COMMUNICATIONS
ALLIANCE LTD

INDUSTRY GUIDELINE

G616:2013

ACOUSTIC SAFETY FOR TELEPHONE EQUIPMENT

Incorporating Amendment No. 1/2014

Industry Guideline — *Acoustic safety for telephone equipment*

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Disclaimers

1. This guideline deals with issues and circumstances that affect the issue of acoustic shock that are outside the Standards AS/CA S004 and AS/CA S042.1.
2. This guideline is advisory only. It does not form part of the AS/CA S004 Standard or the AS/CA S042.1 Standard and is not legally binding.
3. This guideline suggests generic steps and measures intended to help organisations reduce the risks of acoustic shock. The steps and measures set out in this guideline may not completely eliminate these risks. Organisations should seek specific advice on the risks of acoustic shock in their particular situation.
4. This document is aimed at users of telephone headsets and/or handsets, call centre management and manufacturers and suppliers of telecommunications equipment for these users.
5. Following the guidance provided by this document does not guarantee avoidance of acoustic shock. This guideline is not intended to provide a comprehensive guide to minimising the risks of acoustic shock nor to identify all factors which contribute to the risks of acoustic shock. The document is mainly concerned with office telecommunications equipment, but minimising the risks of acoustic shock is a broader occupational health and safety issue which requires a holistic assessment of the entire workplace environment.
6. Nothing in this guideline limits the Standards AS/CA S004 or AS/CA S042.1 in anyway.
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G616 GUIDELINE - AT A GLANCE	
Why the guideline has been developed?	To provide guidance in the development of equipment, workplaces and processes to reduce the risk and severity of acoustic shock. It provides advice including an optional acoustic safety specification that organisations can consult if they wish to increase the protection against acoustic shock beyond that specified in the Australian Standards AS/CA S004 or AS/CA S042.1.
Compliance	The guideline does not provide any mandatory requirements. As such compliance with G616 cannot be claimed as it is only providing guidance and is not a Standard.
Acoustic shock	Acoustic shock may occur when a person is exposed to a loud, unexpected sound from telephone equipment. The offending sound is often reported to be high-pitched. Exposure may result in a startle and/or injury which may result in long term symptoms being experienced.
Headsets, handsets & usage	The likelihood of an acoustic shock incident occurring is greater when using a headset compared to using a handset. The likelihood of an acoustic shock also increases with the amount of time a user spends on the telephone and with the number of individual calls. A residential telephone user has a very low probability of experiencing an acoustic shock incident while a call centre worker has a higher probability of experiencing an acoustic shock incident.
Sound levels, protection & speech intelligibility	The risk and severity of an acoustic shock may be reduced by limiting the maximum level of sounds to which a person can be exposed to from the telephone equipment. The lower the maximum sound level the greater the protection. However, it is not possible to have a single sound level limit that will protect all people at all times and simultaneously provide adequate speech intelligibility in all situations, such as when there are high levels of background noise.
Background noise	Maintaining a low level of background noise in the user's environment will allow the use of safer (lower) limiting levels whist maintaining adequate speech intelligibility.
Protection technology	The sound level limit suggested in this guideline of 102 dB SPL DRP (ear-drum reference point) is a compromise between safety and speech intelligibility. Using a device with lower limiting levels will provide a greater level of safety. Likewise using technologies that suppress those sounds known to cause acoustic shock, or control sounds so they do not exceed the loudness of on-going speech, will also provide a greater level of safety.
Where to now?	Please refer to the following sections for more information on: • general principles of acoustic shock protection (Section 4) • acoustic safety issues (Appendix A) • suggested maximum sound pressure level specification (Appendix B) • test method for assessing the maximum sound pressure levels (Appendix C)

FOREWORD

General

This Guideline has been prepared by Communications Alliance, and most recently revised by the WC41 *Voice Frequency Performance Revision* Working Committee.

This Guideline evolved from the Working Committee's review of the acoustic safety requirements of AS/CA S004 *Voice performance requirements for Customer Equipment*. The Working Committee determined that users needed additional information about acoustic safety which was outside the scope of AS/CA S004.

This Guideline contains additional information about acoustic safety and should be read in conjunction with AS/CA S004 or AS/CA S042.1.

Intellectual property rights

Equipment which is manufactured to comply with this Standard may require the use of technology which is protected by patent rights in Australia. Questions about the availability of such technology, under licence or otherwise, should be directed to the patent holder or Australian licensee (if known) or through enquiry at IP Australia which incorporates the Patent, Designs and Trade Marks Offices. Further information can be found at www.ipaustralia.gov.au.

Guideline revision

Documents developed by the Communications Alliance are updated, according to the needs of the industry, by amendments or revision. Users of Communications Alliance documents should make sure that they possess the latest amendments or editions. Representations concerning the need for a change to this Communications Alliance Guideline should be addressed to:

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Customer Equipment and Cable Reference Panel
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1 SCOPE AND OBJECTIVES

1.1 Scope

This Guideline is intended to provide guidance to—

(a) organisations that have staff who use telephone equipment for extended periods of time;

(b) manufacturers;

(c) call centres;

(d) audio consultants; and

(e) testing laboratories,

in order to reduce the risk and severity of acoustic shock.

1.2 Objectives

This Guideline was developed with the following aims:

(a) To provide guidance in the development of equipment, workplaces and processes to reduce the risk and severity of acoustic shock.

(b) To provide additional, optional acoustic safety specifications that organisations can call up if they wish to increase the protection against acoustic shock beyond that specified in the Standards AS/CA S004 and AS/CA S042.1.

NOTE: At the time of publication of this Guideline, AS/CA S004 and AS/CA S042.1 have different ranges of test frequencies. The list of test frequencies in this Guideline currently reflects those of AS/CA S004. The reader is directed to AS/CA S042.1 for the test frequencies to be used for Customer Equipment scoped under that Standard.

2 ABBREVIATIONS AND DEFINITIONS

2.1 Abbreviations

AGC	automatic gain control
AS	Australian Standard
ASPDL	Acoustic Shock Protective Device Limit
CE	Customer Equipment
CODEC	Coder Decoder
dB	Decibel
dBA	decibel A (Logarithmic measurement of sound pressure level measured through an ‘A’ curve filter.)
DRP	(ear) Drum Reference Point
ERP	Ear Reference Point
ETSI	European Telecommunications Standards Institute
ITU-T	International Telecommunications Union - Telecommunication Standardization Sector
ISDN	Integrated Service Digital Network
OH&S	Occupational Health and Safety
PSTN	Public Switched Telephone Network
RMS	Root Mean Square
SPL	Sound Pressure Level
VF	Voice Frequency

2.2 Definitions

Acoustic incident

The receipt by a telephone user of any unexpected sound that has acoustic characteristics that may cause an adverse reaction in some telephone users. Depending on the characteristics of the sound and of the user, an acoustic shock may result from the incident.

Acoustic shock

Any temporary or permanent disturbance of the functioning of the ear, or of the nervous system, which may be caused to the user of a telephone earphone by a sudden sharp rise in the acoustic pressure produced by it. (ITU-T and ETSI definition)

NOTE 1: Acoustic shock may include acoustic trauma, but can occur at sound levels considerably lower than those necessary to cause acoustic trauma.

NOTE 2: This definition is the one used by ETSI and ITU-T.

Acoustic shock protective device

A device that meets the ASPDL conditions specified in this Guideline may be referred to as being *Acoustic Shock Protected*.

NOTE: A device that only meets the maximum sound pressure level requirements specified in AS/CA S004 or AS/CA S042.1 is not to be represented as providing protection against acoustic shock.

Acoustic Shock Protective Device Limit (ASPDL)

The maximum RMS sound pressure level allowed to be generated by a device that is represented as protecting against acoustic shock.

Acoustic trauma

Physiological damage to the auditory system that can occur near-instantaneously as a result of exposure to a very high intensity sound of typically brief duration.

Air interface

A radio frequency link between customer equipment and a telecommunications network.

Call Centre (or Contact Centre)

A work area or workplace specifically dedicated to the use of telephone and/or computer technology that provides value-added services to clients. It is comprised of people whose primary function is to respond to inbound and/or outbound telephone traffic.

NOTE: Call centres can operate in many industries. Some are separate entities whose core function is to provide call centre services to client organisations. Others exist as a division within an organisation, undertaking call centre functions specific to that organisation's requirements, e.g. information provision, account enquiries, sales, marketing, surveys etc.

Customer Equipment (CE)

Defined by the *Telecommunications Act 1997*, but broadly, any telecommunications device that is equipment used beyond the customer's end of the PSTN, (or other carrier service) line.

dBm0

A term used to indicate the level of a signal that will hold true at different parts of a gain/loss network. Signal levels through a telephone exchange network are referred to a single point at nominally 'zero relative level'. This point is the 0 dBr reference point and all other points in the network are given a relative reference back to this level. The actual level in absolute terms is dBm = dBm0 + dBr.

In a digital network, dBm0 is the analogue signal level that is represented by the digital encoding.

Ear-Drum Reference Point (DRP)

A point located at the end of the ear canal, corresponding to the ear-drum position. (refer to ITU–T Recommendation P.57)

Ear Reference Point (ERP)

A virtual point for geometric reference located at the entrance to the listener's ear, traditionally used for calculating telephonometric loudness ratings. (refer to ITU–T Recommendation P.57)

Handset

The part of the CE which is held by the user in conversation mode and has the acoustic transmitter and receiver transducers mounted in it.

Headset

The part of the CE which provides the equivalent functionality of the handset but designed to be worn on the head leaving the user's hands free. A headset may use corded or wireless technology.

Insert earphone

Earphones which are intended to partially or completely enter the ear canal. (refer to ITU–T Recommendation P.57)

Intra-concha earphone

Earphones which are intended to rest within the concha cavity of the ear. They have an external diameter (or maximum dimension) of less than 25 mm but are not made to enter the ear canal.
(see ITU–T Recommendation P.57)

Public Switched Telephone Network (PSTN)

The 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 3.1 kHz.

Supra-aural earphone

Earphones which rest upon the pinna and have an external diameter (or maximum dimension) of at least 45 mm. (see ITU–T Recommendation P.57)

Supra-concha earphone

Earphones which are intended to rest upon the ridges of the concha cavity and have an external diameter (or maximum dimension) greater than 25 mm and less than 45 mm. (see ITU–T Recommendation P.57)

Voice Frequency (VF)

Frequencies in the range of 300 Hz to 3.4 kHz.

3 GENERAL PRINCIPLES

3.1 Acoustic shock protection

General information about acoustic safety can be found in Appendix A. Further information on relevant legislation, other sources of information on acoustic safety and related organisations can be found in Appendix D.

The AS/CA S004 and AS/CA S042.1 Standards specify the maximum output levels that can be emitted by headsets and handsets intended for connection to the telephone network (PSTN or ISDN) and mobile telephone equipment respectively. Acoustic tones of these levels are capable of causing acoustic shock to users.

Protection is a relative term. A headset with a maximum output of 118 dBA, as specified in AS/CA S004, clearly provides more protection against adverse effects, including acoustic shock, than one whose output exceeds 118 dBA. The mandatory limit of 118 dBA therefore provides considerable protection compared to no protection at all. However, the fact that incidents occur with headsets limited to 118 dBA indicates that more protection is needed in those types of situations where acoustic shock has been found to occur.

Devices can provide significantly greater levels of acoustic shock protection by either limiting the maximum output SPL to levels significantly lower than the maximum levels allowed by AS/CA S004 and AS/CA S042.1, and/or by suppressing the types of sounds that most commonly cause acoustic shock.

The likelihood of a device causing acoustic shock decreases as the maximum output level decreases. It is unlikely to be feasible, however, to simply limit the output of devices to levels low enough to prevent acoustic shock to all potential users of a device. The reason for this is that if speech is limited to too low a level, intelligibility and/or quality of the speech will be adversely affected. Because of this conflict, some devices use more sophisticated means to help protect against acoustic shock. Such means include, but are not limited to:

(a) Automatic identification and suppression of sounds, such as high-pitched tones, that are responsible for most incidents of acoustic shock.

(b) Automatic identification and suppression of any sounds that have levels and/or sound spectra those are not characteristic of ongoing speech.

(c) Multi-band limiting methods that cause sounds with very narrow bandwidth, such as high-pitched tones, to be limited to levels significantly lower than the limiting levels for wider bandwidth sounds, such as speech.

A device should not be described as an acoustic shock protection device unless the maximum output level of the device is less than the Acoustic Shock Protective Device Limit (ASPDL) specified in the following section. This provision applies irrespective of the method used to ensure that sounds do not exceed the ASPDL values shown in Table 1. Note that devices whose maximum output for narrowband high pitched tones are significantly below the ASPDL values will provide significantly greater protection against acoustic shock than devices whose maximum output is at or just below the ASPDL values.

NOTE: This Guideline was originally developed to address acoustic safety issues involving telephone equipment without an air interface to the public telecommunications network and in particular to address issues involving headsets in call centres. However many of the recommendations apply to acoustic safety issues involving telephone equipment with an air interface to the public telecommunications network i.e. mobile telephones.

3.2 Reducing the risk and severity of acoustic shock

There are many possible sources of acoustic shock. By recognising the many factors that may influence the risk and the severity of an acoustic shock, and by applying appropriate actions, the impact of an acoustic incident may be significantly reduced.

Possible risk-reducing factors relating to some industry sectors are—

(a) using headsets or handsets or amplifiers that limit the maximum sound level to levels lower than those specified by the Standards AS/CA S004 and AS/CA S042.1;

(b) using devices that detect and reduce the level of high-pitched tones;

(c) using devices that limit the increase in sound compared with the previous average speech level;

(d) improving the working environment to reduce personal stress;

(e) reducing background noise levels in the work environment, such as by introducing acoustic barriers or adding sound absorption; and

(f) appropriate use of training and counselling strategies.

3.3 Use of equipment with improved acoustic safety

Devices meeting the Acoustic Shock Protective Device Limit (ASPDL) voluntary conditions specified in Appendix B of this Guideline can be used by organisations wishing to provide additional acoustic limiting as part of their overall acoustic management plan. The requirements of different environments could require different solutions.

Compared to conventional devices (i.e. devices that meet the maximum sound pressure levels as defined in AS/CA S004 and AS/CA S042.1), devices that meet the ASPDL conditions are considered to provide—

(a) additional reduction in the likelihood of users experiencing an acoustic shock; and

(b) lessening of the severity of any potential acoustic shock injury.

It is not possible to limit the sound output of devices to a specific level that simultaneously provides complete protection against acoustic shock while maintaining high intelligibility in all listening situations. Some users may wish to achieve greater acoustic protection by choosing devices that limit the output signal to levels lower than those required by the ASPDL conditions.

Manufacturers are encouraged to state how their device addresses the recommendations in this Guideline and in particular state if their device meets the Acoustic Shock Protective Device Limit (ASPDL) conditions. However compliance with this document cannot be claimed as it is a guideline rather than a Standard.

If a supplier wishes to state that a device limits the output sound pressure to a level lower than the ASPDL by any specified amount, then such statements (whether made in advertising, user manuals or device labels) need to be based on the same test methods used to establish conformity with the ASPDL conditions.

APPENDIX

A ACOUSTIC SAFETY

A.1 Introduction

Acoustic incidents occur when people hear loud or unexpected sounds. This guideline restricts itself to acoustic incidents that occur when telephone equipment is being used.

It has been found that the impact of an acoustic incident cannot be properly accounted for if an attempt is made to attribute it to a single factor such as the level of the sound experienced. Acoustic safety is a multi-faceted issue, so no single factor causes acoustic shock.

It should be emphasised that the risk of receiving an acoustic shock is low. Acoustic shock is not a problem for all phones, or all users, or all work environments. A person who uses the telephone infrequently, e.g. a residential user, has a very low risk of ever experiencing one significant acoustic shock in their lifetime. People who use the telephone frequently, such as call centre operators, receptionists and telemarketing staff, are at greater risk of experiencing an acoustic shock. For these people it may be desirable to reduce the risk and/or severity of an acoustic shock.

A.2 Factors affecting acoustic safety

There has been considerable research and discussion by scientists and acoustic professionals about the causes of acoustic shock relating to telephone equipment. Whilst there may not be total agreement on the details, it is generally agreed that acoustic shock is caused by the sudden, unexpected increase of sound levels. However the effect on individuals can vary greatly for the same sudden, unexpected increase in sound level.

Evidence (Patuzzi R, Risking Acoustic Shock Seminar, 2001) suggests that there may be a startle response induced by an acoustic incident.

The factors influencing the likelihood of an individual receiving an acoustic shock include the following:

(a) *The number of calls made or received by a person in a working day*

The number of calls a person makes or receives (rather than the total time spent on a telephone) increases the chance of receiving an acoustic shock.

(b) *Whether a handset or headset is used*

A handset can be removed from the ear rather quickly when a person detects an acoustic incident. The handset is being held in a hand and the natural reaction is to remove the offending sound. A headset cannot be removed as quickly and so the effect of an acoustic incident of the same sound type and level on a person using a headset can be greater. The majority of acoustic shock injuries reported in Australia in recent years have involved headsets rather than handsets.

(c) *The background noise level*

High background or ambient noise (or the chatter level) in the environment may result in people increasing the sound level so they can easily understand the conversation in the earpiece. Most people require average speech levels to be about 10 dB to 15 dB above background noise for good intelligibility.

(d) *The loudness of the received sound*

The likelihood and severity of the acoustic shock is believed to increase with increasing loudness.

(e) *The suddenness of an increase in sound level*

The sudden onset or the unexpected nature of a sound may induce a startle response in a person. Sounds at even moderate levels can cause acoustic shock in some rare circumstances.

(f) *The duration of the increase in sound level*

The duration of an increase in sound level affects the startle response. The perceived loudness of a sound progressively increases as the duration of the sound increases (up to approximately 200 ms).

(g) *The frequency/frequencies of the sound*

Frequencies in the range of 1 kHz to 4 kHz are more likely to cause a startle response than lower frequencies. These higher frequencies are close to the resonant frequency of the ear canal.

(h) *The nature and unexpectedness of the sound*

Reports on acoustic shock in Australia have often described the offending sounds as being loud, high pitch tones that appear suddenly and are sustained. These sounds are also referred to as shrieks. The loudness experienced at a specific pitch is described as exceeding that of speech although these offending sounds may have peak levels less than speech.

(i) *Personal characteristics*

A person's condition can have a significant effect on how they will respond to a particular acoustic incident. The physical and mental health of a person can affect their response. Stress levels have been shown to have a significant influence. Personal conditions can relate to general health, middle-ear health, tiredness, anxiety or stress.

(j) *The number of any previous acoustic incidents*

If a person has previously experienced an acoustic incident, they may be more likely to react to a similar acoustic incident.

(k) *The severity of any previous acoustic incidents*

The severity of any previous acoustic incident may increase the effect of the acoustic incident on a person and may increase the time it takes before the predisposition significantly reduces.

(l) *The time since the last acoustic incident*

The greater the time between acoustic incidents, the less the predisposition to being adversely affected by an acoustic incident. The time it takes for this predisposition to significantly reduce may vary from individual to individual.

A.3 Sources of telecommunications acoustic incidents

New network and customer equipment technologies and new services have changed the types of acoustic incidents being experienced by people.

Sources that may cause acoustic incidents include the following:

(a) The sudden onset of fax or modem tones.

(b) Faults in customer equipment such as the shorting of the wires in the curly cords of some telephone handsets (usually only heard by the person on the distant telephone).

(c) Transmission faults within the network.

(d) Cordless telephones that have a loudspeaker sometimes can produce acoustic feedback or a *howl* when the handset is brought too close to the speaker when it is active (both ends of the connection hear the *howl*).

(e) Mobile phones sometimes can produce a loud sound when a *flip* cover is closed (the distant end hears the sound for a short time).

(f) Malicious events such as yelling, blowing a whistle or the sounding of a horn.

(g) Electrical impulses in the telecommunications networks and mains power supply due to lightning strikes.

A.4 Long term exposure to sound

Whilst long term exposure is not an acoustic incident, it should be noted that long term exposure to moderate to high levels of sound can adversely affect a person's hearing in the long term. There are limits to the aggregate amount of sound that a person can be exposed to.

The States, Territories and the Commonwealth Government set the exposure levels within their jurisdictions. Currently the Commonwealth, the Territories and all the States except South Australia require that workers shall not be exposed to an eight-hour equivalent continuous sound pressure level of more than 85dB(A) per day on average during a five day working week. The *National Standard for Occupational Noise* [NOHSC: 1007(2000)], published by the National Occupational Health and

Safety Commission also specifies an eight-hour equivalent continuous sound pressure level of 85 dB(A). The South Australian regulation differs from the others in that it specifies an eight-hour equivalent continuous sound pressure level of 90 dB(A) rather than 85 dB(A).

AS/NZS 1269.1 specifies methods of determining the long term exposure to sound in terms of the eight-hour equivalent continuous A-weighted sound pressure level, $L_{Aeq,8h}$. Measurement methods and calculation procedures are described in the Standard.

The *National Code of Practice For Noise Management and Protection of Hearing At Work* [NOHSC: 2009(2000)], published by the National Occupational Health and Safety Commission, presents methods for managing noise exposure for people who are at risk of excessive noise exposure. While the 2000 version of the Code is applicable to noise exposure generally it does not specifically address issues related to exposure to sound from telephony equipment.

It should be noted that the maximum sound pressure levels specified in Appendix B are designed to help protect against acoustic shock. Conforming to them does not ensure that the sound levels received by telephone users will be less than an eight-hour equivalent continuous sound pressure level of 85 dB(A) or sufficiently low to avoid noise-induced hearing loss following long term use.

B MAXIMUM SOUND PRESSURE LEVEL SPECIFICATION

B.1 Maximum sound pressure level

For a device to not exceed the ASPDL, the maximum RMS output sound pressure level from the device needs to be equal to or less than the values specified in Table 1 when any receiver volume control is set to maximum when using the test methods of Appendix C. The maximum instantaneous output sound pressure level is the same as that specified in AS/CA S004 for a CE intended to be connected to the PSTN or ISDN.

The choice of acoustic coupler and artificial ear needs to be in accordance with Section 5 of ITU-T Recommendation P.57 that describes which of the three types of artificial ear (Type 1, Type 2, or Type 3) should be used for different types of earphones.

Note that ITU-T Recommendation P.57 also contains data for translating between measurements made at the ear reference point (ERP) (using a Type 1 ear) to equivalent SPLs at the drum reference point (DRP) (using a Type 2 or 3 ear) or vice versa. These conversion data apply only to supra-aural and supra-concha earphones with a high acoustic source impedance. All smaller earphones (insert and intra-concha) and earphones of any size with a low acoustic source impedance, must be measured at the drum reference point with a Type 2 or Type 3 ear.

Because the volume simulated by a Type 1 ear includes the concha, measurements made on insert or intra-concha earphones using a Type 1 ear will produce highly misleading (low) sound pressure levels, even if a flat-plate adaptor is added to the Type 1 ear.

Table 1

Acoustic Shock Protective Device Limit (ASPDL) sound pressure levels

Frequency (Hz)	Maximum RMS dB SPL at DRP	Maximum RMS dB SPL at ERP
100	102	102
125	"	102
160	"	102
200	"	102
250	"	102
315	"	102
410	"	102
516	"	101
649	"	101
818	"	101
972	"	101
1029	"	100
1090	"	100
1155	"	100
1223	"	100
1296	"	99
1372	"	99
1454	"	99
1540	"	98
1631	"	98
1728	"	97
1830	"	97
1939	"	96
2053	"	95
2175	"	94
2304	"	94
2441	"	93
2585	"	92
2738	"	92
2901	"	91
3073	"	91
3255	"	92
3652	"	94
4340	"	97
4597	"	98
5158	"	99
5788	"	100
6494	"	99
7286	"	96
8175	"	88

NOTE 1: All earphones need to be measured using the methods and artificial ears specified in ITU-T Recommendation P.57.

NOTE 2: Conversion between DRP and ERP for wide band stimuli is in accordance with conversion values given in Table 2a & 2b of ITU-T Rec P.57.

NOTE 3: Maximum RMS dB SPL needs to be determined using 'RMS', 'F' or 'Fast', max hold settings of sound level meters as specified in AS IEC 61672.1.

NOTE 4: The level of 102 dB SPL at DRP has been selected based on the following considerations:

(a) Normal hearing people experience loudness discomfort for sounds of level 100 to 105 dB SPL or greater at the DRP (Pascoe, 1988).

(b) Any single number (frequency independent) limit expressed at the ERP would allow high frequency sounds to have a higher level than low-frequency sounds when measured at the DRP. A limit that increases with frequency conflicts with the repeated observation that most acoustic shocks are caused by high-pitched tones. A flat limit at the DRP is therefore more appropriate than a rising limit at the DRP.

(c) Acoustic shocks of all severities may be caused by devices that produce sound levels of 118 dBA SPL or less at the ERP.

(d) Field tests with devices that limit sounds to 85 dB SPL at the DRP indicate insufficient loudness in some environments.

(e) One estimate of an acceptable level would be the point midway between these two levels found to be too high and too low, respectively.

For devices that can be demonstrated not to include time-dependent limiting (e.g. AGC, high-pitched tone rejection, control of relative levels), the maximum RMS level can be measured using either a swept pure tone or a series of pulsed pure tones.

For devices that may include time-dependent limiting, the maximum RMS level needs to be measured using pulsed pure tones. Pulsed pure tones used for testing need to include frequencies spaced no more widely than at one-third octave intervals for frequencies below 900 Hz, and one-twelfth octave intervals over the frequency range from 900 Hz to 3 kHz and one-sixth octave intervals for frequencies above 3 kHz with a pulse duration of at least 0.5 second, separated by silent gaps sufficient for the AGC to stabilise.

Some devices provide acoustic shock protection by comparing the spectra of all incoming sounds to the measured spectra of incoming speech signals. For the protection provided by such devices to be measured, active speech would need to be input to the device immediately prior to introducing the test signal whose output level is to be measured. With these devices the silent gaps preceding the pulsed test tones need to be preceded by active speech. The active speech level needs to be adjusted so that its long term output level is either 80 dB SPL at the ERP, or 84 dB SPL at the DRP, as appropriate to the coupler used.

Manufacturers are encouraged to specify the **highest** RMS sound level that devices can deliver at the Drum Reference Point in units of dB SPL.

The RMS sound level needs to be measured by exponentially time averaging the square of the signal using a 125 millisecond time constant. This corresponds to the 'F' or 'Fast' exponential time averaging weighting defined in the AS IEC 61672.1specification for sound level meters.

It should be noted that conforming to the specified maximum sound pressure levels does **not** ensure that the sound levels received by telephone users will be less than an eight-hour equivalent continuous sound pressure level of 85dB SPL or sufficiently low to avoid noise-induced hearing loss following long term use.

B.2 CE with an analogue interface to the network

To determine the maximum output sound pressure level for CE with an analogue interface, the CE needs to be subjected to an input voltage varied between 100 mV r.m.s. and 30 V r.m.s., while varying the frequency between 100 Hz and 8 kHz with line currents of 20 mA and 80 mA (or maximum attainable line current).

B.3 CE with a digital interface to the network

To determine the maximum output sound pressure level for CE with a digital interface, an applied digitally encoded signal needs to be varied from a level of –9 dBm0 to +10 dBm0 while varying the frequency between 100 Hz and 8 kHz. Although 3.14 dBm0 is the maximum possible undistorted signal at the digital interface using a G.711 PCM codec, code saturation is required to produce the maximum possible energy and hence sound pressure level. Code saturation is achieved by applying sufficient signal level to the coder to cause a rectangular peak coded pattern. For other digital technologies use the appropriate test CODEC.

B.4 Handsets and/or headsets, supplied independently, for use with one or more host CE

Handsets and/or headsets supplied with detachable amplifiers need to be tested in the mode for which adherence to the ASPDL conditions are to be tested. The levels in each mode tested, (e.g., both with and without the amplifier), need to be recorded. Handsets and/or headsets supplied with dedicated and/or non-detachable amplifiers need to be tested as complete units.

The maximum output sound pressure level needs to be determined when the input voltage to the CE is varied between 0.1 V and 10 V r.m.s. from a 220 Ω source impedance while varying the frequency between 200 Hz and 4 kHz.

B.5 CE with an air interface to the network

To determine the maximum output sound pressure level for CE with an air interface, the test signal to be applied to a network simulator needs to be varied from a level of –9 dBm0 to +10 dBm0 while varying the frequency between 100 Hz and 8 kHz. The test signal should be applied so that the peaks of the highest level test signals produce the maximum digital code (code saturation) in the network simulator and hence the air interface. Similar principles may apply here as for B.3 above.

C MAXIMUM SOUND PRESSURE LEVEL TEST METHODS

C.1 Test conditions

Testing should be conducted in accordance with the standard test conditions as specified in Section 6 of AS/CA S004 or Section 6 of AS/CA S042.1 as appropriate. If there is any conflict between the test conditions used in Clause C.2 and the test conditions used in these Standards, the test conditions in Clause C.2 take precedence.

C.2 General testing

C.2.1 If a volume control can be used with the equipment under test, the volume control needs to be set to maximum level for the tests.

C.2.2 An initial measurement at the maximum input signal level needs to be made to determine the frequency producing the highest acoustic pressure. The signal level should then be varied over the specified range at this frequency.

C.2.3 Unless it can be established that the CE being tested does not have the capability to dynamically vary the receive gain in response to a received signal, measurements over the frequency range and subsequent signal level range needs to be performed as a series of step tests.

C.2.4 Recommended step test parameters for devices that provide absolute control of level:

(a) Frequency steps to be in one-third octave intervals over the frequency range from 100 Hz to 900 Hz, one-twelfth octave intervals over the frequency range from 900 Hz to 3 kHz and one-sixth octave intervals over the frequency range from 3 kHz to 8 kHz.

(b) Tone duration: 500 ms

(c) Tone off time between steps: 3 seconds

(d) Level step size:

(i) Analogue PSTN interface graduated between 100 mV and 30 V r.m.s.

(ii) Digital (including air) interface: 2 dB

(iii) Handsets/headsets graduated between 100 mV and 10 V r.m.s.

C.2.5 Recommended step test parameters for devices that control level relative to active speech level:

(a) Frequency steps to be in one-third octave intervals over the frequency range from 100 Hz to 900 Hz, one-twelfth octave intervals over the frequency range from 900 Hz to 3 kHz and one-sixth octave intervals over the frequency range from 3 kHz to 8 kHz.

(b) 5 seconds of active speech.

(c) 1 second silence or less.

(d) Tone duration: 500 ms

(e) Tone off time between steps: 3 seconds

(f) Level step size:

(a) Analogue PSTN interface graduated between 100 mV and 30 V r.m.s.

(b) Digital (including air) interface: 2 dB

(c) Handsets/headsets graduated between 100 mV and 10 V r.m.s.

NOTE: These recommended test sequences for C2.4 are included as a CD ROM provided with AS/CA S004.

C.2.6 Testing is to be undertaken using the appropriate artificial ear as described in ITU-T Recommendation P.57.

C.2.7 Measurements of supra-aural and supra-concha earphones may be performed at the ERP provided that a suitable conversion is made to determine the equivalent sound pressure levels at the DRP. The conversion information should be replicated in the test report.

C.2.8 Testing needs to be undertaken using a sound level meter equivalent to that described in AS IEC 61672 using the following settings: 'RMS' detection and 'F' or 'Fast' time weighting with maximum value held, i.e. 'max hold'.

C.3 CE with an analogue interface to the network

The maximum output sound pressure level is to be tested with the circuit shown in Figure 1.

C.4 CE with a digital interface to the network

The maximum output sound pressure level is to be tested with the circuit shown in Figure 2.

C.5 Handsets and/or headsets, supplied independently, for use with one or more host CE

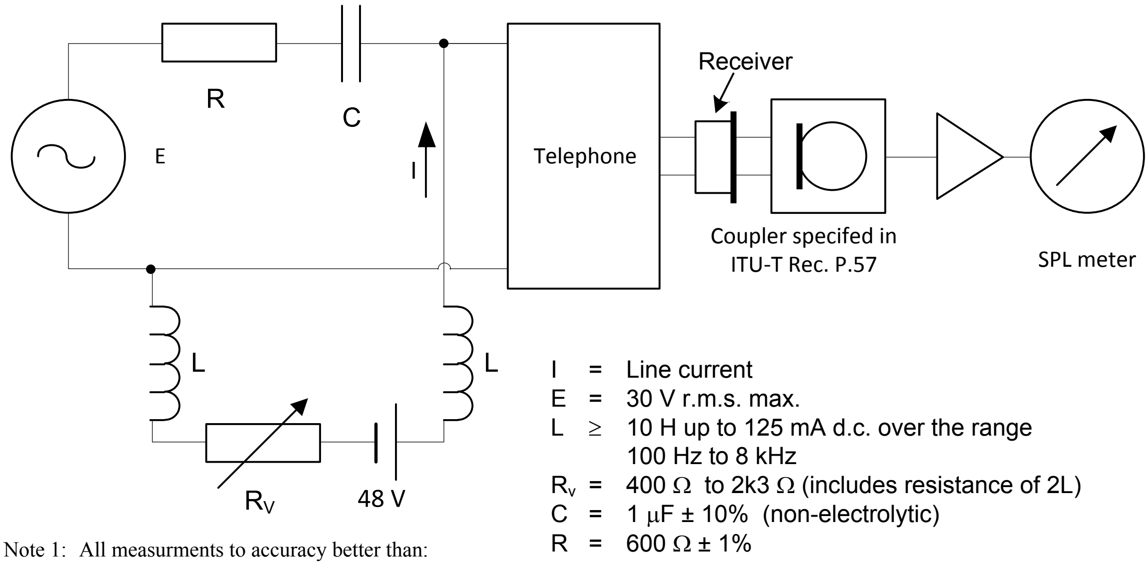
C.5.1 Handsets and/or headsets supplied with detachable amplifiers are to be tested with and without the amplifier.

C.5.2 Handsets and/or headsets supplied with dedicated and/or non-detachable amplifiers are to be tested as complete units.

C.5.3 The maximum output sound pressure level is to be tested with the circuit shown in Figure 3.

C.6 CE with an air interface to the network

The maximum output sound pressure level is to be tested with the circuit shown in Figure 4.



Note 1: All measurments to accuracy better than:
± 2% voltage and current
± 0.5% time
± 0.25% frequency
± 0.2 dB power level
Note 2: Oscillator frequency set for peak receive response

Figure 1
Test circuit for PSTN tests

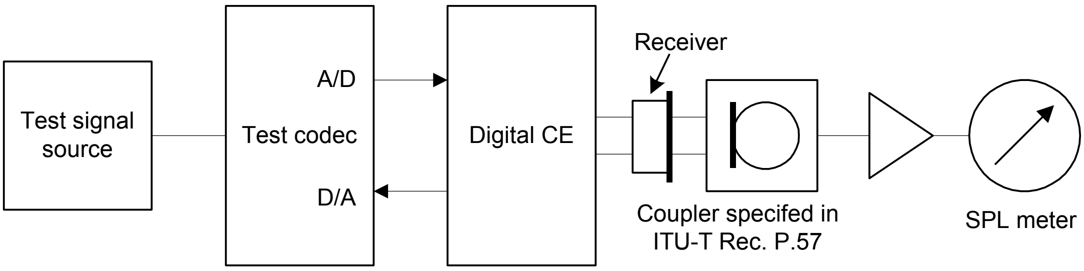
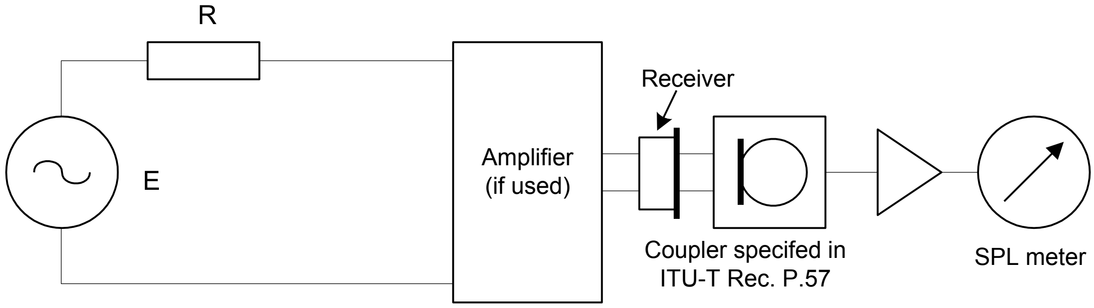


Figure 2
Test circuit for digital interface tests



R = 220 Ω
E = 0 to 10 V r.m.s

Figure 3
Test circuit for independently supplied headsets/handsets

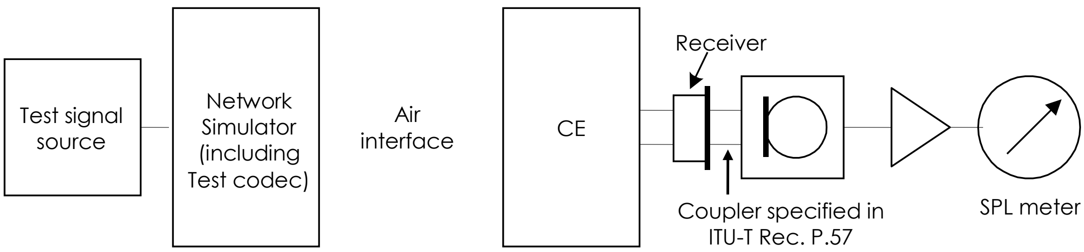


Figure 4
Test circuit for air interface tests

D BIBLIOGRAPHY

D.1 Relevant Australian legislation

Queensland Industrial Relations Act 1999

See http://www.austlii.edu.au for Federal and State legislation

State OH&S legislation

Telecommunications Act 1997

Telecommunications (Consumer Protection and Service Standards) Act 1999

D.2 Other Sources of information/advice on acoustic safety

Acoustic Shock Injury report, August 2001, Janice Milhinch, Milhinch Audiology P/L, 74 Mount St., Heidelberg, Victoria, Australia 3079 (milaud@tpgi.com.au)

AS/NZS 60950.1:2011 *Information technology equipment - Safety - General requirements* (http://www.standards.com.au)

ETSI STQ Technical Committee (http://www.etsi.org)

ITU-T Recommendation P.360 (12/98) *Efficacy of devices for preventing the occurrence of excessive acoustic pressure by telephone receivers*

Queensland Government *Code of Practice for Call Centres*, December 2001

A Guide to Health and Safety in the Call centre Industry, Workplace Health and Safety Queensland, The State of Queensland Department of Industrial Relations 2003 (www.whs.qld.gov.au)

UK *Advice regarding Call Centre Work Practices*, December 2001, UK Health and Safety Executive (HSE) - Health & Safety Executive / Local Authorities Enforcement Liaison Committee (HELA), (http://www.hse.gov.uk/)

D.3 Organisations

National Acoustic Laboratories (http://www.nal.gov.au)

Australian Teleservices Association (ATA), http://www.ata.asn.au/

Customer Contact Management Association (CCMA), http://www.ccma.asn.au/

Standards Australia http://www.standards.com.au

The Audiological Society of Australia Inc. (ASA), http://www.audiology.asn.au/

REFERENCES

Publication	Title
Australian Standards	
AS/NZS 1269	Occupational noise management
AS/NZS 1269.1:2005	Part 1: Measurement and assessment of noise immission and exposure
AS IEC 61672.1-2004	Electroacoustics - Sound level meters – Specifications
Communications Alliance Standards	
AS/CA S004:2013	Voice performance requirements for Customer Equipment
AS/CA S042	Requirements for connection to an air interface of a Telecommunications Network
AS/CA S042.1:2010	Part 1: General
ITU-T Recommendations	
P.57 (12/2011)	Artificial ears
Other references	
ETSI TR 101 800 V 1.1.1 (2000-07)	Acoustic safety of Terminal Equipment (TE); An investigation on standards and approval documents
Risking Acoustic Shock Seminar	Fremantle, Western Australia, September 2001 (CD of Seminar)
Pascoe, D.	Clinical measurement of the auditory dynamic range and their relation to formulas for hearing aid gain. In J.H. Jensen (ed) Hearing Aid Fitting. Copenhagen: Storgaard Jensen, 1988
European Parliament	Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise)

PARTICIPANTS

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

Organisation	Membership
Cisco Systems	Voting
Comtest Laboratories	Voting
Jabra	Voting
Primus Telecoms	Voting
Trillium Technology	Voting
Communications Alliance	Non-voting

This Working Committee was chaired by Malcolm Garnham of Trillium Technology. Mike Johns of Communications Alliance provided project management support.

AMENDMENT CONTROL SHEET

Details of Amendment No.1/2014

Clause No.	Clause detail	Notes
G616 GUIDELINE – AT A GLANCE Protection technology Page i	Previous: 102 dBA SPL DRP	Typographic error
	As amended: 102 dB SPL DRP	

NOTES

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.

It is committed to the achievement of the policy objective of the Telecommunications Act 1997 - the greatest practicable use of industry self-regulation without imposing undue financial and administrative burdens on industry.

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