IEC 62232

Edition 3.0 2022-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Détermination de l'intensité du champ de radiofréquences, de la densité de puissance et du DAS à proximité des stations de base dans le but d'évaluer l'exposition humaine

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DETERMINATION OF RF FIELD STRENGTH, POWER DENSITY AND SAR IN THE VICINITY OF BASE STATIONS FOR THE PURPOSE OF EVALUATING HUMAN EXPOSURE

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IEC 62232 has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure. It is an International Standard.

This third edition cancels and replaces the second edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) increased frequency range, from 110 MHz to 300 GHz (including consideration of ambient sources from 100 kHz to 300 GHz);
b) specification of assessment procedures based on the actual maximum approach including methods for the validation of monitoring counter and control features;
c) introduction of assessment methods relevant to 5G technologies and BS using beam-steering such as massive MIMO systems;
d) clarification of criteria for exposure from multiple sources;

e) restructuring of Annex B (Evaluation methods) for better readability;

f) update of the requirements and procedures for power density measurements in laboratory conditions;

g) update of simplified assessment formulas for dish antennas used in radio relays and microwave links;

h) compatibility with ICNIRP-2020 [1][1] exposure limits.

This document contains attached files that are cited in Figure B.30 and G.4.4.3. These files can be downloaded from https://www.iec.ch/tc106/supportingdocuments.

The text of this International Standard is based on the following documents:

Draft	Report on voting
106/576/FDIS	106/590/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at http://www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

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

INTRODUCTION

This document addresses the evaluation of RF field strength, power density and specific absorption rate (SAR) levels in the vicinity of base stations (BS), also called products or equipment under test (EUT), intentionally radiating in the radio frequency (RF) range 110 MHz to 300 GHz in accordance with the scope, see Clause 1. It does not address the evaluation of current density.

RF exposure evaluation methods to be used for product compliance, product installation compliance and in-situ RF exposure assessments are specified in this document. Exposure limits are not specified in this document. The entity conducting RF exposure assessments refers to the set of exposure limits applicable where exposure takes place. Examples of applicable exposure limits considered in this document are provided in the Bibliography, for example ICNIRP-2020 [1], ICNIRP-1998 [2], IEEE Std C95.1™-2019 [3] and Safety Code 6 [4].

NOTE In this document, "ICNIRP" used without "-1998 or "-2020" applies to both [1] and [2].

This document is based on IEC 62232:2017 leveraging guidelines and lessons learned from the implementation guide IEC TR 62669:2019 [5]. In particular, it specifies how to implement the actual maximum approach.

Clause 2, Clause 3 and Clause 4 address normative references, terms and definitions, symbols, and abbreviated terms, respectively.

Clause 5 provides advice on how to use this document, including a quick-start guide.

Clause 6 describes the three main application areas of this document: RF exposure evaluation methods for product compliance, product installation compliance, and in-situ RF exposure assessments. It includes the key requirements for assessing RF exposure based on using the actual maximum approach. It also includes simplified criteria for putting BS into operation. Further details are provided in Annex C, Annex D and Annex E.

Clause 7 provides guidelines on how to select the evaluation method. Further details are provided in Annex A.

Clause 8 specifies the RF exposure evaluation methods to be used and refers to further details in Annex B, Annex C, Annex F and Annex H.

Clause 9 addresses the estimation of uncertainty and refers to Annex G and Annex H for further details.

Clause 10 describes reporting requirements for the evaluation or assessment.

Annexes and the bibliography are referenced extensively to provide useful clarifications or guidance.

Additional guidance can be found in IEC TR 62669:2019 [5], which includes a set of case studies providing practical examples of the application of this document.

DETERMINATION OF RF FIELD STRENGTH, POWER DENSITY AND SAR IN THE VICINITY OF BASE STATIONS FOR THE PURPOSE OF EVALUATING HUMAN EXPOSURE

1 Scope

This document provides methods for the determination of RF field strength, power density and specific absorption rate (SAR) in the vicinity of base stations (BS) for the purpose of evaluating human exposure.

This document:

a) considers intentionally radiating BS which transmit on one or more antennas using one or more frequencies in the range 110 MHz to 300 GHz;

b) considers the impact of ambient sources on RF exposure at least in the 100 kHz to 300 GHz frequency range;

c) specifies the methods to be used for RF exposure evaluation for compliance assessment applications, namely:

   1) product compliance – determination of compliance boundary information for a BS product before it is placed on the market;

   2) product installation compliance – determination of the total RF exposure levels in accessible areas from a BS product and other relevant sources before the product is put into operation;

   3) in-situ RF exposure assessment – measurement of in-situ RF exposure levels in the vicinity of a BS installation after the product has been taken into operation;

d) specifies how to perform RF exposure assessment based on the actual maximum approach;

e) describes several RF field strength, power density, and SAR measurement and computation methodologies with guidance on their applicability to address both the in-situ evaluation of installed BS and laboratory-based evaluations;

f) describes how surveyors establish their specific evaluation procedures appropriate for their evaluation purpose;

g) provides guidance on how to report, interpret and compare results from different evaluation methodologies and, where the evaluation purpose requires it, determine a justified decision against a limit value;

h) provides methods for the RF exposure assessment of BS using time-varying beam-steering technologies such as new radio (NR) BS using massive multiple input multiple output (MIMO).

NOTE 1 Practical implementation case studies are provided as examples in the companion Technical Report IEC TR 62669:2019 [5].

NOTE 2 Although the current BS product types have been specified to operate up to 200 GHz (see, for example, [6] and [7]), the upper frequency of 300 GHz is consistent with applicable exposure limits.

NOTE 3 The lower frequency considered for ambient sources, 100 kHz, is derived from ICNIRP-1998 [2] and ICNIRP-2020 [1]. However, some applicable exposure guidelines require ambient fields to be evaluated as low as 3 kHz, e.g. Safety Code 6 [4] and IEEE Std C95.1-2019 [3].

NOTE 4 Specification of appropriate RF exposure mitigation measures such as signage, access control, and training are beyond the scope of this document. It is possible to refer to the applicable regulations or recommended practices on these topics.

NOTE 5 While this document is based on the current international consensus about the best engineering practice for assessing the compliance of RF exposure with the applicable exposure limits, it is possible that national regulatory agencies specify different requirements. The entity conducting an RF exposure assessment needs to be aware of the applicable regulations.