

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electroacoustics – Hearing aids –
Part 15: Methods for characterising signal processing in hearing aids with a
speech-like signal**

**Électroacoustique – Appareils de correction auditive –
Partie 15: Méthodes de caractérisation du traitement des signaux dans les
appareils de correction auditive avec un signal de type parole**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2012 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electroacoustics – Hearing aids –
Part 15: Methods for characterising signal processing in hearing aids with a
speech-like signal**

**Électroacoustique – Appareils de correction auditive –
Partie 15: Méthodes de caractérisation du traitement des signaux dans les
appareils de correction auditive avec un signal de type parole**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

ICS 17.140.50

ISBN 978-2-88912-932-4

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions.....	8
4 Limitations.....	9
5 Setup.....	9
5.1 System overview.....	9
5.2 Estimated insertion gain.....	11
5.3 Coupler gain.....	12
6 Test equipment.....	12
6.1 Acoustical requirements.....	12
6.2 Test signal.....	13
6.2.1 Specification of ISTS.....	13
6.2.2 Shaping of the test signal for determining the EIG.....	14
6.3 Earphone coupler and attachments.....	15
6.3.1 Estimated insertion gain.....	15
6.3.2 Coupler gain.....	15
7 Test conditions.....	15
7.1 Programming of hearing aid.....	15
7.2 End user settings for programming.....	16
7.2.1 Hearing aid features.....	16
7.2.2 Vent selection for programming.....	16
7.2.3 Directionality.....	16
7.3 Audiograms for a typical end-user.....	16
8 Measurements and analysis.....	18
8.1 Measurements.....	18
8.1.1 General.....	18
8.1.2 Estimated insertion gain (EIG).....	19
8.1.3 Coupler gain (optional for 2 cm ³ coupler).....	19
8.2 Analysis.....	19
8.2.1 General.....	19
8.2.2 Compensating for hearing aid processing delay.....	21
8.2.3 Correction for use of 2 cm ³ coupler for EIG determination.....	21
8.2.4 Calculation of the estimated insertion gain for the LTASS of the ISTS (LTASS EIG).....	21
8.2.5 Calculation of the coupler gain for the LTASS of the ISTS (LTASS coupler gain) (optional).....	22
8.2.6 Sectioning of recorded signals for percentile calculations.....	22
8.2.7 Calculation of the EIG for the 30 th , 65 th and 99 th percentiles of the ISTS (percentile EIG).....	23
8.2.8 Calculation of the coupler gain for the 30 th , 65 th and 99 th percentiles of the ISTS (Percentile coupler gain) (optional).....	23
9 Data presentation.....	24
9.1 LTASS gain (LTASS EIG or LTASS coupler gain).....	24
9.2 Percentile gain (percentile EIG or percentile coupler gain).....	25

9.3 Interpretation of gain views	26
9.3.1 LTASS gain view	26
9.3.2 Percentile gain view	26
9.4 Mandatory data	27
Annex A (informative) International speech test signal (ISTS)	28
Bibliography.....	32
Figure 1 – Measurement setup for the estimated insertion gain.....	11
Figure 2 – Measurement setup for the coupler gain.....	12
Figure 3 – ISTS 30 th , 65 th , 99 th percentiles and LTASS in dB versus one-third-octave bands	14
Figure 4 – Standard audiograms for the flat and moderately sloping group	17
Figure 5 – Standard audiograms for the steep sloping group.....	18
Figure 6 – Overview of analysis	20
Figure 7 – Time alignment of output signal (y) relative to the input signal (x)	21
Figure 8 – Sectioning of recorded signals	22
Figure 9 – Illustration of the method for obtaining "time aligned gain" for the 65 th percentile.....	24
Figure 10 – LTASS gain at 3 input sound pressure levels	24
Figure 11 – LTASS gain at 3 input levels relative the LTASS gain at 65 dB input sound pressure level	25
Figure 12 – Percentile gain for 3 percentiles and corresponding LTASS gain.....	25
Figure A.1 – ISTS level distributions for five third-octave bands as measured from 50 % overlapping 125 ms sections of the ISTS	31
Table 1 – ISTS 30 th , 65 th , 99 th percentiles and LTASS in dB at one-third-octave bands	14
Table 2 – Standard audiograms for the flat and moderately sloping group.....	17
Table 3 – Standard audiograms for the steep sloping group.....	18
Table 4 – Recommended coupler correction values when using the 2 cm ³ coupler	21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTROACOUSTICS –
HEARING AIDS –**

**Part 15: Methods for characterising signal processing
in hearing aids with a speech-like signal**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60118-15 has been prepared by IEC technical committee 29: Electroacoustics.

The text of this standard is based on the following documents:

CDV	Report on voting
29/719/CDV	29/730A/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 60118 series, published under the general title *Electroacoustics – Hearing aids*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

This document is a preview generated by EVS

INTRODUCTION

The characterisation of hearing aids in actual use can differ significantly from those determined in accordance with standards such as IEC 60118-0 and IEC 60118-7. These standards use non speech-like test signals with the hearing aid set to specific settings which are, in general, not comparable with typical user settings.

This standard describes a recommended speech-like test signal, the International Speech Test Signal (ISTS), and a method for the characterisation of hearing aids using this signal with the hearing aid set to actual user settings or to the manufacturers' recommended settings for one of a range of audiograms. For the purposes of this standard the hearing aid is considered to be a combination of the physical hearing aid and the fitting software which accompanies it.

ELECTROACOUSTICS – HEARING AIDS –

Part 15: Methods for characterising signal processing in hearing aids with a speech-like signal

1 Scope

This part of IEC 60118 specifies a test signal designed to represent normal speech, the International Speech Test Signal (ISTS), together with the procedures and the requirements for measuring the characteristics of signal processing in air-conduction hearing aids. The measurements are used to derive the estimated insertion gain (EIG). For the purposes of characterizing a hearing aid for production, supply and delivery, the procedures and requirements to derive the coupler gain on a 2 cm³ coupler as defined in IEC 60318-5 are also specified.

The procedure uses a speech-like test signal and the hearing aid settings are set to those programmed for an individual end-user or those recommended by the manufacturer for a typical end-user for a range of flat, moderately sloping or steep sloping audiograms, so that the measured characteristics are comparable to those which may be obtained by a wearer at typical user settings.

The purpose of this standard is to ensure that the same measurements made on a hearing aid following the procedures described, and using equipment complying with these requirements, give substantially the same results.

Measurements of the characteristics of signal processing in hearing aids which apply non-linear processing techniques are valid only for the test signal used. Measurements which require a different test signal or test conditions are outside the scope of this standard.

Conformance to the specifications in this standard is demonstrated only when the result of a measurement, extended by the actual expanded uncertainty of measurement of the testing laboratory, lies fully within the tolerances specified in this standard as given by the values given in 6.1.

Measurement methods that take into account the acoustic coupling of a hearing aid to the individual ear and the acoustic influence of the individual anatomical variations of an end-user on the acoustical performance of the hearing aid, known as real-ear measurements, are outside the scope of this particular standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60118-7, *Electroacoustics – Hearing aids – Part 7: Measurement of the performance characteristics of hearing aids for production, supply and delivery quality assurance purposes*

IEC 60118-8:2005, *Electroacoustics – Hearing aids – Part 8: Methods of measurement of performance characteristics of hearing aids under simulated in situ working conditions*

IEC 60318-4, *Electroacoustics – Simulators of human head and ear – Part 4: Occluded-ear simulator for the measurement of earphones coupled to the ear by means of ear inserts*

IEC 60318-5, *Electroacoustics – Simulators of human head and ear – Part 5: 2 cm³ coupler for the measurement of hearing aids and earphones coupled to the ear by means of ear inserts*

IEC 61260, *Electroacoustics – Octave-band and fractional-octave-band filters*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1

sound pressure level

all sound pressure levels specified are measured in decibels (dB) referenced to 20 μ Pa

3.2

percentile sound pressure level

sound pressure level, in dB, below which a certain percentage of the measured sound pressure levels fall, measured in a 125 ms time interval, over a stated measurement period

Note 1 to entry: As an example: The 30th percentile sound pressure level is the sound pressure level below which 30 % of the measured sound pressure levels are found, and the remaining 70 % of the measured sound pressure levels are higher.

Note 2 to entry: The 99th percentile may be interpreted as a peak sound pressure level indicator.

Note 3 to entry: The definition of percentile used here is according to general statistics. This definition may differ from other sciences such as acoustics.

3.3

international speech test signal

ISTS

speech-like test signal as defined in this standard

3.4

long term average speech spectrum

LTASS

sound pressure level measured in one-third-octave bands averaged over a long time period of speech

Note 1 to entry: For this standard a time period of 45 s is chosen.

3.5

occluded ear simulator

OES

ear simulator as defined in IEC 60318-4

3.6

estimated insertion gain of a hearing aid

EIG

estimate of the real-ear insertion gain as may be obtained across a group of persons

Note 1 to entry: This estimate is based on measurements of hearing aid gain using an occluded ear simulator or a 2 cm³ coupler, as defined in IEC 60318-5.