PD IEC PAS 63446:2022

BSI Standards Publication

Conversion method of specific absorption rate to absorbed power density for the assessment of human exposure to radio frequency electromagnetic fields from wireless devices in close proximity to the head and body — Frequency range of 6 GHz to 10 GHz

Documents
Document Sharing Hub

Full document details: PD IEC PAS 63446:2022

National foreword

This Published Document is the UK implementation of IEC PAS 63446:2022.

The UK participation in its preparation was entrusted to Technical Committee GEL/106, Human exposure to low frequency and high frequency electromagnetic radiation.

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

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2022
Published by BSI Standards Limited 2022

ISBN 978 0 539 22329 3

ICS 17.220.20

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 November 2022.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: PD IEC PAS 63446:2022

IEC PAS 63446

Edition 1.0 2022-10

PUBLICLY AVAILABLE SPECIFICATION

Conversion method of specific absorption rate to absorbed power density for the assessment of human exposure to radio frequency electromagnetic fields from wireless devices in close proximity to the head and body – Frequency range of 6 GHz to 10 GHz

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 17.220.20

ISBN 978-2-8322-5854-5

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

Documents
Document Sharing Hub

Full document details: PD IEC PAS 63446:2022

CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 Symbols and abbreviated terms 9
4.1 Physical quantities 9
4.2 Constants 10
4.3 Abbreviations 10
5 Application of this document 10
6 APD conversion method by evaluation of the SAR distribution 11
7 Uncertainty estimation 11
7.1 Measurement uncertainty 11
7.2 Numerical uncertainty 12
8 Measurement and computational report 12
Annex A (informative) Rationale for conversion of *psSAR* into *psAPD* 13
Annex B (informative) Poynting vector and absorbed power density 14
B.1 Introduction 14
B.2 Electric fields and magnetic fields in a lossy half space 14
B.3 Power density absorbed in the lossy half space 15
B.4 Power transmitted by the Poynting vector of the TE-waves 16
B.5 Power transmitted by the Poynting vector of the TM-waves 17
B.6 Summary 18
Annex C (normative) Reference dipoles and *psAPD* values for system check and validation 19
C.1 System check and validation 19
C.2 Reference dipoles 19
C.3 Numerical model of the system check dipoles 20
Annex D (normative) Supplemental files and their checksums 21
Bibliography 22

Figure C.1 – Mechanical details of the standard dipoles 19

Table 1 – Conversion factors for *psSAR* to *psAPD* 11
Table 2 – Uncertainty budget template for evaluating the uncertainty in the measured value of the *psAPD* of a DUT or validation antenna 12
Table C.1 – Mechanical dimensions of the reference dipoles 20
Table C.2 – Parameters of the dielectric components of the CAD models of the reference dipoles 20
Table C.3 –Numerical *psAPD* target values (rotating square) and the values converted from numerical *psSAR* results 20

Documents
Document Sharing Hub
Full document details: PD IEC PAS 63446:2022

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONVERSION METHOD OF SPECIFIC ABSORPTION RATE TO ABSORBED POWER DENSITY FOR THE ASSESSMENT OF HUMAN EXPOSURE TO RADIO FREQUENCY ELECTROMAGNETIC FIELDS FROM WIRELESS DEVICES IN CLOSE PROXIMITY TO THE HEAD AND BODY – FREQUENCY RANGE OF 6 GHZ TO 10 GHZ

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.

A PAS is an intermediate specification made available to the public and needing a lower level of consensus than an International Standard to be approved by vote (simple majority).

IEC PAS 63446 has been processed by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
106/572/DPAS	106/580/RVDPAS

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

Documents
Document Sharing Hub

Full document details: PD IEC PAS 63446:2022

This PAS shall remain valid for an initial maximum period of 2 years starting from the publication date. The validity may be extended for a single period up to a maximum of 2 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

This document contains supplemental files that are detailed in Annex D. These files can be downloaded from https://www.iec.ch/tc106/supportingdocuments.

Documents
Document Sharing Hub

Full document details: PD IEC PAS 63446:2022

INTRODUCTION

This document provides the method to conservatively evaluate the area averaged electromagnetic (EM) power density entering the human body, i.e. the absorbed power density (APD), for communication devices intended to be used at a position near the human head or body, or mounted on the body, combined with other transmitters within a product, or embedded in garments. The device categories covered include but are not limited to mobile telephones, radio transmitters in personal computers, and desktop and laptop devices. The applicable frequency range is from 6 GHz to 10 GHz.

This document specifies:

- conversion of the psSAR to the psAPD (Clause 6);
- uncertainty estimation (Clause 7);
- reporting requirements (Clause 8);
- methods of validation and system check (Annex C)

The measurement and computational standards IEC/IEEE 63195-1:2022 [1][1] and IEC/IEEE 63195-2:2022 [2] for incident power density (IPD) cover the frequency range from 6 GHz to 300 GHz. Hence there is a frequency overlap from 6 GHz to 10 GHz between this document on APD and the IEC/IEEE standards addressing IPD. The committee was aware of this fact and opted for enhanced flexibility by providing methods for basic restriction metric APD in addition to reference level metric IPD.

[1] Numbers in square brackets refer to the Bibliography.

Documents
Document Sharing Hub

Full document details: PD IEC PAS 63446:2022

CONVERSION METHOD OF SPECIFIC ABSORPTION RATE TO ABSORBED POWER DENSITY FOR THE ASSESSMENT OF HUMAN EXPOSURE TO RADIO FREQUENCY ELECTROMAGNETIC FIELDS FROM WIRELESS DEVICES IN CLOSE PROXIMITY TO THE HEAD AND BODY – FREQUENCY RANGE OF 6 GHZ TO 10 GHZ

1 Scope

This document specifies a conversion method for the assessment of the peak spatial-average absorbed power density ($psAPD$) in the human head and body due to exposure to radio frequency (RF) electromagnetic fields (EMF) from wireless communication devices, with a specified conversion uncertainty. This conversion method is based on specific absorption rate (SAR) values and is specified with the objective to yield conservative and reproducible absorbed power density values of the exposure for a significant majority of the population during the use of hand-held, body-worn or any other RF transmitting communication devices that can operate in close proximity to a human head or body. This conversion method applies for devices that can feature single or multiple transmitters and/or antennas and can be operated with their radiating structure(s) at distances up to 200 mm from a human head or body.

The conversion method of this document can be employed to determine conformity with applicable absorbed power density or epithelial power density limits, such as those defined in ICNIRP guidelines 2020 [3] and IEEE Std C95.1™-2019 [4], of different types of RF transmitting communication devices being used in close proximity to the head and body. The assessment of $psAPD$ is based on the conversion of the peak spatial-average specific absorption rate (psSAR) values assessed according to applicable international standards. The applicable frequency range of the conversion method of this document is 6 GHz to 10 GHz.

NOTE Applicable international standards for the assessment of the psSAR are those accepted by the local regulatory body or specified in the CENELEC product standards. Such international standards include, e.g. IEC/IEEE 62209-1528 and IEC 62209-3 [5] for measurement methods, and IEC/IEEE 62704-1 [6] and IEC/IEEE 62704-4 [7] for computational methods. The frequency range of [5], [6] and [7] is limited up to 6 GHz. While the applicability of the methods of [5] for the frequency range of this document may need further verification, the numerical standards [6] and [7].may be applied for frequencies up to 10 GHz.

The categories of RF transmitting communication devices covered in this document include but are not limited to mobile telephones, radio transmitters in personal computers, and desktop and laptop devices or devices embedded in garments, using single or multiple transmitters and/or antennas, when operating within the frequency range indicated above.

The conversion method of this document does not apply for EMF evaluation of exposure from the devices or objects intended to be implanted in the body, such as active or passive implanted medical devices.

2 Normative references

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.

IEC/IEEE 62209-1528:2020, *Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation and procedures (Frequency range of 4 MHz to 10 GHz)*

Documents
Document Sharing Hub

Full document details: PD IEC PAS 63446:2022