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AUSTRALIAN STANDARD

AS/CA S003.2:2010

Requirements for Customer Access Equipment for connection to a Telecommunications Network —

Part 2: Analogue and TDM based technologies

Adopted for regulatory purposes

Australian Standard – *Requirements for Customer Access Equipment for connection to a Telecommunications Network — Part 2: Analogue and TDM based technologies*

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FOREWORD

General

This Standard was prepared by the Communications Alliance WC20 : ***Customer Access 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.

This Standard is a revision of the AS/ACIF S003:2005 and AS/ACIF S003:2008 *Customer Access Equipment for connection to a Telecommunications Network* Standards. This Standard is the result of a consensus among representatives on the Communications Alliance Working Committee to produce it as an Australian Standard.

The designation of this Standard has been changed from AS/ACIF to AS/CA to reflect that the Standard has been published by Communications Alliance as an accredited Standards Development Organisation.

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 or other Parts of this Standard.

Part 2 of this Standard should be read in conjunction with AS/CA S003.1 [3].

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Regulatory notice

This document has been made by ACMA as Telecommunications Technical Standard AS/CA S003.2–2010 under s376 of the *Telecommunications Act 1997*.

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

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 ACMA below at:

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Introduction

This introduction for the AS/CA S003.2 ***Requirements for Customer Access Equipment for connection to a Telecommunications Network — Part 2: Analogue and TDM based technologies*** 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.

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 that provides access (gateway functions) to a Telecommunications Network in order to meet the regulatory arrangements for such equipment in Australia. The objective of Part 2 of this Standard is to provide requirements specifically for analogue and PCM-based TDM (Pulse Code Modulation-based Time Division Multiplexing) technologies, but not including packet or cell based technologies.

The objective of this revision is to divide the requirements for customer equipment that provides access (gateway functions) into technology specific Parts. The separation of requirements into Part 2 facilitates compliance of—

(i) modified Customer Access Equipment (CAE) that complied with the requirements for AS/ACIF S003:2005; and

(ii) new CAE that uses analogue and PCM-based TDM technologies.

The principal differences between this edition of AS/CA S003.2 and the 2005 edition of AS/ACIF S003 are the following:

(a) The transmission requirements that are specific to analogue and PCM-based TDM technologies, that were previously found in AS/ACIF S003:2005, have been included in AS/CA S003.2.

(b) A preferred loss plan (relative levels +3 dBr / –9 dBr) and an alternate loss plan (relative levels 0 dBr / –6 dBr) have been included to assist compliance when analogue or PCM-based TDM technology CE complying with an earlier Standard is being modified or upgraded but does not introduce packet or cell based technology.

(c) Figures for 'Attenuation/Frequency distortion', 'Variation of gain with level' and 'Signal to total distortion limits' masks have been relaxed from the ES 201 168 figures to allow for consistency of the requirement with previous editions of the Standard.

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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 '**. 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.

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].

1.7 Parts of Standards

Customer Equipment (CE) scoped by this Standard is to comply with requirements in Part 1 and the applicable technology-specific Part of this Standard.

2 SCOPE

2.1 This Standard applies to Customer Equipment (CE) that is—

(a) using analogue and/or PCM based TDM technologies to accomplish any port interconnection;

(b) not using any packet based technologies, or having interfaces to packet based networks;

(c) designed with multiple ports (local or network) that provides or is intended to provide access (gateway functions) to a Telecommunications Network; and

(d) capable of switching, storage, processing, conversion, integration, line isolation/coupling or multiplexing of analogue or digital voice or voice equivalent communication.

Note: CE incorporating Asynchronous Transfer Mode (ATM) technologies are not within the scope of Part 2 of this Standard. Part 3 is applicable to CE incorporating these technologies

2.2 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.

3 REFERENCES

	Publication	Title
	Australian Standards	
[1]	AS ISO 1000-1998	The international System of Unit (SI) and its application
	AS/ACIF and AS/CA Standards	
[2]	AS/ACIF S002:2005	Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network
[3]	AS/CA S003.1:2010	Customer Access Equipment for connection to a Telecommunications Network Part 1: General
[4]	AS/ACIF S004:2008	Voice frequency performance requirements for Customer Equipment
	ITU-T Recommendations	
[5]	P.10/G.100 (07/06)	Vocabulary and effects of transmission parameters on customer opinion of transmission quality (Series P) International telephone connections and circuits – General definitions (Series G)
[6]	G.223 (11/01)	Assumptions for the calculations of noise on hypothetical reference circuits for telephony
[7]	G.703: 1991	Physical/electrical characteristics of hierarchical digital interfaces
[8]	G.711 (11/88)	Pulse code modulation (PCM) of voice frequencies
[9]	I.430 (11/95)	Basic user-network interface - Layer 1 specification
[10]	O.41 (10/94)	Psophometer for use on telephone type circuits
[11]	O.71 (11/88)	Impulsive noise measuring equipment for telephone type circuits
[12]	O.81 (11/88)	Group-delay measuring equipment for telephone-type circuits

4 ABBREVIATIONS AND DEFINITIONS

For the purposes of this Standard, the following abbreviations and definitions and those of Part 1 apply:

4.1 Abbreviations

AC	Alternating Current
ACIF	Australian Communications Industry Forum
ACMA	Australian Communications and Media Authority
AGC	Automatic Gain Control
AS	Australian Standard
CAE	Customer Access Equipment
CE	Customer Equipment
CSS	Customer Switching System(s)
DC	Direct Current
IAD	Integrated Access Device
ISDN	Integrated Services Digital Network
ISO	International Standardization Organization
LCL	Longitudinal Conversion Loss
LCTL	Longitudinal Conversion Transfer Loss
NZS	New Zealand Standard
PCM	Pulse Code Modulation
PSTN	Public Switched Telephone Network
TBRL	Terminal Balance Return Loss
TCL	Transverse Conversion Loss
TCTL	Transverse Conversion Transfer Loss
TDM	Time Division Multiplexing
VF	Voice Frequency

4.2 Definitions

4.2.1 Carriage Service Provider

Refer to the *Telecommunications Act 1997*.

4.2.2 Carrier

Refer to the *Telecommunications Act 1997*.

4.2.3 Customer Access Equipment (CAE)

CE with multiple ports (local or network) that provides access (gateway functions) to a Telecommunications Network and is capable of switching, storage, processing, conversion, integration, line isolation/coupling or multiplexing of analogue or digital voice or voice equivalent communication.

Note: Examples of CAE include, but are not limited to, PABX or Key Systems, line isolators, ISDN terminal adapters, echo cancellers, interactive voice response systems, voice/packet gateway, IAD and voice messaging systems.

4.2.4 Customer Equipment (CE)

Refer to the *Telecommunications Act 1997*.

4.2.5 Customer Switching System (CSS)

See Customer Access Equipment

4.2.6 Exchange line

See Network Port

4.2.7 Extension line

See Local Port (On Premises).

4.2.8 External extension

See Local Port (Off Premises).

4.2.9 Integrated Access Devices (IAD)

A device that aggregates multiple channels, (voice or voice equivalent, with data), for transport to a telecommunications network via one or more transmission paths.

Note: IADs may use DSL, ATM, optical or other means of connection.

4.2.10 Local Port (Off Premises)

A port on a CAE that is capable of supporting terminating CE over a connecting link outside a building cabling environment; a carrier or carriage service provider may provide part of the link or it may be wholly provided by the customer.

Note 1: A local port may be directly provided by a CAE or indirectly by system integral equipment.

Note 2: Also see Table E1 in Appendix E in AS/CA S003.1[3] for international port abbreviations.

4.2.11 Local Port (On Premises)

A port on a CAE that is capable of supporting terminating CE over a connecting link within a building-cabling environment.

Note 1: A local port may be directly provided by a CAE or indirectly by system integral equipment.

Note 2: Also see Table E1 in Appendix E in AS/CA S003.1[3] for international port abbreviations.

4.2.12 Network Port

A port on a CAE that is capable of connection to a Telecommunications Network Service.

Note: Also see Table E1 in Appendix E in AS/CA S003.1[3] for international port abbreviations.

4.2.13 Network Port (Four wire E&M)

A Network Port for connection to a PSTN or CE that presents a 6-wire analogue interface. Four wires are used for the voice path. Two wires are used as separate E & M signalling leads.

4.2.14 Network Port (Indial)

A Network Port with the ability to accept address signals from the PSTN/ISDN.

4.2.15 Network Port (Loop-in)

A unidirectional call set-up port (set-up from the PSTN to a CAE) that is seized by application of a DC loop at the PSTN exchange.

4.2.16 Network Port (Ring-in/Loop-out)

A bothway call set-up port. Incoming signalling to CE is by application of a ring signal at the PSTN exchange. Outgoing signalling from CE is by application of a DC loop at the CE.

4.2.17 Point of zero relative level (0 dBr point)

A particular place within a transmission path chosen for reference and calculation purposes (also called the '0 dBr point'). ITU-T Recommendation G.223 [6] defines a 0 dBr point as a point where the long term average speech level per subscriber in an individual VF channel is –15 dBm.

4.2.18 Port

An interface to equipment for the purpose of supplying an output signal and/or accepting an input signal.

4.2.19 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.

4.2.20 Standard telephone instrument

CE, or part thereof, for analogue two-wire voice communication to which the requirements of AS/ACIF S002 [2] and AS/ACIF S004 [4] apply where both initiation and termination of the call is under user control.

Note: Address signalling is provided by either loop-disconnect decadic signalling or by dual-tone multifrequency (DTMF) signalling, under direct user control or by user initiation of stored numbers.

4.2.21 Telecommunications Network

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

4.2.22 Test Access Point (TAP)

Break access test points in the transmission path through the CAE equipment.

4.2.23 Tie Line Port

A Network Port for the interconnection of CAE.

Note: Also see Table E1 in Appendix E in AS/CA S003.1[3] for international port abbreviations.

4.2.24 Voice Frequency (VF)

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

4.2.25 Voiceband

Voiceband is a general term that may include frequencies from 200 Hz to 4.0 kHz.

5 REQUIREMENTS

5.1 General

5.1.1 Applicability

The requirements of Clause 5.1 apply to each direction of the full duplex transmission paths for CE which has provision for one or more of the following:

(a) The connection of other CE (Ring-in/Loop out).

(b) The transit switching of telephone calls in any call connection combinations shown in Tables 1 and 2.

Note 1: Transmission parameters for local port to local port connections are recommendations only and need not be tested.

Note 2: Transmission parameters for a local port that is considered to be proprietary (i.e. for the connection of analogue system integral equipment only), that is not compliant with the requirements of Clause 5.3 of AS/CA S003.1 [3] (and therefore not suitable for the connection of CE that is compliant with the requirements of AS/ACIF S002 [2]) are recommendations only and need not be tested.

Compliance with Clause 5.5.1 should be checked using the test set-up as indicated in Clause 6.6.2.

5.1.2 Test frequency

The test tone frequency unless otherwise stated in this Standard, is nominally 1000 Hz (1004 Hz to 1020 Hz).

5.1.3 Test level

The test tone level unless otherwise stated in this Standard is –10 dBm0.

5.1.4 DC test current

For all analogue ports, the DC current for testing purposes **shall** be determined by the range of terminations shown in Table 3 of AS/CA S003.1[3].

5.1.5 Port impedances

For all analogue ports, the nominal impedance of the transmission test access points and their associated balance networks in a four-wire CE or a two-wire CE incorporating four-wire amplified loops, is to be according to Figure 2 and Table 4 of AS/CA S003.1[3]. The actual impedances of the CE ports are to comply with the return loss requirements of Clause 5.5.1.2 of AS/CA S003.1 [3]. It is preferable that the nominal impedance be maintained at the local port during call set-up and clearing. However, if a break in the DC loop is required then a reactive impedance corresponding to at least 68 nF **shall** be maintained.

5.1.6 Complex impedance power

For analogue ports, the measurement of the power into a complex impedance is to be in accordance ITU–T Recommendation G.101 [5].

5.1.7 Digital port equivalent power

For digital ports, the equivalent power levels are to be defined with respect to the analogue port of a test codec, or a digital equivalent, complying with ITU-T Recommendation G.711 [8] A-law at a digital access point.

5.2 Test Access Points (TAPs)

Provision of TAPs assist in laboratory testing of the switchblock/transmission paths and more importantly, provide standard test points for initial line-up and testing of local and network ports. Figure 3 depicts the arrangement of switchblock/transmission paths and TAPs in a CE.

5.3 Switchblock/Transmission path performance

5.3.1 General

The Relative Levels assigned by public network carriers/carriage service providers for CE connected to analogue 2-wire PSTN are +3 dBr Sending, and –9 dBr Receiving. These Relative Levels take account of the fixed 6 dB inter-exchange loss and the nominal 3 dB (average) customer access network loss.

5.3.2 Loss plans

5.3.2.1 Loss plan options

For the purpose of assisting compliance when CE complying with an earlier Standard is being modified or upgraded, two Loss Plan options are provided in this Standard. These are set out in Table 1 (the +3/–9 Loss Plan) and Table 2 (the 0/–6Loss Plan). Either of these two Loss Plans is acceptable. However, the use of the 0/–6 Loss Plan may lead to some user issues (see Note 1 to Table 2) and therefore the +3/–9 Loss Plan is the preferred option wherever possible.

Note: The implementation of the +3/–9 Loss Plan will result in improved end to end performance when there is digital interconnection between CE compliant to Parts 2 and 3 of this Standard.

5.3.2.2 Loss plan selection

Nominal Relative Levels are assigned as shown in Tables 1 and 2 for the selected Loss Plan.

(a) These levels **shall** be used as the reference for all transmission measurements.

(b) The tolerance for Relative Levels in Tables 1 and 2 is +/–0.7dB.

(c) A Loss Plan combining selected values from Tables 1 and 2 **shall not** be implemented for CE.

(d) The Supplier **shall**—

(i) advise the Test House which Loss Plan is to be used for test purposes; and

(ii) state in the CE documentation which Loss Plan (or Loss Plans if more than one) is implemented.

Note: These levels are used to relate specifications expressed in units of dBm0 and measured values expressed in units of dBm. The relationship between dBr, dBm0 and dBm is dBm = dBm0 + dBr.

Compliance with Clause 5.3.2 should be checked by using the test set up as indicated by Clause 6.6.2.

Table 1

Relative levels (dBr) and nominal composite loss (dB)
+3/–9 Loss Plan (Preferred)

		B		
		Standard analogue Local Port	**Analogue Network Port two-wire**	**Analogue/Digital Network Port four-wire**
	Input relative levels (dBr)	(+3) (Note 3)	(–9) (Note 3)	(0) (Notes 1, 2, 3)
A	**Standard analogue Local Port**	12	0 to 1.2 (Note 3)	3/9 (Notes 3, 4)
	Analogue Network Port two-wire (Note 1)	0 to 1.2 (Note 3)	(Notes 5, 7)	–9 / 0 (Notes 4, 5, 6, 7)
	Analogue/Digital Network Port four-wire (Note 2)	9/3 (Notes 3, 4)	–3 / –9 (Notes 4, 5, 6, 7)	0/0 (Notes 3, 4)

Note 1: The nominal relative level of a 192 kbit/s ITU-T Recommendation I.430 [9] interface is 0 dBr.

Note 2: The nominal relative level of a 2048 kbit/s ITU-T Recommendation G.703 [7] interface is 0 dBr.

Note 3: The shaded areas indicate the mandatory Relative Levels and Composite Loss values. All other entries are recommended design values.

Note 4: Composite loss A to B/Composite loss B to A.

Note 5: 2-wire Analogue Network to 2-wire Analogue Network gain/loss is to comply with the requirements of AS/ACIF S002 [2] for Automatic Call Transfer Equipment (ACTE). It may not always be possible to obtain satisfactory end-to-end transmission performance using two-wire analogue interfaces. In such cases, the use of a digital switched Telecommunications Network access will provide an improved (zero interconnect loss) performance.

Note 6: Within the Table, nominal composite gain values are shown with a negative sign (–).

Note 7: Loop stability is to be maintained for all transit call connections.

Table 2

Relative levels (dBr) and nominal composite loss (dB) 0/–6 Loss Plan (Not Preferred)

		B		
		Standard analogue Local Port	**Analogue Network Port two-wire**	**Analogue/Digital Network Port four-wire** (Note 1)
	Input relative levels (dBr)	(0) (Note 5)	(–6) (Note 5)	(0) (Notes 3, 4, 5)
A	**Standard analogue Local Port**	6	0 to 1.2 (Note 5)	0/ 6 (Notes 3, 4, 5
	Analogue Network Port two-wire (Note 1)	0 to 1.2 (Note 5)	(Notes 7, 9)	–6 / 0 (Notes 5, 6, 8, 9)
	Analogue/Digital Network Port four-wire (Note 2)	6/ 0 (Notes 5, 6)	0 / –6 (Notes 5, 6, 8, 9)	0/0 (Notes 5,6)

Note 1: The use of this Loss Plan may result in distant user echo, network overloading and end to end inband information transfer difficulties when connected to analogue or digital 4-wire access lines. The use of Table 1 is recommended for CE using analogue or digital 4-wire access lines.

Note 2: Where the CAE is installed on long analogue two wire lines, a gain of up to 3 dB may be provided in the CE or private network (see Clause 5.3.3(b) for further information). However, the use of Table 1 is recommended in these cases.

Note 3: The nominal relative level of a 2048 kbit/s ITU-T Recommendation G.703 [7] interface is 0 dBr.

Note 4: The nominal relative level of a 192 kbit/s ITU-T Recommendation I.430 [9] interface is 0 dBr.

Note 5: The shaded areas indicate the mandatory Relative Levels and Composite Loss values. All other entries are recommended design values.

Note 6: Composite loss A to B/Composite loss B to A.

Note 7: Exchange to exchange gain/loss is to comply with the requirements of AS/ACIF S002 [2] for Automatic Call Transfer Equipment (ACTE). It may not always be possible to obtain satisfactory end-to-end transmission performance using two-wire analogue interfaces. In such cases, the use of a digital switched Telecommunications Network access will provide an improved (zero interconnect loss) performance.

Note 8: Within the Table, nominal composite gain values are shown with a negative sign (–).

Note 9: Loop stability is to be maintained for all transit call connections.

5.3.3 Composite loss

Composite loss **shall** comply with the mandatory values in Tables 1 or 2 as appropriate for the selected Loss Plan option.

(a) Conference and Operator Intrusion: for conference calls involving more than two external lines (Local Ports [Off Premises] or Network Ports) the requirements of Appendix E of AS/CA S003.1[3] apply. For all other conference calls, loss additional to the upper limits specified in Tables 1 or 2 as appropriate, is permitted as follows:

(i) When the operator enters a call connection, an extra loss of up to—

(A) 0.3 dB when the operator listens only; or

(B) 3.5 dB when the operator speaks.

(ii) For any call connection in a conference configuration, an extra loss of up to 9 dB is allowed.

(b) Use of amplification to offset insertion loss is subject to the following conditions:

(i) The call connection **shall** be unconditionally stable with all ports terminated with the appropriate impedances given in Table 4 of AS/CA S003.1[3], i.e. balance network as well as with open and short circuit terminations.

(ii) For CE that can be used to support a call path using the public network, the use of voice switching techniques for that path **shall not** be permitted, except during voice conferencing and diversion.

Note 1: The return path of the four-wire connection may be opened or inhibited during tests for composite loss.

Note 2: The definition of composite loss is given in ITU-T Recommendation P.10/G.100 (07/06) [5].

Compliance with Clause 5.3.3 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.4 Loss/Frequency distortion

Loss/Frequency Distortion with respect to the loss at 1000 Hz (nominal) **shall** be within the limits of Figure 4.

Compliance with Clause 5.3.4 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.5 Non-linear distortion (variation of gain with input level)

The gain for a sine-wave signal in the frequency range 700 to 1100 Hz applied to the input port of a call connection at a level between –55 and +3 dBm0, relative to the gain at an input level of –10 dBm0, **shall** be within the limits of Figure 5.

Compliance with Clause 5.3.5 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.6 Absolute delay and delay distortion

5.3.6.1 Absolute delay

The absolute delay should not exceed 1950 μs.

Note: Absolute delay refers to the minimum delay measured in the frequency band 500 Hz to 2800 Hz in one transmission direction. Absolute delay is identical to the One-way Propagation Time. For switching systems the One-way Propagation Time includes times due to electronic devices such as frame aligners and time stages of the switching matrix but does not include times due to ancillary functions such as echo suppression or echo cancellation.

5.3.6.2 Delay distortion

The delay distortion of the call connection should not exceed 1950 μs.

Compliance with Clause 5.3.6 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.7 Signal-to-total-distortion limits

5.3.7.1 Variation with input level

The psophometrically weighted signal-to-total-distortion ratio (including harmonic distortion and quantising distortion), **shall** comply with the requirements of Figure 6 when using a 1000 Hz (nominal) test signal with levels in the range –45 to 0 dBm0.

5.3.7.2 Fixed input level

The signal-to-total-distortion ratio as defined above **shall** be greater than 26 dB when using a 400 Hz, 0 dBm0 test signal.

Compliance with Clause 5.3.7 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.8 Intermodulation products

CE **shall not** produce any $2f_1 – f_2$ (or $2f_2 – f_1$) intermodulation product having a level greater than 35 dB below the lower power level of either output signal when measured using two superimposed sine-wave signals (denoted as the fundamental frequencies f_1 and f_2) each in the range 450 Hz to 2050 Hz (but not harmonically related), and of equal level in the range –21 dBm0 to –4 dBm0.

Compliance with Clause 5.3.8 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.9 Crosstalk

The level measured at the TAP of any one call connection **shall not** be greater than –67 dBm0 when a 0 dBm0, 1000 Hz signal is applied at the TAP of any other call connection.

Compliance with Clause 5.3.9 should be checked by using the test set up as indicated in Clause 6.6.13.

5.3.10 Crosstalk via service tone connections

Any two test connections connected to a common service or intrusion tone generator, the signal-to-crosstalk ratio, measured with disturbing and disturbed circuits terminated **shall** be greater than 65 dB for tones transmitted during conversation periods (e.g. Intrusion Tone, Offer Tone) and 55 dB for other tones.

Note 1: A service or intrusion tone test connection may or may not involve a through call connection within the CE. In cases where a through call connection exists, the distant ends are to be terminated in the relevant impedances specified in Table 4 of AS/CA S003.1[3], i.e. the balance impedance at the distant end.

Note 2: Measurements of return loss and crosstalk may be made with the tone generator turned on, using a selective level meter, provided adequate rejection of the service tone signal is achieved (to allow reliable readings at the measurement frequency).

Compliance with Clause 5.3.10 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.11 Noise performance

The following requirements apply to any test call connection, terminated at the input port with terminating impedance as specified in Table 4 of AS/CA S003.1[3] and terminated at the output port in 600 Ω:

(a) Mean noise power

The mean noise power **shall not** exceed—

(i) –65 dBm0p, measured using a psophometer weighted in accordance with ITU-T Recommendation O.41 [10]; and

(ii) –40 dBm0 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, **shall not** exceed –50 dBm0.

(c) Impulsive Noise

The number of noise counts above a threshold level of –35 dBm0 **shall not** exceed five counts in 5 mins, measured using an impulsive noise counter compliant with ITU–T Recommendation O.71 [11], using the 600 Hz to 3 kHz filter described in § 3.5 therein.

Compliance with Clause 5.3.11 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.12 Spurious in-band signals

The output level at any frequency, other than the frequency of the applied signal, **shall** be less than –40 dBm0, when measured selectively (maximum 40 Hz bandwidth) in the range 300 Hz to 3400 Hz, with a sinusoidal signal in the frequency range 700 Hz to 1100 Hz, and at a level of 0 dBm0 applied to the input port of a test call connection.

Compliance with Clause 5.3.12 should be checked by using the test set up as indicated in Clause 6.6.2.

5.3.13 Spurious out-of-band signals

The level of spurious out-of-band image signals **shall** be less than –25 dBm0, when measured selectively (maximum 40 Hz bandwidth) at the output port, with a sinusoidal signal in the frequency range 300 Hz to 3300 Hz at a level of 0 dBm0 applied to the input port of a test call connection.

Compliance with Clause 5.3.13 should be checked by using the test set up as indicated in Clause 6.6.2.

6 TESTING

6.1 Verification of compliance with requirements

Compliance with all mandatory requirements in this AS/CA 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 6.6.

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.

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 Test configurations

Test configurations used should be outlined for each individual test. Test circuits other than those indicated in this Standard may be used but details of the circuits are to accompany test reports.

Note: Some tests for which no specific test configuration is provided in this Standard may be performed by inspection, as indicated in the appropriate requirements Clauses of this Standard.

6.4 Test level

Unless otherwise specified, transmission tests should be carried out with a send level of –10 dBm0 (i.e. –10 dBm at 0 dBr point).

6.5 Test frequencies

Test frequencies should be in the range of 300 Hz to 4000 Hz 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 sub-multiples of the PCM sampling rate of 8000 Hz, an offset of 3 Hz to 20 Hz should be used to reduce errors in level measurements.

6.6 Parameters to be tested

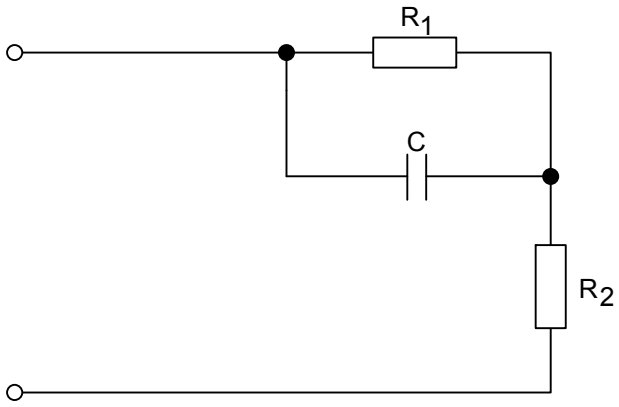
6.6.1 Testing and inspection

All requirements specified in this Standard, applicable to the particular CE, should be verified by testing or inspection, as appropriate.

6.6.2 Transmission measurements

6.6.2.1 The transmission requirements should be measured between representative samples of all available port types. Transmission tests should be performed using the circuit of Figure 12 of AS/CA S003.1 [3] as a guide. The values of V–, $R_{NETWORK}$ and R_{LOCAL} should be the minimum, maximum, and mid-range values selected from Table 3 of AS/CA S003.1 [3].

6.6.2.2 When performing return loss measurements, the return path of the four wire circuit in the call connection should be opened. To enable testing, instructions should be provided with the CE equipment to indicate the method of opening this return path. If the return path is not readily accessible then the far end of the test call connection should be terminated with the appropriate impedance given in Table 3 of AS/CA S003.1 [3], i.e. far end balance network, to achieve maximum semi-loop loss.



R1 = 820 Ω ± 0.1%

R2 = 220 Ω ± 0.1%

C = 115nF ± 0.1% or 120nF ± 0.1%

Figure 1

Reference impedance (TN12) for impedance measurement

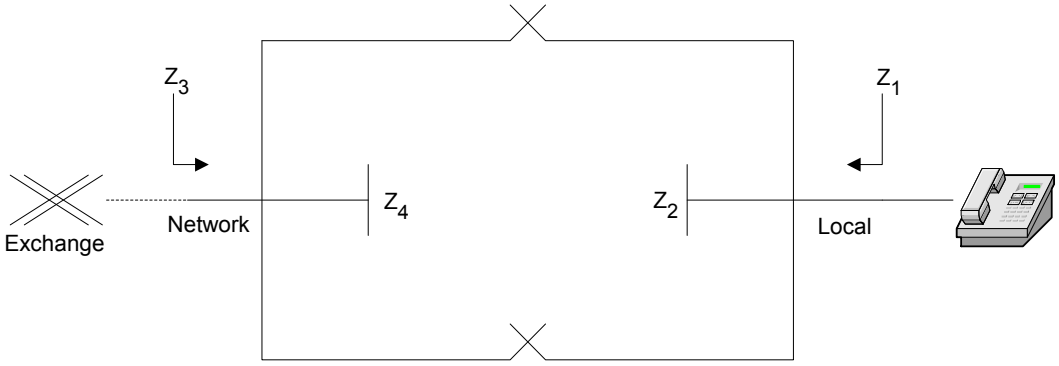
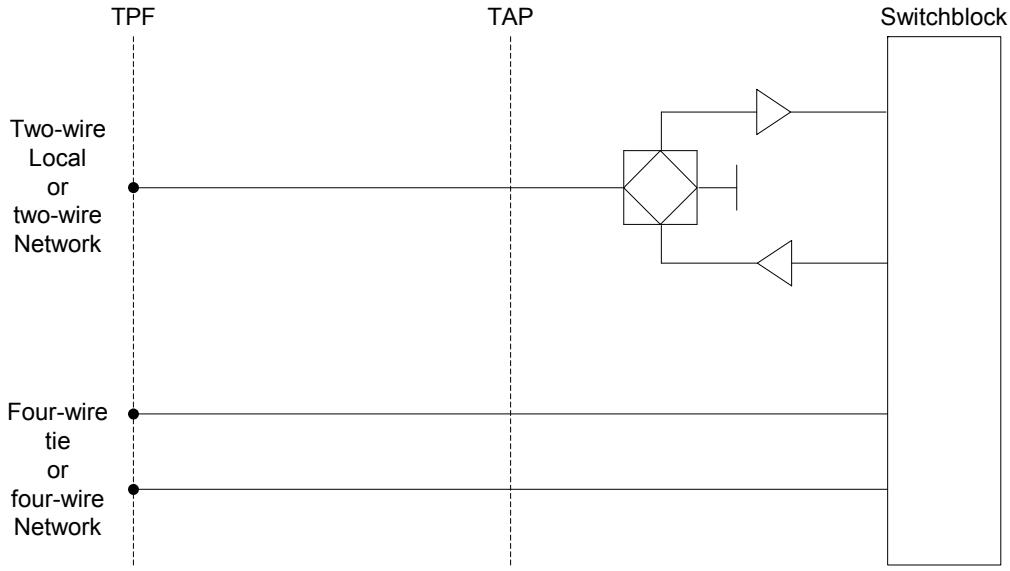


Figure 2

Designation of port impedance



TPF Test Point Frame
TAP Test Access Point

Figure 3

CE Test Access Points TAPs

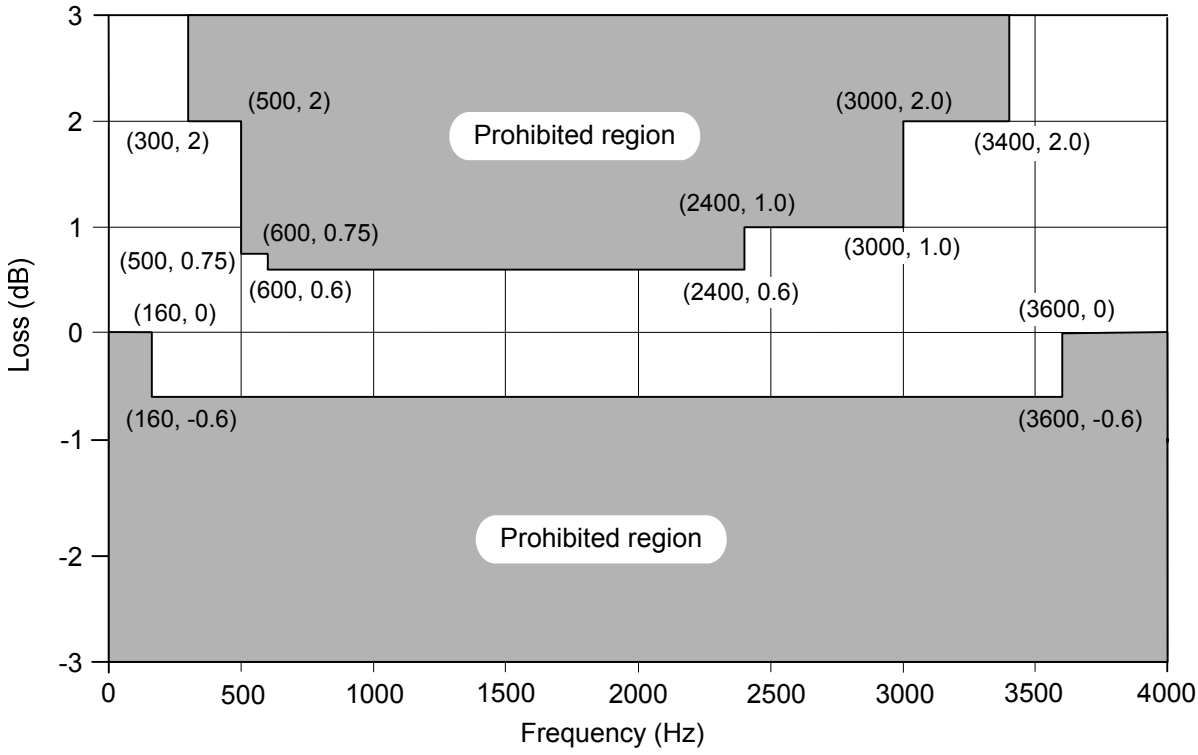


Figure 4

Loss/Frequency distortion

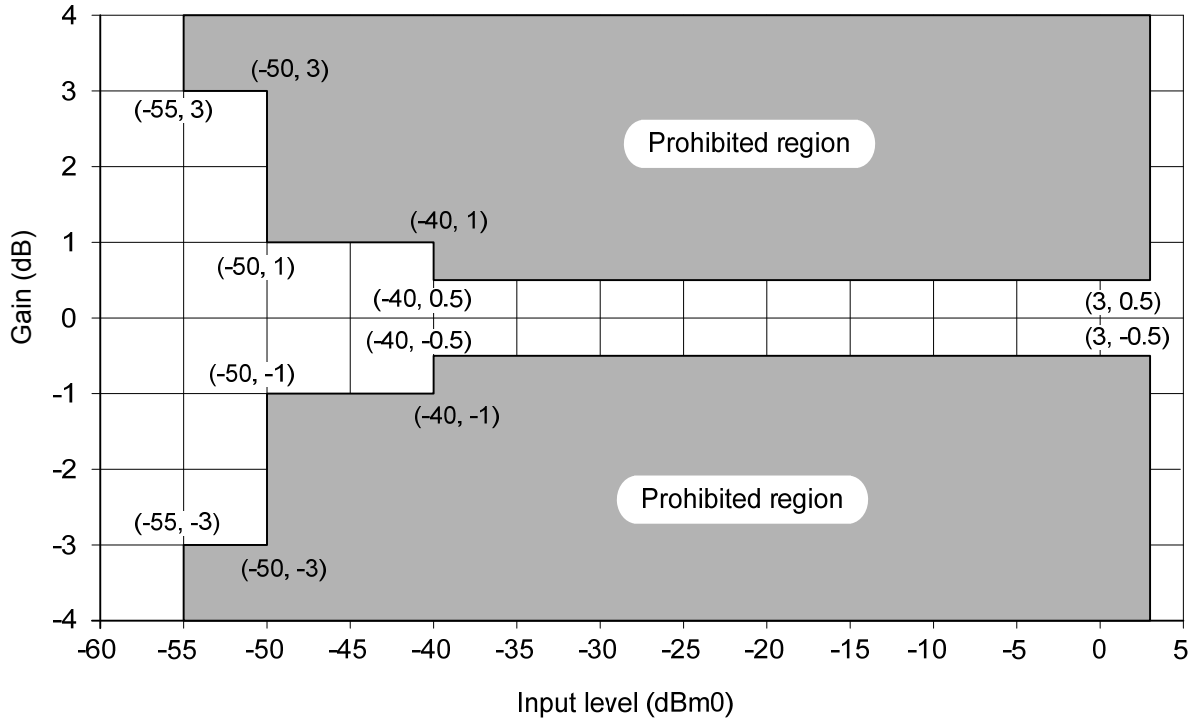


Figure 5

Variation of gain with level

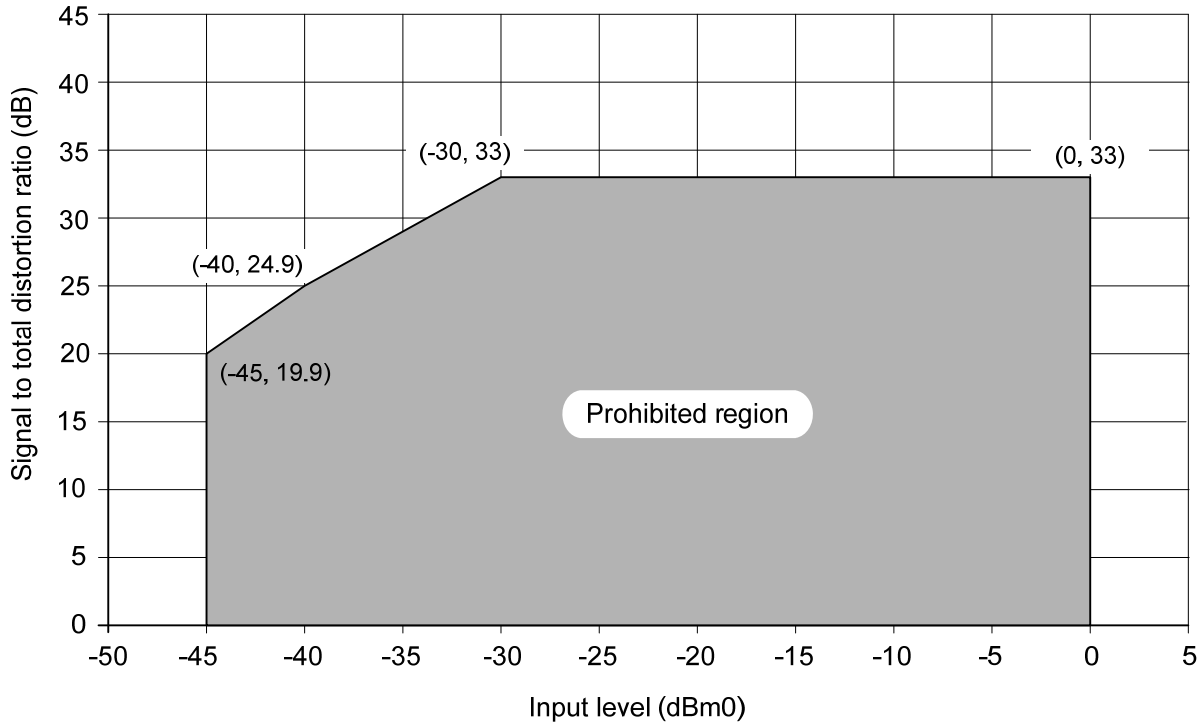


Figure 6

Signal to total distortion limits

PARTICIPANTS

The Working Committee that developed this Standard consisted of the following organisations:

Organisation	**Membership**
ACMA	Non-Voting
Comtest Laboratories	Voting
NEC	Voting
Optus	Voting
Telstra	Voting
Testing & Certification Australia	Voting
Thompson Telecom Australia	Voting
Trillium Communications	Voting

This Working Committee was chaired by Laurie Collier. Mike Johns of Communications Alliance Ltd 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.

Communications Alliance seeks to facilitate open, effective and ethical competition between service providers while ensuring efficient, safe operation of networks, the provision of innovative services and the enhancement of consumer outcomes.

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