



BSI Standards Publication

**Acoustics — Objective method  
for assessing the audibility of  
tones in noise — Engineering  
method**

**National foreword**

This Published Document is the UK implementation of ISO/PAS 20065:2016.

The UK participation in its preparation was entrusted to Technical Committee EH/1, Acoustics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2016. Published by BSI Standards Limited 2016

ISBN 978 0 580 93282 3

ICS 17.140.01

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 July 2016.

**Amendments issued since publication**

Date	Text affected
------	---------------

---

**PUBLICLY  
AVAILABLE  
SPECIFICATION**

**ISO/PAS  
20065**

First edition  
2016-07-01

---

---

**Acoustics — Objective method for  
assessing the audibility of tones in  
noise — Engineering method**

*Acoustique — Méthode objective pour évaluer l'audibilité des tons  
dans le bruit — Méthode d'expertise*



Reference number  
ISO/PAS 20065:2016(E)

© ISO 2016



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2016. Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

# Contents

	Page
Foreword .....	iv
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Measurement procedure</b> .....	<b>5</b>
4.1 General .....	5
4.2 Measurement instruments .....	5
4.3 Merging the basic spectra .....	5
<b>5 Evaluation</b> .....	<b>6</b>
5.1 General information .....	6
5.2 Width $\Delta f_c$ of the critical band .....	7
5.3 Determination of prominent tones .....	7
5.3.1 General information .....	7
5.3.2 Determination of the mean narrow-band level $L_S$ of the masking noise .....	7
5.3.3 Determination of the tone level $L_T$ of a tone in a critical band .....	8
5.3.4 Distinctness of a tone .....	9
5.3.5 Determination of the critical band level, $L_G$ , of the masking noise .....	10
5.3.6 Masking index .....	10
5.3.7 Determination of the audibility, $\Delta L$ .....	10
5.3.8 Determination of the decisive audibility, $\Delta L_d$ , of a narrow-band spectrum .....	10
5.3.9 Determination of the mean audibility $\Delta L$ of a number of spectra .....	12
<b>6 Calculation of the uncertainty of the audibility, <math>\Delta L</math></b> .....	<b>13</b>
<b>7 Recommendations on the presentation of results</b> .....	<b>16</b>
7.1 Measurement .....	16
7.2 Acoustic environment .....	16
7.3 Instruments for measurement, recording and evaluation .....	16
7.4 Acoustic data .....	16
<b>Annex A (informative) Window effect and Picket fence effect</b> .....	<b>17</b>
<b>Annex B (informative) Resolving power of the human ear at frequencies below 1 000 Hz and geometric position of the critical bands — corner frequencies</b> .....	<b>20</b>
<b>Annex C (informative) Masking, masking threshold, masking index</b> .....	<b>22</b>
<b>Annex D (informative) Iterative method for the determination of the audibility, <math>\Delta L</math></b> .....	<b>23</b>
<b>Annex E (informative) Example for the determination of the tonal audibility</b> .....	<b>27</b>
<b>Bibliography</b> .....	<b>33</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

The committee responsible for this document is ISO/TC 43, Acoustics, Subcommittee SC 1, *Noise*.

# Acoustics — Objective method for assessing the audibility of tones in noise — Engineering method

## 1 Scope

This Publicly Available Specification describes a method for the objective determination of the audibility of tones in environmental noise.

This Publicly Available Specification is intended to augment the usual method for evaluation on the basis of aural impression, in particular, in cases in which there is no agreement on the degree of the audibility of tones. The method described can be used if the frequency of the tone being evaluated is equal to, or greater than, 50 Hz. In other cases, if the tone frequency is below 50 Hz, or if other types of noise (such as screeching) are to be captured, then this method cannot replace subjective evaluation.

The method presented herein can be used in continuous measurement stations that work automatically.

## 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.

ISO 1996-1, *Acoustics — Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: Specifications*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1996-1 and the following apply.

### 3.1

#### tonality

presence of a tone in a noise, the level of which is below that of the remaining noise components in the *critical band* (3.5) about the *tone frequency* (3.2) by less than the value of the *masking index* (3.16),  $a_v$

### 3.2

#### tone frequency

$f_T$

frequency of the *spectral line* (3.23) (or mid-band frequency of the narrow-band filter), to the level of which the tone contributes most strongly

### 3.3

#### tone level

$L_T$

energy summation of the *narrow-band level* (3.22) with the *tone frequency* (3.2),  $f_T$ , and the lateral lines about  $f_T$ , assignable to this tone

Note 1 to entry: If the *critical band* (3.5) for the frequency,  $f_T$ , under consideration contains a number of tones, then the tone level,  $L_T$ , is the energy sum of these tones. This level,  $L_T$ , is then assigned to the frequency of the participating tone that has the maximal value of *audibility* (3.4),  $\Delta L$ .

Note 2 to entry: The method for the determination of the tone level,  $L_T$ , of a tone in a critical band is described in 5.3.3.