Hz to 3.4 kHz. This test is to be applied with respect to the TRC terminal and protective earth termination, separately and connected together when either or both of these terminations are provided.

Compliance with Clause 5.4.4 should be checked by using the method described in Clause 6.7.3.

5.4.5 Noise performance

The following requirements for noise generated by STS CE when measured across a 600 Ω port termination (with other equipped ports properly terminated) are to apply when the STS CE is in the ON-LINE state and not transmitting signals:

(a) Mean noise power **shall not** exceed—

(i) –62 dBmp (Psophometric), measured using a device compliant with ITU–T Rec. O.41 [18]; and

(ii) –37 dBm (unweighted), measured using a device with a uniform frequency response over the range 30 Hz to 20 kHz.

(b) Single-frequency noise power Any single frequency (in particular the sampling frequency and its submultiples where appropriate) over the range 30 Hz to 20 kHz, measured selectively with a 30 Hz bandwidth, **shall not** exceed –47 dBm.

(c) Impulsive noise The number of noise counts above a threshold level of –32 dBm **shall not** exceed five counts in 5 minutes, measured using an impulsive noise counter compliant with ITU-T Rec. O.71 [19], using the 600 Hz to 3 kHz filter described in § 3.5 therein.

Compliance with Clause 5.4.5 should be checked by using the method described in Clause 6.7.5.

5.4.6 Longitudinal power limits

During the idle, hold, ringing states, the power level of individual spectral components of any longitudinal component of the output signals **shall not** exceed the limits shown in Figure 26.

Compliance with Clause 5.4.6 should be checked by using the methods described in Clauses 6.7.14.

5.5 Signalling requirements

5.5.1 Two-wire ring-in/loop-out PSTN line interface

5.5.1.1 Ring signal detection and CE performance during ring

5.5.1.1.1 STS CE which is required to recognise ring signals **shall** respond to signals of 200 ms duration or greater, superimposed on 48 V dc of polarity each with a terminal voltages in the range—

(a) 50 V r.m.s to 90 V r.m.s over the frequency range 15.3 Hz to 25 Hz; and

(b) 40 V r.m.s. to 90 V r.m.s. over the frequency range 25 Hz to 50 Hz.

Note 1: CE suppliers should nominate to the test house the response or responses (if any) expected from the CE, when ring signal is applied to the CE.

Note 2: Some PSTN exchanges may provide ring signals with a CE terminal voltage from 45 to 95 V r.m.s.

Note 3: The standard ring cadence is nominally 0.4 s ON, 0.2 s OFF, 0.4 s ON and 2.0 s OFF. Other cadences may also be used in the network for special purposes e.g. distinctive ring. For characteristics of the PSTN Distinctive Ring Signal, refer to Appendix E.

Note 4: Ring signals generated by carrier network equipment, CSS and other CE may have a number of different characteristics. CE which responds to the ring signal should not be sensitive to differences in voltage waveshape, d.c. offset, transient changes in voltage level, or whether the ring signal is supplied in a symmetrical or asymmetrical mode.

5.5.1.1.2 CE should not recognise as a ring signal an AC voltage of less than 10 V r.m.s., or a ring signal of less than 100 ms duration.

5.5.1.1.3 CE in the OFF-LINE state should withstand 2 min of continuous non-cadence, 90 V r.m.s. ring signal at 55 Hz superimposed on 48 V d.c. The ring signal should be applied to the terminals of the CE.

5.5.1.1.4 Under fault conditions, ring signal voltage may also be applied to the line terminals of the CE which is in the ON-LINE condition. The CE should remain undamaged if this should occur. A suggested test configuration is shown in Figure 6.

5.5.1.1.5 When a ring signal of 25 Hz sine wave at 95 V r.m.s. superimposed on 56 V d.c. (with a total source impedance of 470 Ω) is applied to the line terminals of CE as shown in Figure 7, the DC component of the current flowing **shall not** exceed 600 µA.

Compliance with Clause 5.5.1.1 should be checked by using the method described in Clause 6.7.6.

5.5.1.2 Ringer Equivalence Number (REN)

CE **shall** have a REN of not greater than 3.

Note 1: The method for determining REN is given in Clause 6.7.6.

Note 2: It is recommended that CE have a REN of not greater than 1 to allow the parallel operation of other CE.

Note 3: Carrier or carriage service providers may only support a total REN of 3.

Note 4: The total value of REN for CE operating in parallel is the sum of the RENs of each CE.

Note 5: As CE may also be required to operate in conjunction with the standard telephone port of a CSS, the requirements of AS/CA S003 [4] should also be considered.

Note 6: The REN should be stated on the CE and in the user documentation to assist customers when connecting multiple CE to a carrier network.

Compliance with Clause 5.5.1.2 should be checked by using the method described in Clause 6.7.6.

5.5.1.3 Meter signal detection

5.5.1.3.1 General

5.5.1.3.1.1 A meter pulse received from the PSTN will be a 12 kHz transverse signal. The availability of this signal is subject to negotiation with the carrier or carriage service provider concerned.

5.5.1.3.1.2 The meter signal detector is deemed to have operated when an unambiguous output occurs on the application of an input signal. The CE supplier should state the expected response of the CE to the meter signal.

5.5.1.3.1.3 The meter signal detector should recognise meter signals in the range 100 ms to 380 ms inclusive, at a maximum repetition frequency of 1.25 Hz.

5.5.1.3.1.4 The meter signal detector should not respond to—

(a) meter signals less than 50 ms duration;

(b) meter signals greater than 500 ms duration; and

(c) signals occurring later than 800 ms after a release signal is initiated for an outgoing call.

5.5.1.3.1.5 The meter signal detector should be responsive—

(a) after completion of address signalling;

(b) during the release condition of the CE (as specified in Clause 5.5.1.11); and

(c) until 800 ms after completion of the call.

5.5.1.3.1.6 Where CE is detecting the Meter Pulse in accordance with the requirements of this Standard and Reversal on Answer in accordance with the requirements of AS/CA S003 [4], 50 ms after the application of a polarity reversal the CE should be able to detect Meter Pulses that occur.

5.5.1.3.2 12 kHz Transverse Meter Signal Detection Requirements

Where CE is designed to detect 12 kHz transverse meter signals, the following requirements are applicable:

(a) The meter signal detector should meet the response limits given in Figure 8.

(b) The transverse input impedance **shall** have a modulus of impedance of greater than 200 Ω with a phase angle of 0° to –30° at 12 kHz.

Compliance with Clause 5.5.1.3 should be checked by using the method described in Clause 6.7.7.

5.5.1.4 Seizure state

5.5.1.4.1 During the seizure state the CE acting as a line termination, for a minimum duration of 0.3 s, **shall** have DC characteristics not within the 'Prohibited' Region A and preferably not within the 'Not Recommended' Region B of Figure 9.

5.5.1.4.2 Momentary breaks during the seizure state **shall not** exceed 2.5 ms.

5.5.1.4.3 The duration of the transition from the idle state to the low resistance state (i.e. line current rise time) should not exceed 100 ms.

Compliance with Clause 5.5.1.4 should be checked by using the method described in Clause 6.7.10.

5.5.1.5 Hold state

5.5.1.5.1 During the hold state, the DC characteristics of CE providing a line termination **shall not** be within the 'Prohibited' Region A of Figure 10.

5.5.1.5.2 Momentary breaks during hold state **shall not** exceed 2.5 ms.

5.5.1.5.3 CE designed to work in parallel with other CE should not have DC characteristics within the 'Not Recommended' Region B of Figure 10.

Compliance with Clause 5.5.1.5 should be checked by using the method described in Clause 6.7.10.

5.5.1.5.4 Under fault conditions, it is possible for one side of the line to be grounded close to the CE while it is in the ON-LINE state. The CE should remain undamaged if this occurs. A suggested test configuration is shown in Figure 25.

5.5.1.6 Supervision of outgoing calls

STS CE **shall** remain ON-LINE and not be adversely affected in its normal operation (before a call is established), if it loses its battery feed potential for up to 300 ms—

(a) during the predialling hold period;

(b) during interdigital pauses; and

(c) after completion of dialling.

Compliance with Clause 5.5.1.6 should be checked by applying a 300 ms break to the battery feed potential.

5.5.1.7 Dialling digit integrity

5.5.1.7.1 If CE has a keypad or rotary dial—

(a) the decadic signal or DTMF tones it generates **shall** be consistent with the ITU–T Rec. E.161 [13] layout chosen;

(b) the sequence of decadic signal or DTMF tones generated **shall** correspond to the keys pressed or numbers dialled; and

(c) for decadic dialling, the number of pulses transmitted for a digit **shall** correspond to the numerical value of the digit, with 10 pulses being transmitted for the digit '0'.

5.5.1.7.2 Any digit storage facility **shall**—

(a) correctly store the digits; and

(b) transmit the digits in the same sequence as originally entered, in accordance with the requirements for decadic or DTMF signalling as defined in this Standard.

Compliance with Clause 5.5.1.7 should be checked by inspection.

5.5.1.8 Decadic signalling

Decadic signalling functionality may not be implemented in all carrier networks and access technologies. Therefore the implementation of decadic signalling in CE is not recommended. The use of DTMF address signalling is recommended.

For the purposes of this Clause, a Break pulse is defined as the DC line condition with less than 2.8 mA of line current flowing and a Make pulse is defined as the DC line condition with greater than 12 mA of line current flowing.

CE which generates decadic pulses is to comply with the following:

(a) Characteristics of pulses;

The following requirements apply for decadic loop-disconnect pulses when the CE is connected in a resistive circuit of 1900 Ω and a feed voltage of 48 V d.c. shown in Figure 11:

(i) 'Break' pulse **shall** be in the range 60 ms to 70 ms inclusive.

(ii) 'Make' pulse **shall** be in the range 30 ms to 40 ms inclusive.

(iii) Contact bounce **shall not** exceed 0.5 ms.

(b) Resistance during transmission;

During transmission of decadic pulses the steady state DC resistance of the CE (when measured in a resistive circuit of 1900 Ω shown in Figure 11) **shall** be:

(i) For the Make period: within the requirements of Clause 5.5.1.5.1.

(ii) For the Break period: greater than 100 kΩ with 100 V d.c. applied.

(iii) For the Inter-digital Pause: within the requirements of Clause 5.5.1.5.1.

(c) Interdigital pause timing;

The interdigital pause period separating consecutive decadic pulse trains **shall** be within the range of 750 ms to 3 s unless due to a programmed pause.

Note: A pause of 800 ms is recommended.

(d) Pulse voltage wave shape;

The voltage when measured in the test circuit shown in Figure 12 **shall** comply with the following:

(i) The peak voltage measured across the terminals of the CE **shall** be less than 230 V.

(ii) For at least the latter half of the Break pulse time the peak-to-peak amplitude of any oscillation **shall not** exceed 12 V.

Compliance with Clause 5.5.1.8 should be checked by using the methods relating to decadic signalling tests described in Clause 6.7.11.

5.5.1.9 DTMF signalling

CE which generates DTMF signals is to comply with the following:

Note: The use of DTMF address signals is preferred as the standard method of operation.

(a) Signalling frequencies

(i) The DTMF signals generated **shall** consist of pairs of frequencies in accordance with ITU–T Rec. Q.23 [20] and **shall** be allocated to the various digits, symbols and characters as shown in Table 5.

(ii) The tolerance of each frequency generated **shall** be less than ±1.5%.

Compliance with Clause 5.5.1.9(a) should be checked by using the methods described in Clauses 6.7.8 and 6.7.9.

TABLE 5

DTMF signalling frequencies

Low Group Frequencies (Hz)	**High Group Frequencies (Hz)**			
	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

Note 1: The provision of the frequency combinations shown as 'A, B, C, D' in Table 5 is not mandatory.

Note 2: The designations 'A, B, C, D' should not be confused with the alphanumeric allocations detailed in Clause 5.1.6.4.

(b) Send levels

(i) The power level of any fundamental frequency **shall** be between –5 dBm and –22 dBm for line lengths between 0 km and 4.2 km using 0.40 mm conductor cable.

(ii) For DC line conditions, provided by DC feed resistances between 400 Ω and 2300 Ω, the power level difference between any two fundamental frequencies **shall** be 2 dB ±2 dB on a zero line length. The higher frequency tone **shall** be at the higher level.

Compliance with Clause 5.5.1.9(b) should be checked by using the method described in Clause 6.7.8.

(c) *Output rise and fall times* The output rise and fall times of the envelope of each tone of each digit, measured between 10% and 90% of full amplitude, **shall** be within 5 ms with the CE connected to all line lengths between 0 km and 4.2 km using 0.40 mm cable terminated in 600 Ω.

Compliance with Clause 5.5.1.9(c) should be checked by using the methods described in Clauses 6.7.8 and 6.7.9.

(d) *Distortion* The total distortion products (measured as harmonics or intermodulation) **shall** be at least 20 dB below the level of the lower power fundamental frequency when measured at the line terminals of the CE.

Compliance with Clause 5.5.1.9(d) should be checked by using the method described in Clause 6.7.8.

(e) *Timing* The timing for automatically and/or repertory dialled DTMF signalling is to be as follows:

(i) The minimum duration of the DTMF burst representing each digit **shall** be 50 ms.

(ii) The minimum interval between the transmission of digits **shall** be 70 ms and in no case **shall** it exceed a maximum period of 3 s unless due to a programmed pause.

Note: It is recommended for post answering DTMF information signalling that the digit duration should be a minimum of 100 ms.

Compliance with Clause 5.5.1.9(e) should be checked by using the methods described in Clauses 6.7.8 and 6.7.9.

(f) *Line termination characteristics* During DTMF signalling over the frequency range 600 Hz to 1660 Hz for DC line conditions, provided by DC feed resistances between 400 Ω and 2300 Ω, the source impedance of the CE **shall** have a return loss greater than—

(i) 7 dB with respect to 600 Ω; and

(ii) 15 dB with respect to the complex impedance as shown in Figure 5.

Note: To facilitate the measurement of this requirement, equipment suppliers should provide details of the test configuration for the CE.

Compliance with Clause 5.5.1.9(f) should be checked by using the method described in Clause 6.7.2.

5.5.1.10 Recall signal

The recall signal used to access enhanced network features, **shall** be a break in the loop holding condition for a duration of 100 ms ±20 ms. The characteristics of the break **shall** be in accordance with Clause 5.5.1.8(b)(ii).

Compliance with Clause 5.5.1.10 should be checked by using the methods described in Clauses 6.7.11.

5.5.1.11 Release signal

The release of a PSTN connection **shall** be indicated by the removal of the DC loop condition on the exchange line.

Note: Carriers and carriage service providers may require up to 800 ms for removal of DC loop to recognise release of connection.

Compliance with Clause 5.5.1.11 should be checked by inspection.

5.6 Cordless telephones

5.6.1 Radiofrequency (RF) Standards

Cordless telephones should comply with the relevant radiofrequency (RF) Standards for the cordless technology used.

Note 1: Requirements for cordless telephones are specified in the relevant cordless telephone Standards.

Note 2: For the information of manufacturers and suppliers of cordless telephones, a form of advice recommended for inclusion in the equipment's handbook and/or packaging, to advise potential users of radio transmitting equipment of the interference potential, is shown below.

IMPORTANT NOTICE

USERS OF THIS EQUIPMENT SHOULD NOTE THAT, AS WITH ANY RADIO TRANSMITTER, THIS EQUIPMENT IS CAPABLE UNDER SOME CIRCUMSTANCES OF CAUSING INTERFERENCE IN OTHER NEARBY ELECTRONIC EQUIPMENT.

USERS SHOULD BE CONSIDERATE OF OTHERS IN THIS REGARD AND, WHERE APPROPRIATE, MOVE THEIR CORDLESS TELEPHONE AWAY FROM ANY NEARBY AFFECTED EQUIPMENT.

5.6.2 Security Measures

Cordless telephones should incorporate security measures to protect against unauthorised use of the PSTN line.

Compliance with Clause 5.6 should be checked by inspection.

5.7 Automatic Call Transfer Equipment (ACTE)

5.7.1 General Requirements

Some items of CE, including CSS, provide the facility to automatically transfer calls received from the PSTN, back onto the PSTN.

Note: In the following requirements, Party A is the calling party, Party B is the originally called party and Party C is the party that Party B wants calls forwarded to.

5.7.1.1 The following requirements apply to ACTE:

(a) A visual signal should be provided when a call is in progress.

(b) Amplifier

(i) Where an amplifier is used, the gain of the amplifier **shall not** exceed 20 dB.

(ii) The amplifier should incorporate AGC for each direction of speech.

(c) Incoming signals received at a level below –48 dBm on each line should not turn on the amplifier, if required, from the quiescent state.

(d) The configuration **shall** be stable and not oscillate when the terminating lines have an impedance with a modulus between 200 Ω and 2 kΩ at a phase angle between –45° and +20°.

(e) Individual lines **shall** be automatically released from the equipment when either Party A or Party B goes OFF-LINE. This may be achieved by the detection of busy tone, congestion tone, dial tone, or NU tone at that port.

5.7.1.2 Disconnection of the line by the ACTE **shall** be achieved within 6.0 s of Dial Busy, Congestion, or NU Tones being applied to either port of the ACTE.

5.7.1.3 ACTE without RVA **shall not** answer an incoming call until Party C has answered the call.

Note: As a result, Party A will have no indication if Party C is engaged or does not answer, but will receive ring tone until Party C answers or the call is released by the PSTN.

5.7.2 Recorded Voice Announcement (RVA) option

5.7.2.1 ACTE which incorporates an RVA should comply with the following requirements:

(a) On detection of the incoming ring signal the ACTE should answer the call and transmit an RVA.

(b) This RVA facility should comply with the requirements of AS/ACIF S004 [5].

5.7.2.2 The RVA should identify the Party B ACTE and should include a message similar to the following example:

'The number you have called is unattended at present and your call is being directed to another number. Please wait for normal service tones.'

5.7.2.3 The ACTE should commence dialling the Party C as soon as the transmission of the RVA is commenced.

5.7.2.4 Interconnection of the speech paths between the A-B and B-C parties should be made immediately the three preceding steps have been completed, so that the ring tone or other service tone associated with Party C will be heard by Party A.

5.7.3 Multiple calling option

ACTE may be designed to make one attempt to direct a call to a single telephone number or to automatically make multiple attempts to establish a call if the original attempt is found to be unsuccessful. Multiple attempts may be directed to a single telephone number or to multiple telephone numbers. Any multiple calling facilities of the ACTE should operate in the manner described in Automatic Operation section of this Standard.

Compliance with Clause 5.7.3 should be checked by inspection and measurement as appropriate.

5.8 Technical conditions for recording of telephone conversations

5.8.1 General

The requirements in Clauses 5.8.2 to 5.8.6 (inclusive) apply to CE, including CSS, capable of or designed for recording telephone conversations.

5.8.2 Tone transmission while recording

CE should transmit a tone in accordance with Clause 5.8.6(b) to the line while the telephone conversation is being recorded.

5.8.3 Incorporation of interlocking circuitry

Interlocking circuitry should be incorporated to ensure that whenever the recorder is in a recording mode, the recording tone generator should send warning tones to the line.

5.8.4 Continuity of tone generation

The recording tone generator should not be capable of being disabled while a conversation is being recorded.

5.8.5 Use of common power supply

The recording tone generator and the recording device should be powered from a common power supply and should incorporate as

much common circuitry as is practicable so as to ensure that under fault conditions the recording of a telephone conversation is unlikely to occur without the recording tone generator transmitting warning tones to line.

5.8.6 Distant party notification and recording tone

CE should comply with the following:

(a) Distant Party Notification

Recording tone should be transmitted to the distant party during recording of a conversation. Recording tone may be transmitted to the local telephone, operator's headset and the conversation recording device in use.

(b) Recording Tone

(i) The recording tone should be a tone of 1400 Hz ±1.5% with a duration of 425 ms ±75 ms bursts.

(ii) The recording tone should be repeated at 15 s ±3 s intervals.

(iii) The power level of each tone burst at the point of connection to the PSTN line (Line Port) should be in the range –10 dBm to –24 dBm when measured across a 600 Ω termination connected to the Line Port, and a 600 Ω termination (representing the telephone) connected across the Local Telephone Port, if any.

Note: It is recommended that the level of Recording Tone applied to the Local Telephone Port is not greater than –20 dBm.

Note: There is Commonwealth and State legislation relating to the recording of, and listening to, communications over the Telecommunications Network. Compliance with this Standard should not be taken to mean that any subsequent use of the equipment complies with relevant legislation.

6 TESTING

6.1 Verification of compliance with requirements

Compliance with all mandatory requirements in this AS/ACIF Standard is to be verified. This may be done by direct measurement, modelling and analysis, operation or inspection.

Methods for demonstrating compliance of CE with the requirements clauses specified in this Standard are described in Clauses 6.2 to 6.7

Methods for demonstrating compliance of CE with the requirements clauses specified in this Standard are described in either—

(a) the testing Clauses 6.2 to 6.7, or

(b) the referenced Standards in the specific Requirements clauses.

Verification of compliance with the referenced standards may be confirmed by test reports to later versions of the referenced standards provided that all clauses of the referenced standards are shown to be met.

Alternative methods of demonstrating compliance to those described may be used if the risk of passing non-compliant CE is not increased because of increased measurement uncertainty.

6.2 Standard test conditions

6.2.1 Unless this Standard provides otherwise, testing for compliance with this Standard should be conducted at the nominal supply voltage of the CE and within the following ranges of atmospheric conditions:

(a) An ambient temperature in the range of 15°C to 25°C inclusive.

(b) A relative humidity in the range of 30% to 75% inclusive.

(c) An air pressure in the range of 86 kPa to 106 kPa inclusive.

(d) The nominal supply voltage of the equipment.

6.2.2 Where elements in a test configuration are variable, the test should be carried out over the indicated range for that element.

6.2.3 Unless indicated elsewhere within this Standard—

(a) the accuracy level of all measurements should be better than ± 2% for voltage and current, ± 0.25% for frequency and ± 0.5% for time; and

(b) the tolerance of the nominal 48 V d.c. test source should be ± 0.5 V.

6.2.4 Unless indicated elsewhere within this Standard for an individual test, all component values in the test configuration should have a tolerance of—

(a) ±1% for resistance;

(b) ±1% for capacitance; and

(c) –0%, +25% for inductors.

6.3 Fail-safe operation

Compliance with the requirements of fail-safe operation as specified in Clause 5.1.1 may be checked by operation and inspection.

6.4 Emergency calling

Compliance with the emergency calling requirements as specified in Clause 5.1.8 may be checked by operation and inspection.

6.5 Levels

6.5.1 Relative levels

The relative levels assigned to CE are +3 dBr transmit (into the PSTN), –9 dBr receive (from the PSTN).

6.5.2 Send level

Unless otherwise specified, transmission tests should be carried out with a send level of –10 dBm0 (i.e., –19 dBm at a –9 dBr point).

6.6 Test frequencies

Test frequencies should be in the range of 300 Hz to 4 kHz unless otherwise specified in the relevant requirement clauses of this Standard. Sufficient measurements should be carried out around all nodal points of relevant masks, where applicable.

Note: Where the test frequencies are submultiples of a PCM sampling rate of 8 kHz, an offset of 3 Hz to 20 Hz should be used to reduce errors in level measurements.

6.7 Parameters to be tested

6.7.1 Impedance

6.7.1.1 The impedance presented by the CE (or network) should be measured by a suitable bridge circuit or a vector impedance meter as shown in Figure 13 using a test level as stated in Clause 6.5.

6.7.1.2 The series impedance of equipment intended to be connected between CE in the OFF-LINE state and the PSTN should be tested with a high impedance voltmeter in the configuration shown in Figure 24.

6.7.2 Return loss

The return loss, as defined in Annex B of ITU–T Rec. G.122 [15], should be measured by a suitable bridge circuit or a vector impedance meter as shown in Figure 13 using a test level as stated in Clause 6.5.

6.7.3 Impedance balance

Impedance balance is defined as the ratio U/V measured as shown in Figure 14. The test should be carried out by injecting a signal of 3 V r.m.s. between the earth and the midpoint of two 300 Ω resistors connected in series, in accordance with ITU–T Rec. O.9 [17]. Earth should be either TRC or protective earth termination, or both.

Note: Impedance Balance = 20 log (U/V) dB.

6.7.4 Insertion loss

Insertion loss should be measured as shown in the test circuit of Figure 15.

Note: Insertion loss = 10 log (P1/P2), dB where P1 is the apparent power in the load before the insertion of the CE (or a network), and P2 is the apparent power that the same generator furnishes via the CE (or network to the load).

6.7.5 Noise performance

6.7.5.1 The following types of noise should be measured:

(a) Psophometric.

(b) Unweighted noise.

(c) Single frequency noise.

(d) Impulsive noise.

6.7.5.2 Depending on the type of noise, appropriate noise measurement equipment should be used as shown in the test circuit of Figure 16, Figure 17 or Figure 18.

Note 1: If the CE has an acoustic input device, the tests should be performed with an ambient noise level of less than 30 dBA.

Note 2: Equipment suppliers should provide details of a method for placing the CE in the ON-LINE condition with no signal being applied to line for a period of not less than 10 min.

6.7.6 Ringer sensitivity, REN and DC component determination

6.7.6.1 For the ringer sensitivity test, the CE (one only) should be required to respond to the signal specified in Clause 5.5.1.1.1.

6.7.6.2 For REN determination the test configuration is shown in Figure 19. The standard ring generator should generate at its terminals 75 V ±1 V a.c. r.m.s. at a frequency of 25 Hz ±0.5 Hz superimposed on 48 V d.c.

Note: A standard ring detector at ringing frequencies in the active ringing state (i.e. with a ringing signal as described in Clause 5.5.1.1 applied) can be characterised as comprising a resistance of 4 kΩ ±5% in series with a 1 μF ±5% capacitor; this combination is defined as having a REN of 1. The bridging impedance of the ring detector at other than ringing frequencies would be expected to comply with relevant Clauses of the Standard.

6.7.6.3 While monitoring the voltage V, the CE to be tested should be connected to the terminals L+ and L–. Further CE having the same nominal characteristics should be additionally connected in parallel until the AC voltage V drops to below 40 V r.m.s. The total number (n) of identical CE connected before the voltage drops to below 40 V r.m.s. should be used to calculate the REN as follows:

REN = 3/n

Where REN is determined to be 0.1 or less, it should be deemed to be 0.1.

6.7.6.4 The DC component of the current flowing during application of ring should be measured using the test configuration shown in Figure 7. The milliammeter used should be a moving-coil DC responding instrument.

6.7.7 Meter signal detection

6.7.7.1 General

The following input signal parameters may affect the output of a meter signal detector and thus produce different meter signal detector responses:

(a) RMS Voltage level V

(b) Pulse Frequency of the pulse F

(c) Pulse Duration t_1

(d) Pulse Repetition Interval time t_2

6.7.7.2 12 kHz transverse meter signal detector performance

6.7.7.2.1 The detector's response should be tested for both the 'Operate' and the 'Not Operate' regions of Figure 8, using—

(a) the test configuration of Figure 20;

(b) the timing parameters of Clauses 5.5.1.3.1.3 and 5.5.1.3.1.4; and

(c) the voltage and frequency limits bounded by the 'Operate' and the 'Not Operate' regions of Figure 8.

6.7.7.2.2 Transverse impedance should be tested using the test configuration of Figure 13.

6.7.8 DTMF signal sending

6.7.8.1 DTMF levels and DTMF signal timing should be measured using a suitable waveform recorder and signal processor.

6.7.8.2 The main frequencies and levels should be measured using the test circuit shown in Figure 21 and Figure 22.

6.7.8.3 Distortion should be measured at the CE using the test circuit shown in Figure 21, but with the artificial line set to 0 km length.

Note: It is recommended that the DTMF measuring instruments should be switched to a bandwidth of 10 Hz for selective measurements.

6.7.9 Signal levels and frequencies

6.7.9.1 Signal levels and frequencies should be measured as shown in Figure 23 using a selective level meter or spectrum analyser with appropriate input dynamic range and frequency range. When used to measure the levels of individual frequency components, bandwidths of 3 Hz, 10 Hz, 30 Hz and 100 Hz may be used as appropriate.

6.7.9.2 Power levels specified in Clause 5.4.2 should be determined as V2/R, the voltage level being measured with a high impedance RMS voltmeter bridged across R, the termination resistor (nominally 600 Ω unless otherwise specified).

6.7.9.3 For the one-minute mean power level measurements the voltmeter should have the following elements:

(a) An input band-selection filter with passband 300 Hz to 3.4 kHz.

(b) A square-law detector having a time constant of 100 ms nominally.

(c) An averaging circuit that performs a continuing averaging process over a period of one minute, i.e. computes the value of:

$$1/60 \int_{T_n}^{T_n + 60} V^2 dt$$

where: T_n is time in seconds
V is the RMS voltage indicated by the square-law detector, in Volts.

Note 1: The measurement should be carried out for a sufficient time for the averaging circuit to record a steady value.

Note 2: In practice, when measuring sustained signals from modems or similar devices, it may be convenient to observe the indication of the square-law detector and then to calculate the one-minute mean value.

6.7.9.4 For determining the measurement of peak to peak voltages required by Clause 5.4.2.2 a storage oscilloscope with a minimum bandwidth of DC to 10 MHz should be used in place of the spectrum analyser in the test circuit shown in Figure 23.

6.7.9.5 Power Spectral Density should be measured using the following:

(a) A 10 kHz noise power bandwidth for frequencies between 3.4 kHz and 30.175 MHz.

(b) A 1 MHz noise power bandwidth for frequencies between 300 kHz and 30.175 MHz as described in Clause 5.4.2.4.2.

6.7.10 Two-wire physical ring-in/loop-out PSTN line interface seizure and hold states

6.7.10.1 The DC conditions in the Seizure and Hold States on ring-in/loop-out PSTN lines, as specified in Clauses 5.5.1.4 and 5.5.1.5, should be tested using the circuits of Figure 1 and Figure 2.

6.7.10.2 The DC conditions of the Seizure State should be measured at 300 ms after the transition to the low resistance (ON-LINE State) determined in Figure 1.

6.7.10.3 The Hold State condition should be measured after DC current has reached its steady state.

6.7.11 Decadic signal generation and reception

6.7.11.1 The test configurations for decadic signalling should be as shown in Figure 11 and Figure 12. Figure 11 indicates the test configuration which should be used to measure pulse timing and the resistance during transmission. Figure 12 indicates the test configuration which should be used to measure the pulse voltage waveshape.

6.7.11.2 When testing for compliance with Clause 5.5.1.8(b)(ii) for the resistance during the break period, a 100 V d.c. source should be used in the test configuration as shown in Figure 11.

6.7.11.3 For timing measurements, a 48 V d.c. source should be used in the test configuration as shown in Figure 11.

6.7.12 Supervisory tone measurement

Supervisory tones should be measured using the test circuit of Figure 23 with a waveform recorder in place of the spectrum analyser.

6.7.13 Service tone detection

Performance of service tone detectors should be verified at levels of –9 dBm and –24 dBm using the test configuration of Figure 23 with the spectrum analyser and resistor 'R' replaced with a service tone generator to provide frequency and cadence of the applicable pre-answer tones as detailed in Appendix A.

6.7.14 Longitudinal power limits

The CE under test should be connected to the measuring instrument as shown in Figure 27. A selective measuring set or spectrum analyser having an effective bandwidth sufficiently narrow to measure individual spectral components should be used to explore the frequency band from 3.4 kHz to 30.175 MHz and to measure the RMS voltage (V) of any spectral component either using the internal calibration or from comparison with a sinusoidal signal of known RMS voltage and the same frequency.

When measuring the longitudinal power generated by the CE during the ringing state, the CE is to be tested with a continuous ring signal for sufficient time to enable longitudinal signal measurement to be performed. The test configuration of Figure 19 can be adapted but with the artificial line removed.

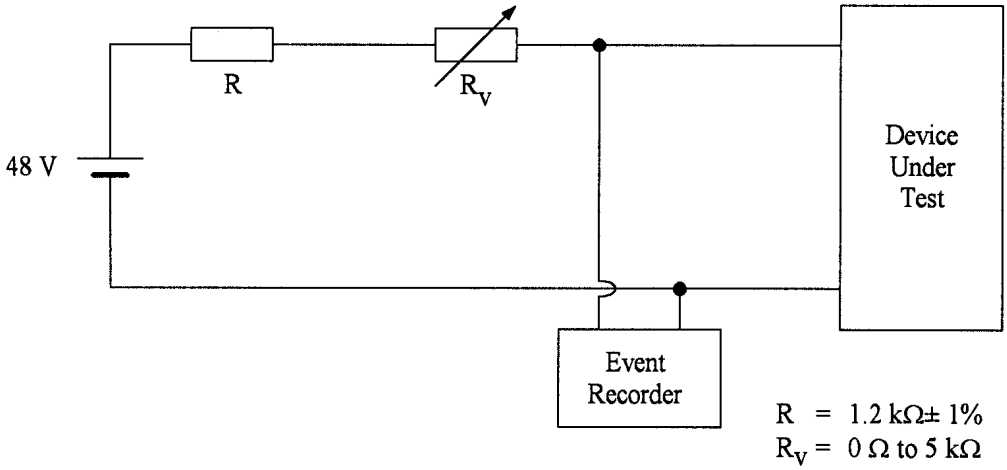


FIGURE 1
Test circuit for seizure state

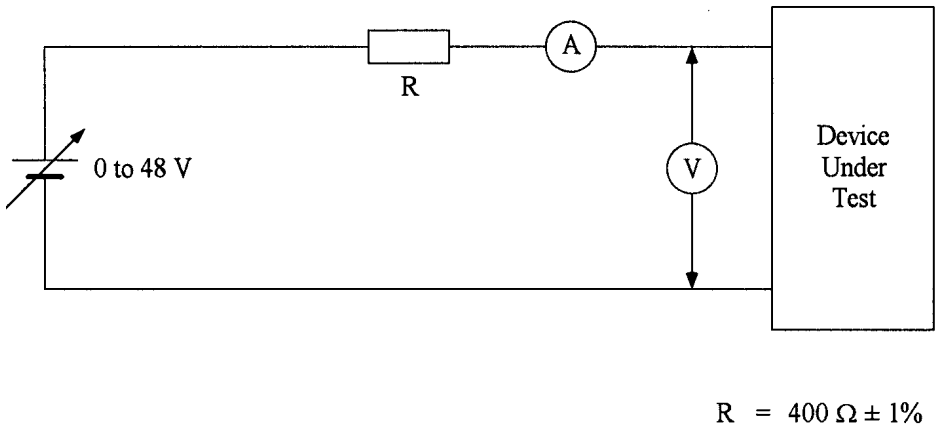
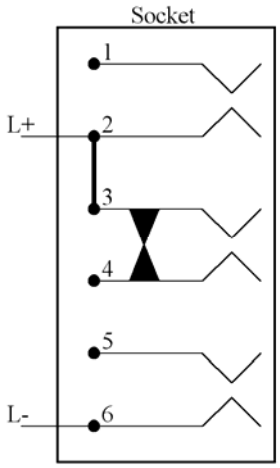
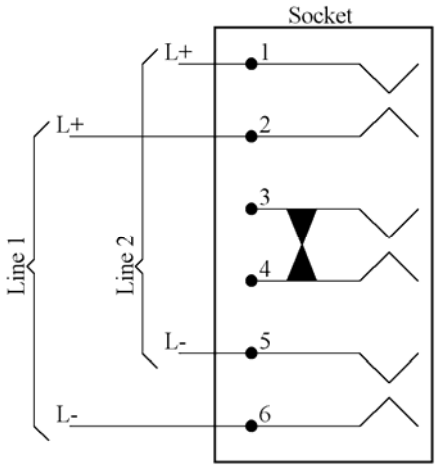


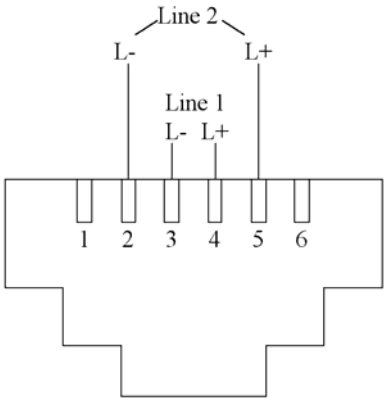
FIGURE 2
Test circuit for hold state



(a) 600 Series Single Line



(b) 600 Series Two Lines

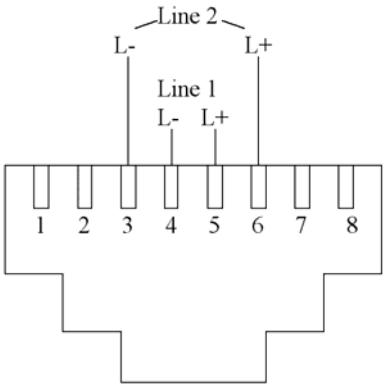


(c) ANSI/TIA-968-A-2002 [9] Six-Position Modular Sockets connection for single or two lines (viewed from the front of socket)

Note 1: The pair assignments align with AS/NZS 3080 [2].

Note 2: The socket is not designed for insertion of a ANSI/TIA-968-A-2002 [9] Four-Position Modular Plug.

Note 3: Although the line polarity may vary over time, it is recommended the polarity should be as shown at installation.



(d) ANSI/TIA-968-A-2002 [9] Eight-Position Modular Socket connection for single or two lines (viewed from the front of socket)

Note 1: The pair assignments align with AS/NZS 3080 [2]. Refer to AS/NZS 3080 [2] for additional pair assignments.

Note 2: The socket is not designed for insertion of a ANSI/TIA-968-A-2002 [9] Four-Position Modular Plug or a ANSI/TIA-968-A-2002 [9] Six-Position Modular Plug.

FIGURE 3

PSTN connections for 600 Type and ANSI/TIA-968-A-2002 [10] sockets

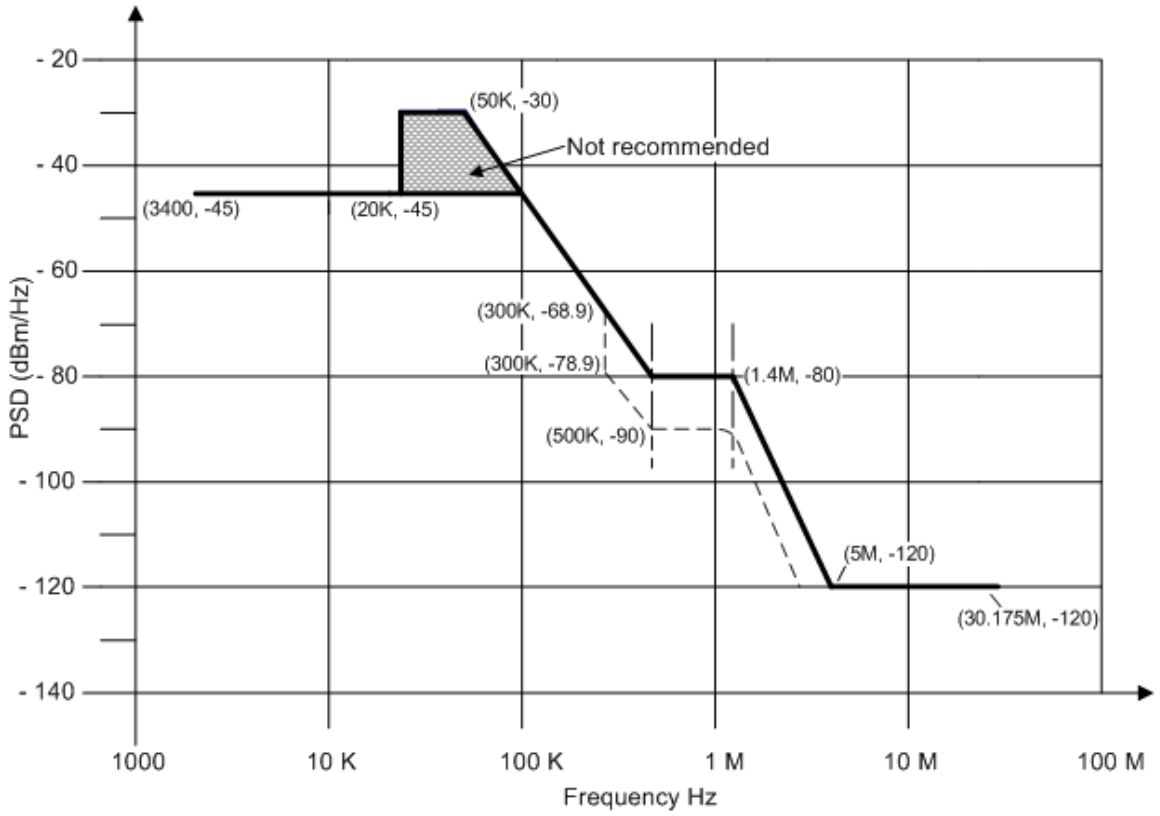
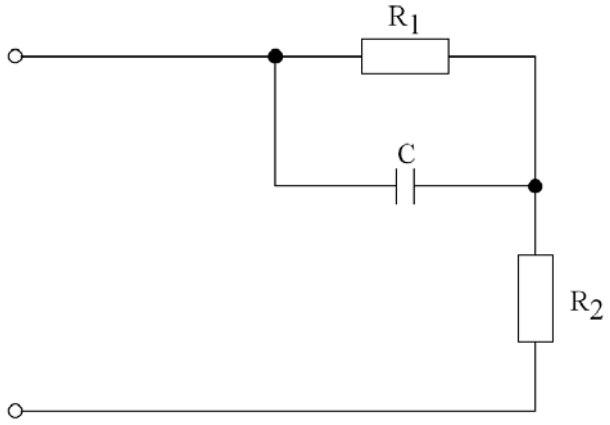


FIGURE 4

Signal Power Levels limits above 3.4 kHz



R_1 = 820 Ω ± 0.1%

R_2 = 220 Ω ± 0.1%

C = 115 nF ± 0.1% or 120nF ± 0.1%

FIGURE 5

Reference impedance (TN12) for impedance measurement

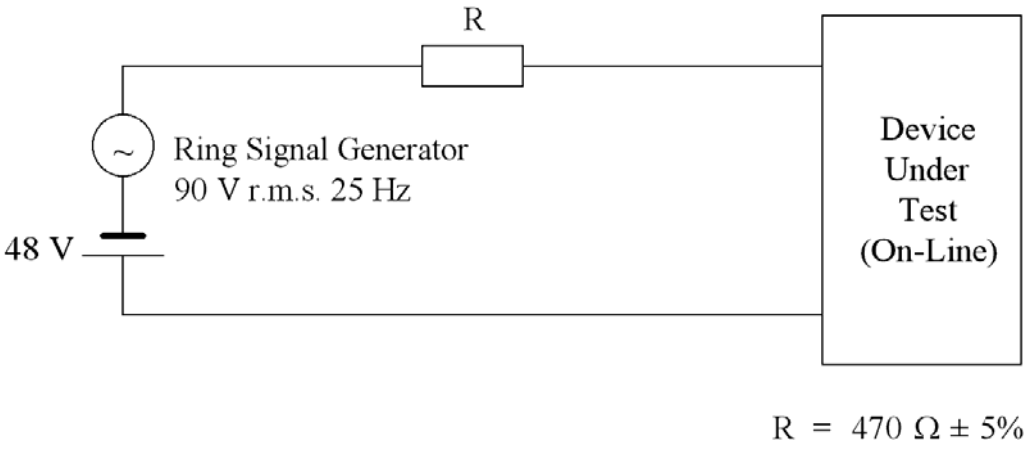
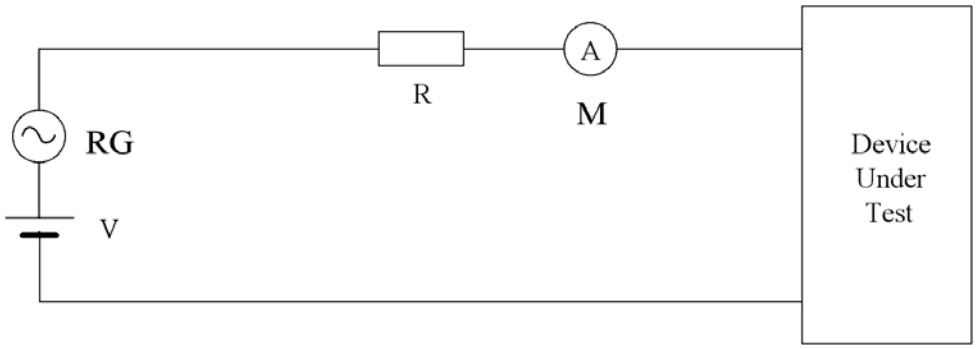


FIGURE 6
Test circuit for ring voltage under fault conditions



M = DC RESPONDING MOVING-COIL MILLI-AMMETER
R = 470 Ω ± 1 %
RG = 95 ± 1 Vrms, 25 ± 1 Hz
V = 56 ± 0.5 Vdc

FIGURE 7
Test circuit for DC flowing during ring

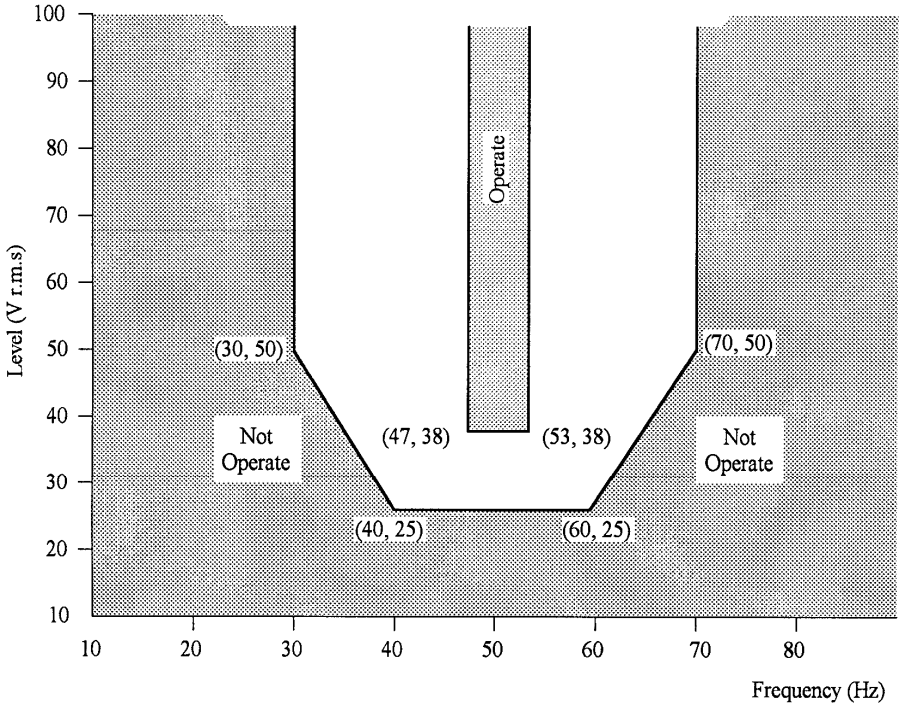


FIGURE 8

Operating range of 12 kHz meter signal detector

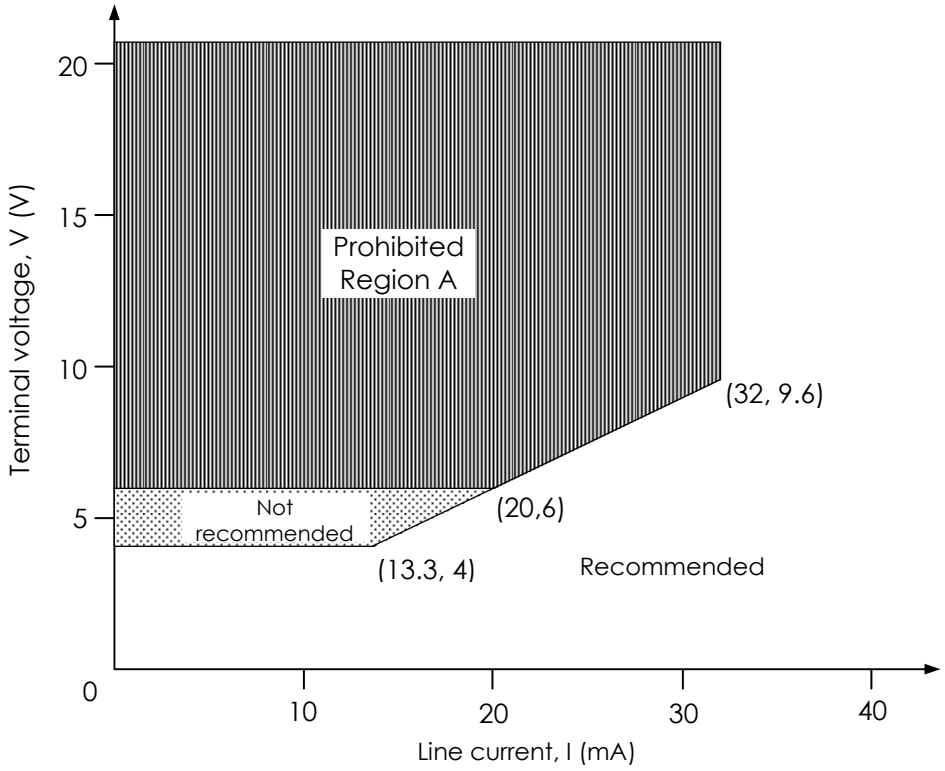


FIGURE 9
Seizure state limits

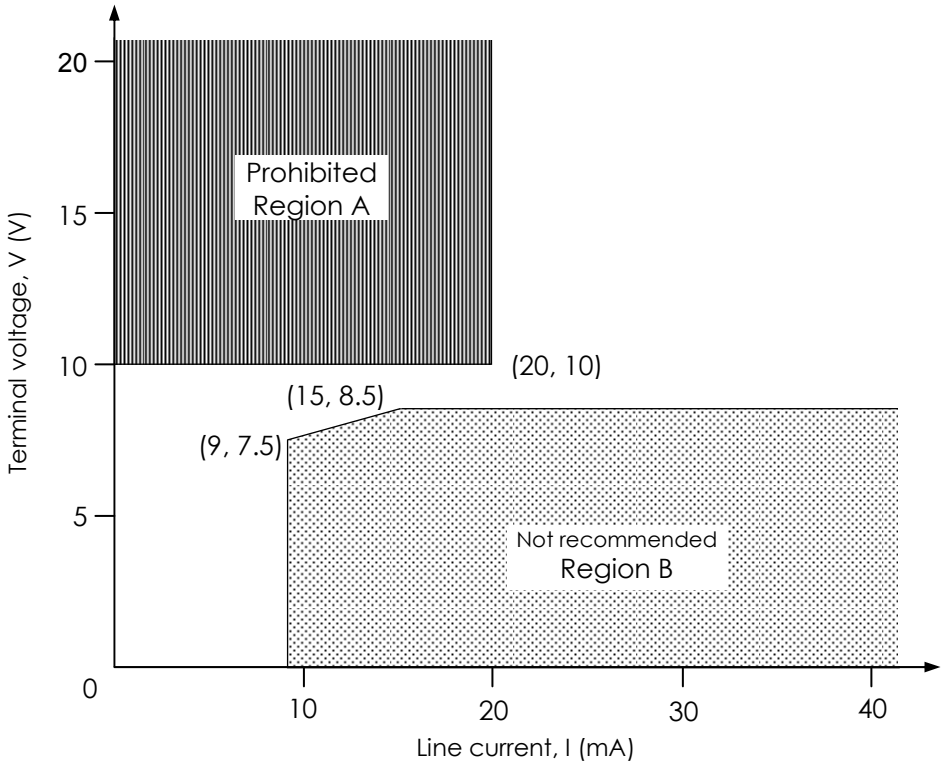
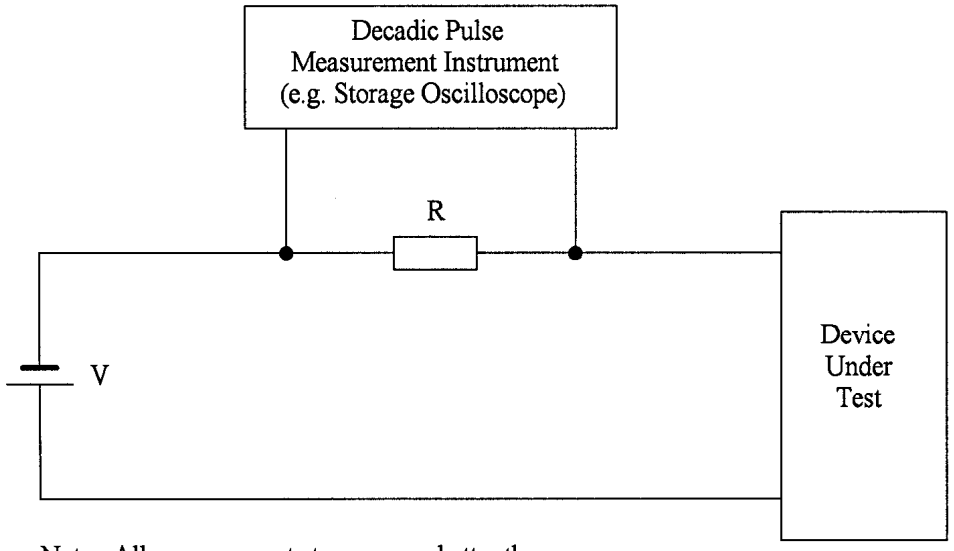


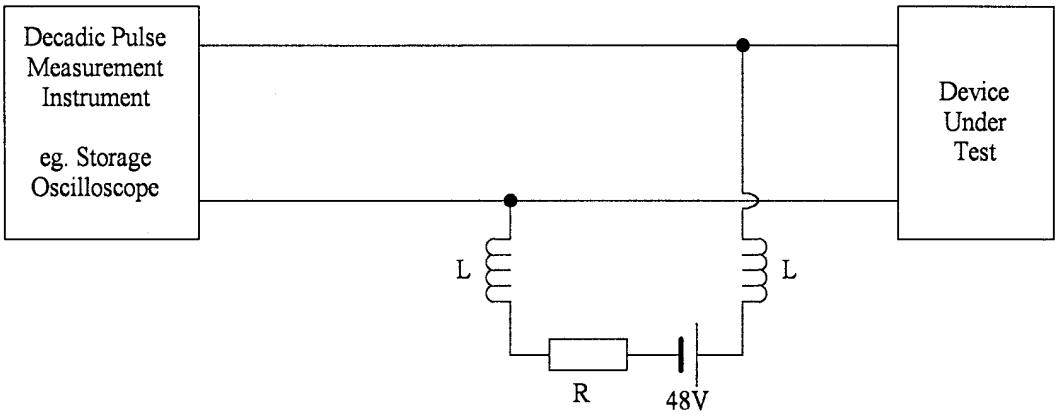
FIGURE 10
Hold state limits



Note: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

R = 1900 Ω ± 3 %

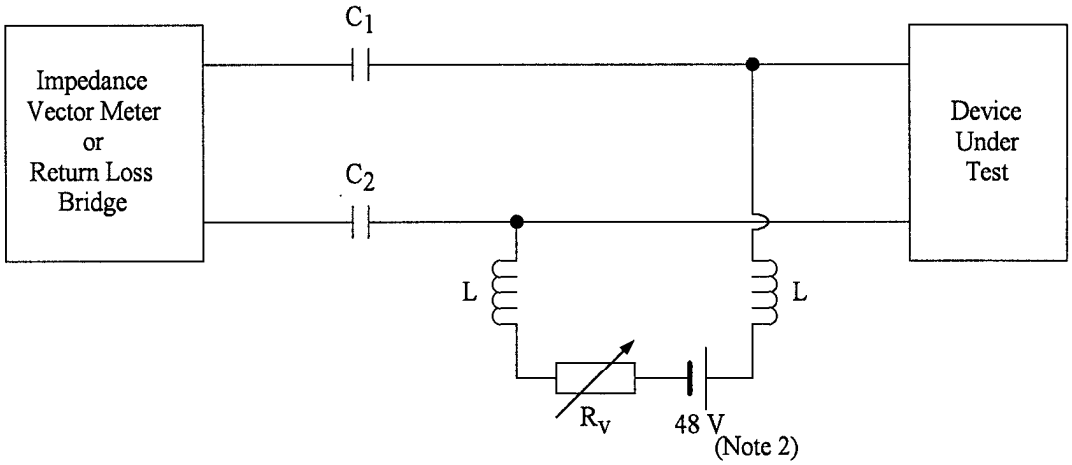
FIGURE 11
Decadic pulse test circuit



Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

L = 2 H ± 10 % for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
R = 400 Ω ± 3 % (Includes resistance of 2 L)

FIGURE 12
Decadic pulse waveshape measurement

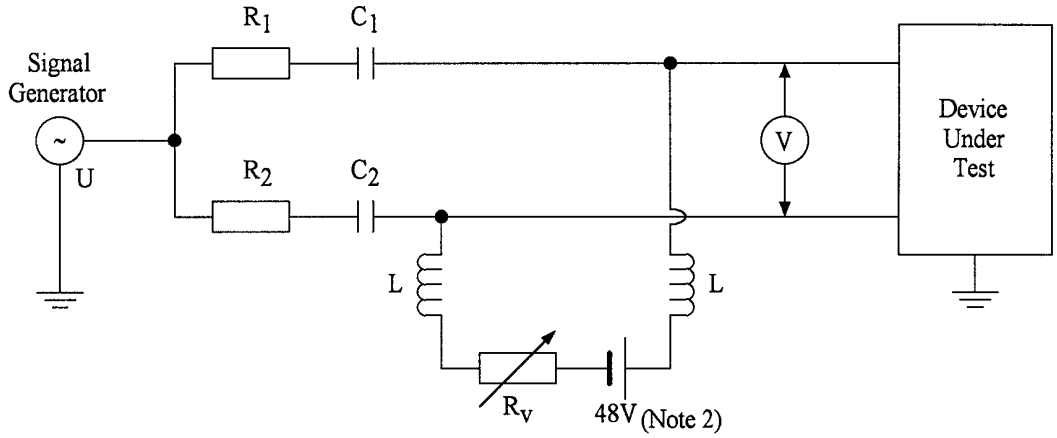


Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

L ≥ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
C_1 ≥ 100 µF
C_2 ≥ 100 µF
R_v = 400 Ω to 2300 Ω (Includes resistance of 2 L)

Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

FIGURE 13
Impedance or return loss measurement

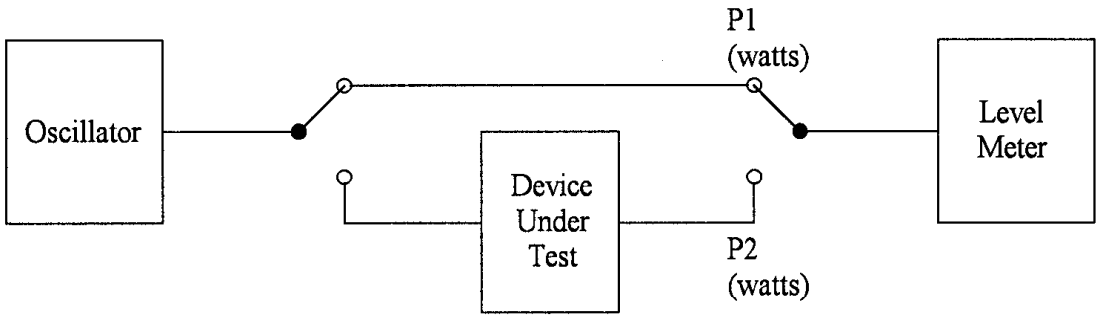


Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

L ≥ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
C_1 ≥ 100 µF
C_2 ≥ 100 µF
$C_1 - C_2 \leq \pm 0.01\ C_1$
R_1 = 300 Ω ± 1%
R_2 = 300 Ω ± 1%
$R_1 - R_2 = \pm 0.1\ \Omega$
R_v = 400 Ω to 2300 Ω (Includes resistance of 2 L)

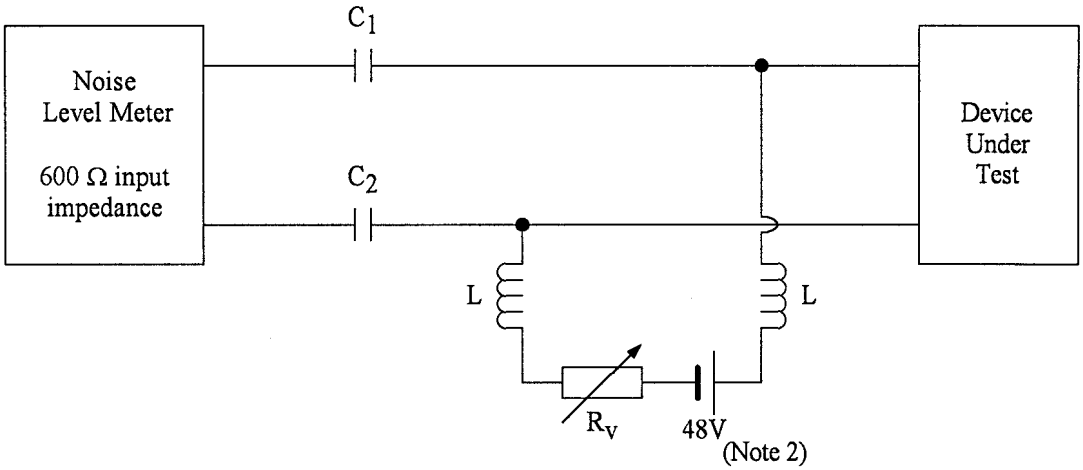
FIGURE 14
Impedance balance measurement



Note: All measurements to accuracy better than:

± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

FIGURE 15
Insertion loss measurement

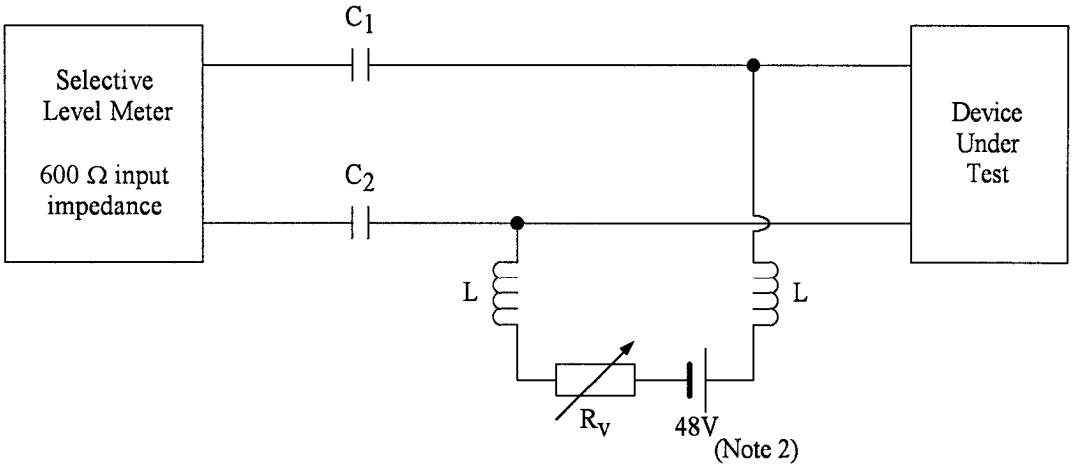


Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

L ≥ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
C_1 ≥ 100 µF
C_2 ≥ 100 µF
R_V = 400 Ω to 2300 Ω (Includes resistance of 2 L)

Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

FIGURE 16
Noise measurement – psophometric and unweighted



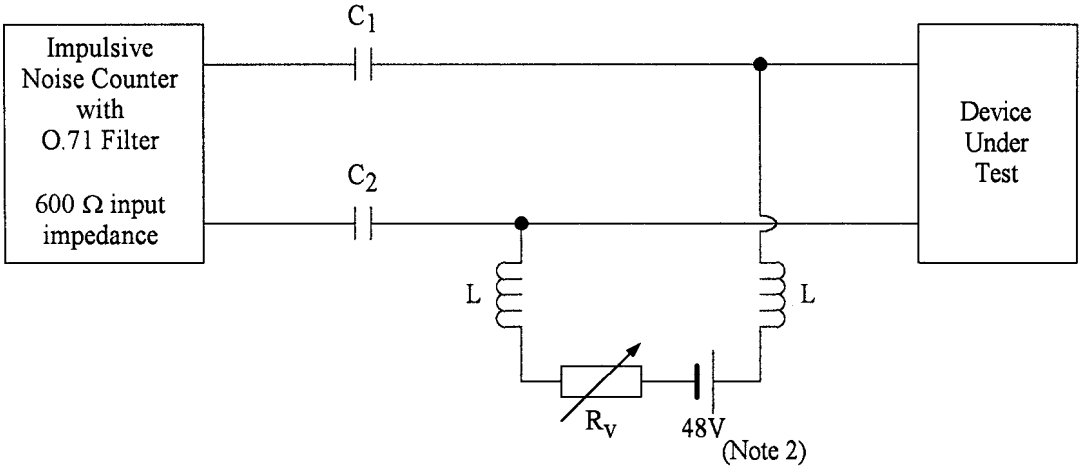
Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

L ≥ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
C_1 ≥ 100 µF
C_2 ≥ 100 µF
R_v = 400 Ω to 2300 Ω (Includes resistance of 2 L)

Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

Note 3: The selective level meter should have a bandwidth of 10 Hz ± 30 % at its 3 dB points.

FIGURE 17
Single frequency noise measurement

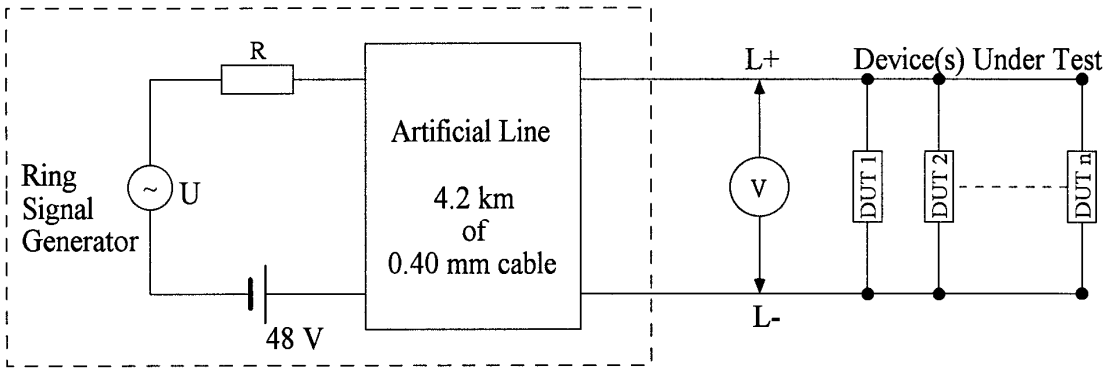


Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

L ≥ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
C_1 ≥ 100 µF
C_2 ≥ 100 µF
R_v = 400 Ω to 2300 Ω (Includes resistance of 2L)

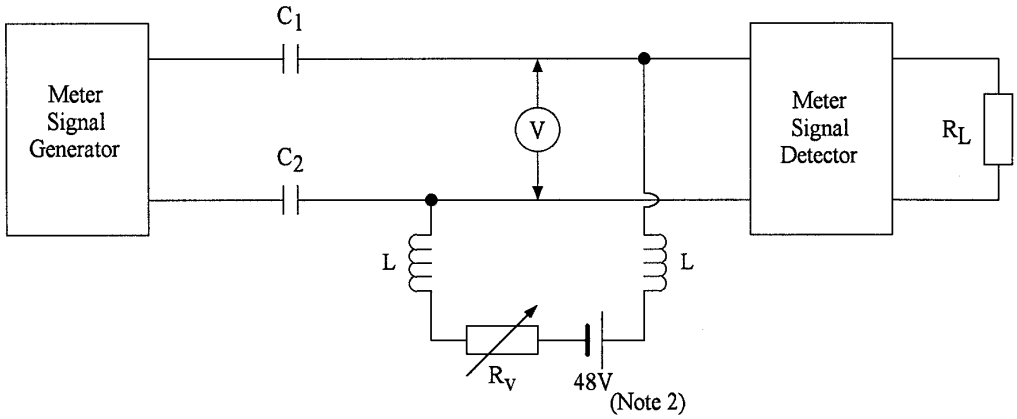
Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

FIGURE 18
Impulsive noise measurement



R = 1200 Ω ± 1%
U = 75 V r.m.s ± 1

FIGURE 19
Test circuit for REN determination



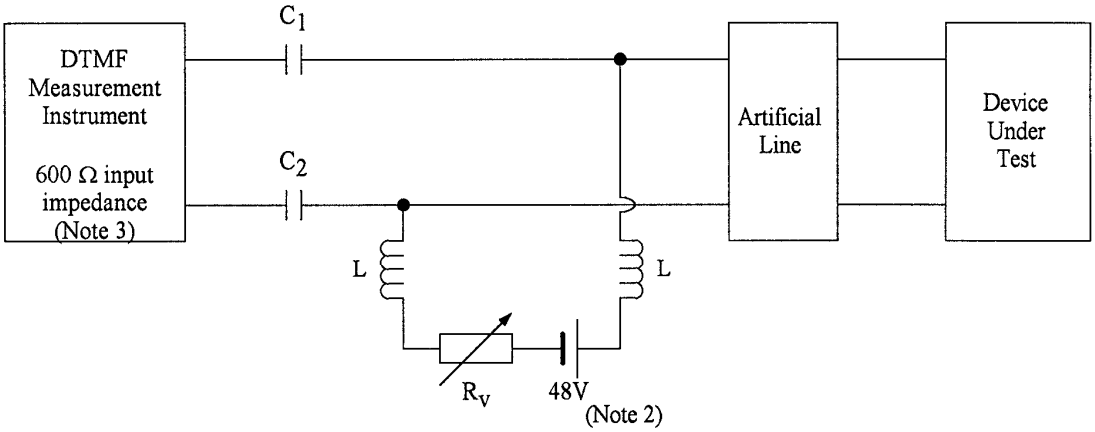
Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

Note 3: R_L is required if the detector is a series device.

L ≥ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
$C_1 \geq$ 100 µF
$C_2 \geq$ 100 µF
$C_1 - C_2 \leq \pm 0.01\ C_1$
$R_L =$ 600 Ω ± 5%
$R_V =$ 400 Ω to 2300 Ω (Includes resistance of 2 L)

FIGURE 20
Test circuit – 12 kHz meter signal detection sensitivity



Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

L ≥ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz
C_1 ≥ 100 µF
C_2 ≥ 100 µF
R_V = 400 Ω to 2300 Ω (Includes resistance of 2 L)

Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

Note 3: A waveform recorder or signal processor can be used.

FIGURE 21
Test circuit – DTMF level

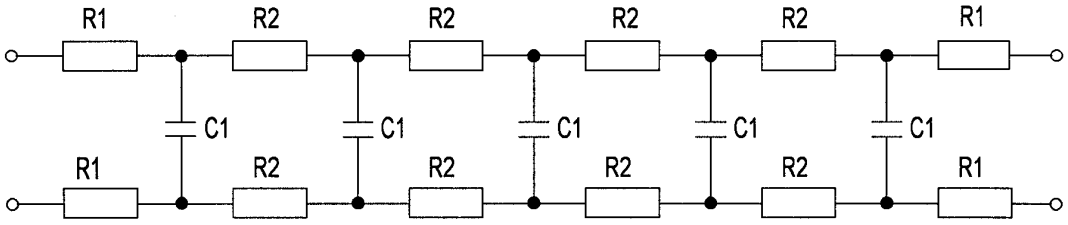


Figure 26(a)
Artificial Line - Limit Length (4.2 km of 0.40 mm cable or 7.0 km of 0.64 mm cable)

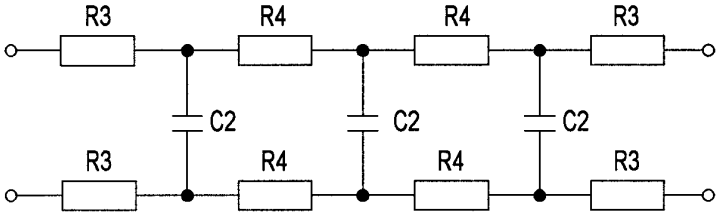


Figure 26(b)
Artificial Line - Average Length (1.6 km of 0.40 mm cable or 2.5 km of 0.64 mm cable)

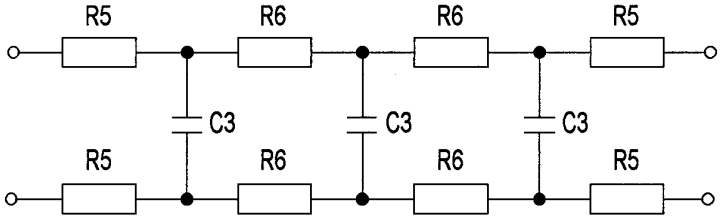
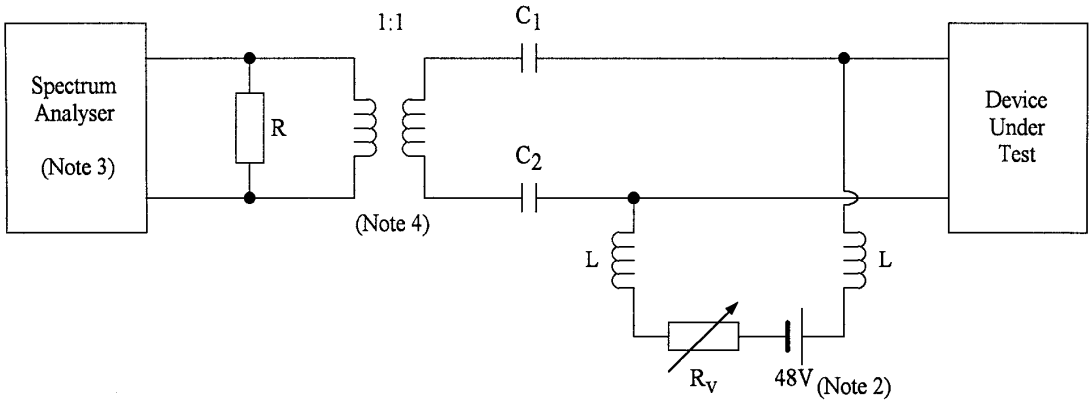


Figure 26(c)
Artificial Line - Short Length (0.5 km of 0.40 mm cable or 0.5 km of 0.64 mm cable)

Component values for Figures 26(a), 26(b) and 26(c)									
Cable size (mm)	R1 (Ω)	R2 (Ω)	R3 (Ω)	R4 (Ω)	R5 (Ω)	R6 (Ω)	C1 (nF)	C2 (nF)	C3 (nF)
0.40	56.1	112.2	35.6	71.3	11.1	22.3	38.0	24.0	7.5
0.64	37.5	75.0	22.5	45.0	4.5	8.9	63.0	38.0	7.5

Tolerance ±2%

FIGURE 22
Artificial lines



Note 1: All measurements to accuracy better than:
± 2 % voltage and current,
± 0.5 % time,
± 0.25 % frequency,
± 0.2 dB power level.

Note 2: The battery should be replaced by a shorting link if D.U.T does not draw loop current from the line.

Note 3: A waveform recorder or signal processor can be used.

Note 4: Transformer to provide isolation and balanced-to-unbalanced conversion as required.

$L \geq$ 10 H for up to 125 mA d.c. over the range 100 Hz to 4000 Hz

$C_1 \geq$ 100 µF

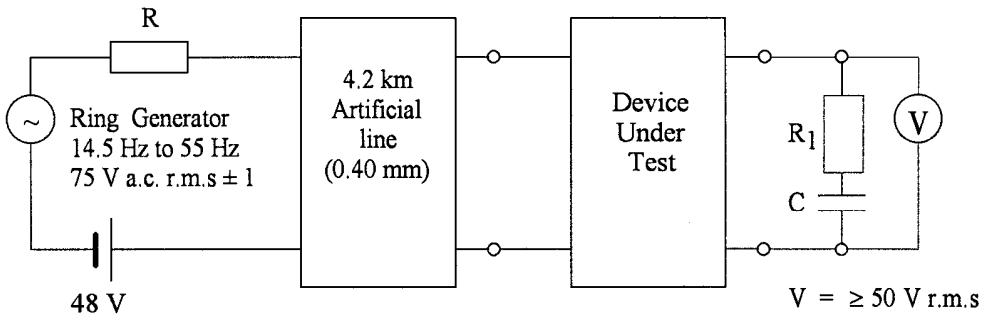
$C_2 \geq$ 100 µF

$R_V =$ 400 Ω to 2300 Ω (Includes resistance of 2 L)

$R =$ 600 Ω ± 1 %

FIGURE 23

Test circuit – tone level (other than DTMF)



R = 1.2 kΩ ± 5 %
R_1 = 4 kΩ ± 5 %
C = 1 uF ± 5 %

FIGURE 24

Test circuit – measurement of impedance for series equipment at ringing frequencies

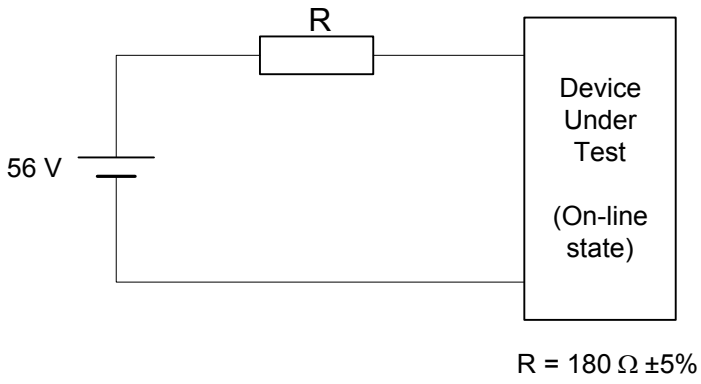


FIGURE 25
Test circuit – fault in hold state

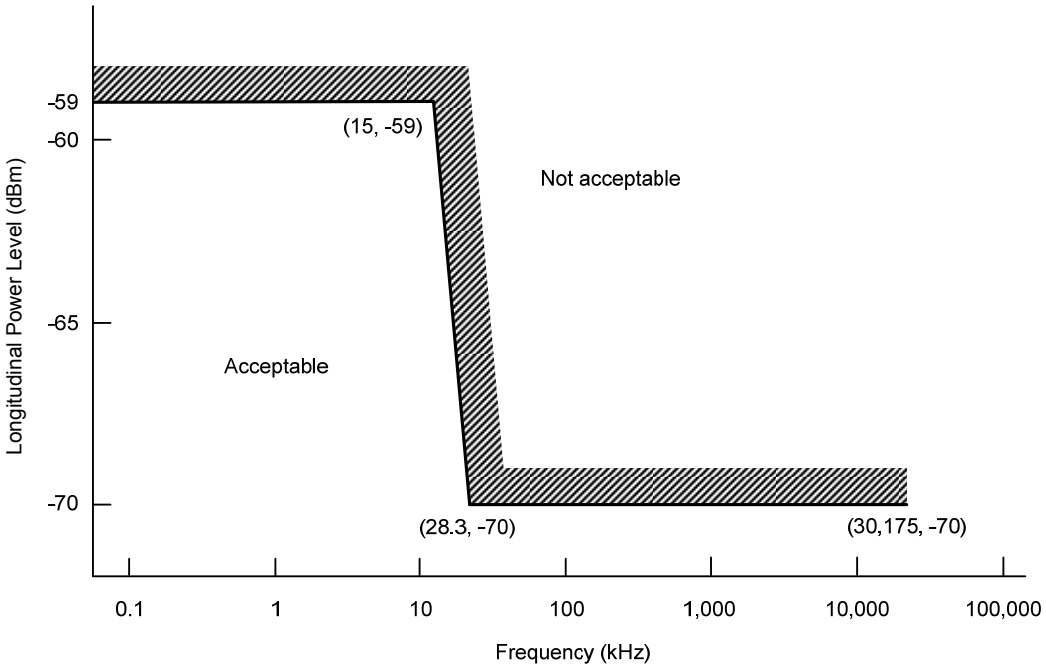


FIGURE 26
Longitudinal power level limits

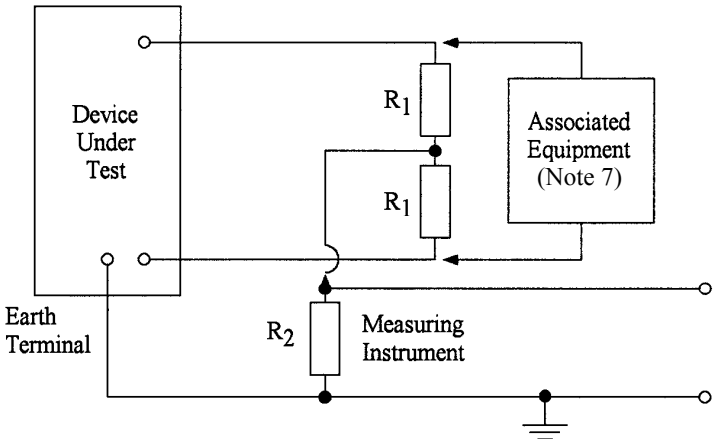


FIGURE 27

Test circuit for measurement of longitudinal power level

Note 1: If the equipment has separate protective and signal earth terminals they are connected together.

Note 2: The two resistors R1 are to be matched to within 0.01%.

Note 3: The measuring instrument is of high impedance, and capable of measuring over the frequency range 3.4 kHz to 30.175 MHz.

Note 4: The measuring instrument is calibrated in dBm as if it was measuring across a resistive load.

Note 5: The adequacy of the balance is checked by repeating measurements with appropriate connection reversal, or equipment disconnection.

Note 6: The value of the resistors R1 and R2 are to be 70 Ω for CE signals with fundamental frequency components in the 3.4 kHz to 30.175 MHz range when the CE is not being tested with any associated equipment.

Note 7: If required, blocking capacitors with a value of 4uF may be placed in series with each R1 resistor during the idle, hold or ringing states. Variations of this arrangement are permitted if necessary for correct operation of the CE, but must be carefully considered to ensure correct longitudinal power level measurements.

APPENDIX

A PSTN SERVICE TONE CHARACTERISTICS

Tone	Frequency (Hz)	Cadence (s)	Level (dBm)	
PRE-ANSWER			Max.	Min
Dial	425 or 425 * 25 or 400 + 425 + 450 400 + 425	Continuous (for a minimum of 10 s)	–13	–24
Stutter Dial	425 * 25 or 400 + 425 + 450	0.1 ON, 0.04 OFF, repeated (for a minimum of 10 s)	–13	–24
Ringing	400 + 450 or 425 * 25 or 400 + 425 + 450	0.4 on, 0.2 off, 0.4 on, 2.0 off, repeated	–13	–24
Busy	425	0.375 on, 0.375 off, repeated	–13	–24
Congestion	425	0.375 on, 0.375 off 0.375 on (attenuated by 10 dB), 0.375 OFF, repeated	–13	–24
Number Unobtainable	425	2.5 on, 0.5 off, repeated	–13	–24
Facilities	425	Continuous	–13	–24
POST-ANSWER				
Call Waiting	425 or 525	0.2 ON 0.2 OFF 0.2 on 4.4 off (for 45 s)	–13	–34
Conference	425 or 525 or 1400	1.0 on 15 off (first burst) 0.36 on 15 off (subsequent bursts)		
OTHER				
Echo Canceller Disable	2100	1.0 ON (with phase reversals each 450 ms)	–7	–27
Echo Suppressor Disable	2100	0.7 ± 0.3 on (single burst)	–7	–27
Data Calling (CNG)	1300	0.6 ON 1.75 off	–7	–27
Data Answering	2100	2.6 on (minimum)	–7	–27
Howler	1500 to 3200	Continuous, swept frequency, graduated level	+10	–20

Note 1: These tones are indicative of the Australian PSTN. Centrex services provided by some carriers and carriage service providers may apply tones with different cadences in some circumstances. The particular carrier/carriage service provider should be consulted for further information.

Note 2: The receiving tolerances applicable to the tone parameters at the network boundary are as follows:

(a) Frequency tolerances: ± 20%; and
(b) Cadence tolerances: ± 20%;

Note 3: The power levels of service tones at the network boundary vary in the range shown above.

Note 4: This range of levels for Preanswer Tones relates to those originating in the Public Telecommunications Network. Preanswer Tones generated in distant CE and transmitted across the Telecommunications Network may be outside this range.

Note 5: * = amplitude modulated > 90%. An upper limit is not specified.
+ = A combined tone of the indicated frequencies.

Note 6: Subscriber Trunk Dialling (STD) is the facility by which the customer can dial national trunk calls directly.

APPENDIX

B CE FOR EXCLUSIVE USE WITH CSS

B1 CE with message wait indicator

Some CSS may use a higher voltage, applied from an extension port in the OFF-LINE state, as a signalling state. CE capable of detecting this signal should have the following:

(a) An insulation resistance of not less than 30 kΩ, when tested with 100 V d.c. applied with either polarity.

(b) Markings which clearly indicate that the CE may only be connected to the extension ports of a CSS.

Note: CE complying with these requirements may need to comply with additional Message Wait Indicator requirements individual to a CSS to ensure interoperability. The relevant CSS supplier should be consulted.

Compliance should be checked by measuring the DC resistance between the line conductors and inspection as appropriate.

APPENDIX

C AUTOMATIC STUTTER DIAL TONE DETECTION

C1 General

C.1.1 Line seizure for stutter dial tone detection

CE may automatically seize the line to detect the presence or absence of stutter dial tone for the purposes of message wait indication. Where CE performs this function it **shall** do so in accordance with the requirements of this Appendix.

C.1.2 Conditions for automatic stutter dial tone detection

CE **shall** perform automatic stutter dial tone detection under one or more of the following conditions:

(a) Perform periodic stutter dial tone detection in accordance with Clause C3.

(b) Go ON-LINE to test for stutter dial tone no more than once after a customer completes a call (outgoing or incoming), and commence the check no earlier than 15 s after the PSTN line has been released.

(c) Provided the visual message indicator is currently inactive, the CE may go ON-LINE once to test for stutter dial tone after an unanswered call not less than 5 min after the cessation of the incoming ringing signal.

C2 Tone detection

C.2.1 Maximum duration

When performing an automatic stutter dial tone detection the CE **shall** seize the line for a maximum duration of 4.0 s to test for stutter dial tone.

Note: PSTN service tone characteristics are described in Appendix A.

C.2.2 Parallel connected CE

C.2.2.1 The CE **shall** incorporate a means of detecting line seizure by parallel connected CE such that only a single line seizure occurs when a stutter dial tone test is performed.

C.2.2.2 The CE should incorporate a means of detecting line seizure by parallel connected CE so that only a single CE automatically seizes the line to test for stutter dial tone. When initially configured for automatic stutter dial tone testing, multiple CE may seize the line for the first periodic detection interval but should not do so during subsequent detection intervals.

C.2.3 Ability to initiate a call

During an automatic stutter dial test, CE **shall not** prevent a customer who is attempting to initiate an outgoing call from receiving dial tone and being able to initiate that call.

Note: When this condition is detected, stutter dial tone detecting CE is required to remove its DC loop so as to allow another CE to initiate a call attempt.

C.2.4 Compliance with onhook requirements

Between automatic stutter dial tone detections, the CE **shall** comply with the onhook requirements of Clause 5.1.5.

C.2.5 Provision of a voice path

During automatic stutter dial tone detection tests, the CE **shall not** automatically provide a voice path to the exchange line except as required by Clause C2.3.

C3 Periodic automatic stutter dial tone detection

CE which performs periodic automatic stutter dial tone detection **shall**—

(a) perform the periodic stutter dial tone test no more than six times in 24 hours; and

(b) ensure that any periodic tests performed are independent of the time of day.

C4 Ring detection

The CE **shall not** automatically seize the line for stutter dial tone detection if incoming ring is present on the line.

APPENDIX

D DISTINCTIVE RING

D1 PSTN distinctive ring signal characteristics

Distinctive Ring is a feature that provides the capability of associating a differing ring cadence with a particular type of incoming call. The Distinctive Ring is the mechanism used to indicate to the user that he/she is receiving a particular type of incoming call.

Note: The Distinctive Ring signals described in Appendix D are those provided by Telstra. Consult other carriers for possible variations.

D2 Distinctive Ring features

D.2.1 List of features

Distinctive Ring is associated with the following features:

Normal Ring	(DR0)	used as the default for all calls.
Distinctive Ring 1	(DR1)	used for calls that have been Call Forwarded in both the PSTN and Centrex environment.
Distinctive Ring 2	(DR2)	used for Recalled Calls and Operator Service Calls and for Selective Ring Feature in both the PSTN and Centrex environment.
Distinctive Ring 3	(DR3)	used for Multiple Subscriber Number (MSN) within the PSTN and Centrex environment.
Distinctive Ring 4	(DR4)	used for the Selective Ring Feature in the PSTN environment and for calls within a Centrex Group and a Closed User Group.
Distinctive Ring 5	(DR5)	used for the Selective Ring Feature in both the PSTN and Centrex environment.
Distinctive Ring 6	(DR6)	used for a second MSN within the PSTN and Centrex environment.
Distinctive Ring 7	(DR7)	used for Data Privacy and Data Service facilities and/or for a third MSN.

Note: The terms used for the features listed above are related to their network functionality. For marketing purposes a different name will be used.

D.2.2 Prioritisation of Distinctive Rings

Where the combination of call types that provide Distinctive Ring to the user would result in multiple simultaneous Distinctive Rings being provided, the Distinctive Ring for the type of call that has the highest priority (as indicated below) will be that which is actually delivered.

D.2.3 List of priorities

In the following list, Priority 1 is considered to be the highest, while Priority 7 is the lowest.

Priority 1	Data Privacy Facility
Priority 2	Selective Ring Service
Priority 3	Multiple Subscriber Number
Priority 4	Call Forwarded Calls Call Forwarded Unconditional Call Forwarding on Busy Call Forwarding on No Reply Call Forwarding Timed Selective Call Forwarding
Priority 5	Recall and Operator Calls Recall of Call Completion to Busy Subscriber Recall of Call Completion on No Reply All Recalls to Attendant Recall on Call Park Recall on Call Transfer to Ring Recall on Call Transfer to Busy Operator Calls (indicated by special category) Alarm Call
Priority 6	Call within a Centrex Group and a Closed User Group
Priority 7	Normal Ring (this is the default ring)

TABLE D1 6

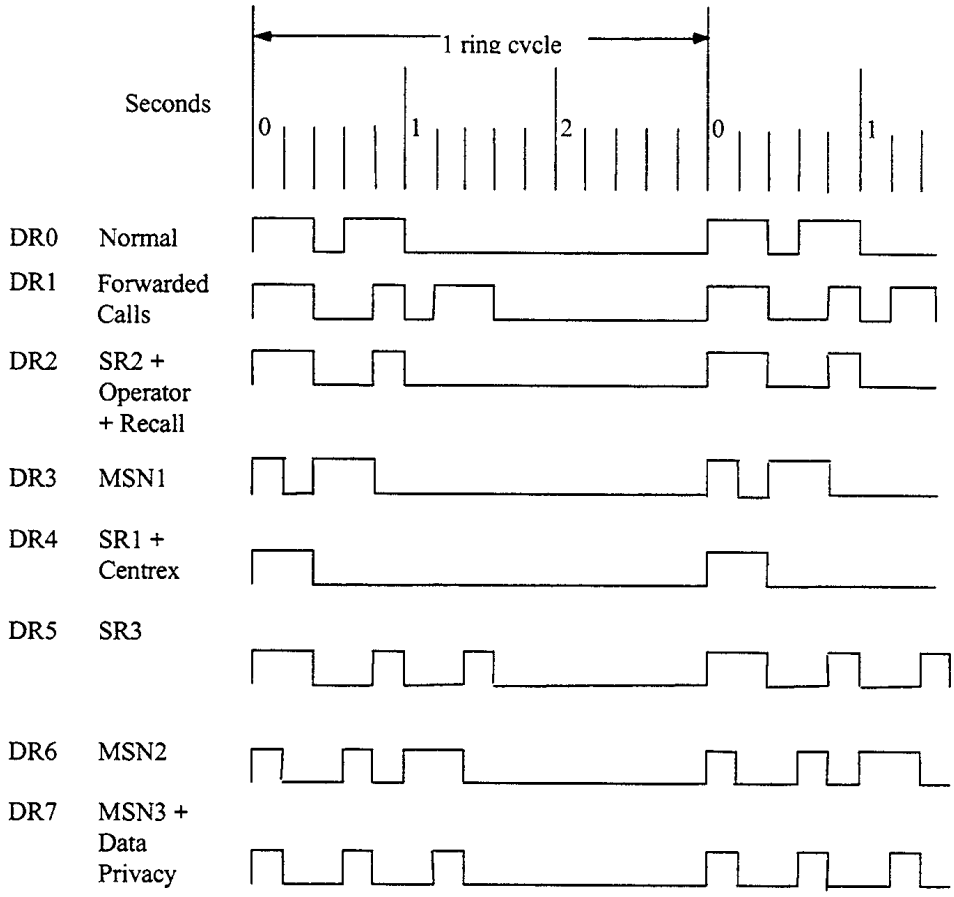
Distinctive ring applications

Call	Type	DR 0	DR 1	DR 2	DR 3	DR 4	DR 5	DR 6	DR 7
Data Privacy	Fax & Data								X
Selective Ring	Public			SR 2		SR 1	SR 3		
	Centrex			SR 2		SR 1	SR 3		
Call Forwarding	Public		X						
	Centrex		X						
MSN	Public				N 1			N 2	N 3
	Centrex				N 1			N 2	N 3
Recall & Operator	Public			X					
	Centrex			X					
Internal Centrex and CUG						X			
Normal Calls		X							

Note: Table E1 summarises the above information
CUG Closed User Group
MSN Multiple Subscriber Number
N Number
SR Selective Ring

D.2.4 Cadences

Figure D1 shows the cadences for the eight ring patterns. All Ring and Silent Interval durations are in multiples of 200 ms. The cycle time for all cadences is 3 s.



Note 1: The Distinctive Ring signals described in this diagram are those provided by Telstra. Consult other carriers for possible variations.

Note 2: The diagram does not show the initial (immediate) burst of ring (Early Guard) which precedes the modem transmission (if required for Calling Line Identity Presentation) and these ring cadences. The duration of this initial burst can be in the range 400 ms to 800 ms at some exchanges where Distinctive Ring is implemented. If no modem transmission is required, there will be at least a 200 ms silent interval between the Early Guard and the first burst in the ring cadence.

FIGURE D1
Distinctive ring cadences

PARTICIPANTS

The Working Committee responsible for the revisions made to this Standard consisted of the following organisations:

Organisation	Membership
Australian Communications and Media Authority	Non-voting
Comtest Laboratories	Voting
Cisco Systems	Voting
NEC Australia	Non-voting
Telstra	Voting
Thomson Telecom Australia	Voting
Trillium Communications	Voting

This Working Committee was chaired by Mike Johns of Communication Alliance, who also provided project management support.

Communications Alliance was formed in 2006 to provide a unified voice for the Australian communications industry and to lead it into the next generation of converging networks, technologies and services.

In pursuing its goals, Communications Alliance offers a forum for the industry to make coherent and constructive contributions to policy development and debate.

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