



Institut luxembourgeois de la normalisation
de l'accréditation, de la sécurité et qualité
des produits et services

ILNAS-EN 62232:2017

Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human

Bestimmung der HF-Feldstärke, der
Leistungsdichte und der spezifischen
Absorptionsrate (SAR) in der
Nachbarschaft von

Détermination de l'intensité de champ de
radiofréquences, de la densité de
puissance et du DAS à proximité des
stations de base de radiocommunication

12/2017



National Foreword

This European Standard EN 62232:2017 was adopted as Luxembourgish Standard ILNAS-EN 62232:2017.

Every interested party, which is member of an organization based in Luxembourg, can participate for FREE in the development of Luxembourgish (ILNAS), European (CEN, CENELEC) and International (ISO, IEC) standards:

- Participate in the design of standards
- Foresee future developments
- Participate in technical committee meetings

<https://portail-qualite.public.lu/fr/normes-normalisation/participer-normalisation.html>

THIS PUBLICATION IS COPYRIGHT PROTECTED

Nothing from this publication may be reproduced or utilized in any form or by any mean - electronic, mechanical, photocopying or any other data carries without prior permission!

English Version

**Determination of RF field strength, power density and SAR in the
vicinity of radiocommunication base stations for the purpose of
evaluating human exposure
(IEC 62232:2017)**

Détermination des champs de radiofréquences, densité de
puissance et du DAS aux environs des stations de base
utilisées pour les communications radio dans le but
d'évaluer l'exposition humaine
(IEC 62232:2017)

Bestimmung der HF-Feldstärke, der Leistungsdichte und
der spezifischen Absorptionsrate (SAR) in der
Nachbarschaft von Funkkommunikations-Basisstationen zur
Ermittlung der menschlichen Exposition
(IEC 62232:2017)

This European Standard was approved by CENELEC on 2017-09-27. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 106/397/FDIS, future edition 2 of IEC 62232, prepared by IEC/TC 106 "Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62232:2017.

The following dates are fixed:

- latest date by which the document has to be (dop) 2018-06-27
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2020-09-27
standards conflicting with the
document have to be withdrawn

This document supersedes EN 50400:2006 + AC:2011 + A1:2012, EN 50383:2010 + AC:2013 and EN 50492:2008 + A1:2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62232:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

ISO/IEC 17025	NOTE	Harmonized as EN ISO/IEC 17025.
CISPR 16-4-2	NOTE	Harmonized as EN 55016-4-2.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62209-1	-	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)	EN 62209-1	-
IEC 62209-2	-	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)	EN 62209-2	-
IEC 62479	-	Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)	EN 62479	-
IEC 62311	-	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)	EN 62311	-



INTERNATIONAL STANDARD



**Determination of RF field strength, power density and *SAR* in the vicinity of
radiocommunication base stations for the purpose of evaluating human
exposure**

CONTENTS

FOREWORD.....	12
INTRODUCTION.....	14
1 Scope.....	15
2 Normative references	15
3 Terms and definitions	16
4 Symbols and abbreviated terms.....	22
4.1 Physical quantities	22
4.2 Constants	23
4.3 Abbreviated terms.....	23
5 Quick start guide and how to use this document	24
5.1 Overview.....	24
5.2 Quick start guide.....	24
5.3 How to use this document	26
5.4 Worked case studies.....	27
6 Evaluation processes for product compliance, product installation compliance and in-situ RF exposure assessments	27
6.1 Evaluation process for product compliance	27
6.1.1 General	27
6.1.2 Establishing compliance boundaries	27
6.1.3 Iso-surface compliance boundary definition	28
6.1.4 Simple compliance boundaries	28
6.1.5 Methods for establishing the compliance boundary	30
6.1.6 Uncertainty	32
6.1.7 Reporting.....	32
6.2 Evaluation process used for product installation compliance	33
6.2.1 General	33
6.2.2 General evaluation procedure for product installations.....	33
6.2.3 Product installation data collection.....	34
6.2.4 Simplified product installation evaluation process	35
6.2.5 Assessment area selection	37
6.2.6 Measurements	39
6.2.7 Computations	40
6.2.8 Uncertainty	41
6.2.9 Reporting.....	41
6.3 Evaluation processes for in-situ RF exposure assessment	42
6.3.1 General requirements, source determination and site analysis.....	42
6.3.2 Measurement procedures	44
6.3.3 Uncertainty	45
6.3.4 Reporting.....	45
6.4 Averaging procedures	46
6.4.1 Spatial averaging.....	46
6.4.2 Time averaging.....	46
7 Determining the evaluation method.....	46
7.1 Overview.....	46
7.2 Process to determine the evaluation method	46
7.2.1 General	46

7.2.2	Establishing the evaluation points in relation to the source-environment plane	47
7.2.3	Exposure metric selection.....	49
8	Evaluation methods	49
8.1	Overview.....	49
8.2	Measurement methods.....	50
8.2.1	General	50
8.2.2	RF field strength measurements	50
8.2.3	<i>SAR</i> measurements	51
8.3	Computation methods	52
9	Uncertainty	53
10	Reporting.....	54
10.1	General requirements	54
10.2	Report format.....	54
10.3	Opinions and interpretations	55
Annex A (informative)	Source environment plane and guidance on the evaluation method selection.....	56
A.1	Guidance on the source-environment plane	56
A.1.1	General	56
A.1.2	Source-environment plane example	56
A.1.3	Source regions	57
A.2	Select between computation or measurement approaches	63
A.3	Select measurement method.....	64
A.3.1	Selection stages	64
A.3.2	Selecting between field strength and <i>SAR</i> measurement approaches	64
A.3.3	Selecting between broadband and frequency-selective measurement.....	65
A.3.4	Selecting RF field strength measurement procedures	66
A.4	Select computation method.....	66
A.5	Additional considerations	68
A.5.1	Simplicity.....	68
A.5.2	Evaluation method ranking	68
A.5.3	Applying multiple methods for RF exposure evaluation	68
Annex B (normative)	Evaluation methods.....	69
B.1	Overview.....	69
B.2	Evaluation parameters	69
B.2.1	Overview	69
B.2.2	Coordinate systems	69
B.2.3	Reference points	70
B.2.4	Variables	70
B.3	Measurement methods.....	73
B.3.1	RF field strength measurements	73
B.3.2	<i>SAR</i> measurements	104
B.4	Computation methods	114
B.4.1	Overview and general requirements.....	114
B.4.2	Formulas	115
B.4.3	Basic algorithms	123
B.4.4	Advanced computation methods	129
B.5	Extrapolation from the evaluated <i>SAR</i> / RF field strength to the required assessment condition.....	150

B.5.1	Extrapolation method	150
B.5.2	Extrapolation to maximum RF field strength using broadband measurements	151
B.5.3	Extrapolation to maximum RF field strength for frequency and code selective measurements	151
B.5.4	Influence of traffic in real operating network	152
B.6	Summation of multiple RF fields	152
B.6.1	Applicability	152
B.6.2	Uncorrelated fields	153
B.6.3	Correlated fields	153
B.6.4	Ambient fields	153
Annex C (informative)	Rationale supporting simplified product installation criteria	154
C.1	General	154
C.2	Class E2	154
C.3	Class E10	155
C.4	Class E100	155
C.5	Class E+	157
Annex D (informative)	Guidance on comparing evaluated parameters with a limit value	159
D.1	Overview	159
D.2	Information required to compare evaluated value against limit value	159
D.3	Performing a limit comparison at a given confidence level	159
D.4	Performing a limit comparison using a process based assessment scheme	160
Annex E (informative)	Uncertainty	161
E.1	Background	161
E.2	Requirement to estimate uncertainty	161
E.3	How to estimate uncertainty	162
E.4	Guidance on uncertainty and assessment schemes	162
E.4.1	General	162
E.4.2	Overview of assessment schemes	162
E.4.3	Examples of assessment schemes	163
E.4.4	Assessment schemes and compliance probabilities	166
E.5	Guidance on uncertainty	168
E.5.1	Overview	168
E.5.2	Measurement uncertainty and confidence levels	169
E.6	Applying uncertainty for compliance assessments	170
E.7	Example influence quantities for field measurements	170
E.7.1	General	170
E.7.2	Calibration uncertainty of measurement antenna or field probe	171
E.7.3	Frequency response of the measurement antenna or field probe	171
E.7.4	Isotropy of the measurement antenna or field probe	173
E.7.5	Frequency response of the spectrum analyser	173
E.7.6	Temperature response of a broadband field probe	173
E.7.7	Linearity deviation of a broadband field probe	173
E.7.8	Mismatch uncertainty	173
E.7.9	Deviation of the experimental source from numerical source	174
E.7.10	Meter fluctuation uncertainty for time varying signals	174
E.7.11	Uncertainty due to power variation in the RF source	174
E.7.12	Uncertainty due to field gradients	174