IEC TR 62669

Edition 3.0 2026-08

TECHNICAL REPORT

Case studies supporting IEC 62232 - Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure

IEC TR 62669:2026-08(en)

ICS 13.280; 17.240

ISBN 978-2-8327-1414-0

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

IEC TR 62669 has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure. It is a Technical Report.

This third edition cancels and replaces the second edition published in 2019. This edition constitutes a technical revision.

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

a) additional case studies and technical updates illustrating the implementation of IEC 62232:2025;

b) general implementation of the actual maximum approach for beamforming antennas;

c) validation of power or EIRP control features;

d) in-situ measurement and implementation of extrapolation methods;

e) introduction of emerging laboratory measurement methods for product compliance assessments.

This document contains attached files in the form of test reports that are cited in this document. These files can be downloaded from https://www.iec.ch/tc106/supportingdocuments.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
106/740/DTR	106/746/RVDTR

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 Technical Report 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 www.iec.ch/publications.

When referring to subdivisions of IEC 62232, the number of the subdivision is followed by the corresponding edition, in order to differentiate from subdivisions of this current document. For example:

– "defined in 6.4 (IEC 62232:2025)" means "defined in 6.4 of IEC 62232:2025";

– "see 8.2" means "see 8.2 of this document, i.e. the current edition of IEC TR 62669".

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, or

– revised.

INTRODUCTION

This document contains a series of case studies for the evaluation of exposure from sources of electromagnetic (EM) emissions transmitting in the frequency range from 110 MHz to 300 GHz (including consideration of ambient sources transmitting from 100 kHz to 300 GHz) to support the implementation of assessment methods specified in IEC 62232:2025 [1][1].

Case studies presented in this document have been chosen to illustrate typical radio frequency (RF) exposure assessments for the most common types of base stations (BSs), deployed in mobile and wireless networks, such as small cells, street cells, macro BSs, and parabolic dish antennas used for wireless transmission or mobile backhaul. Many new case studies, such as Clause 12, Clause 13 and Annex C, have been introduced in order to illustrate the implementation of the actual maximum approach and RF exposure assessment of massive multiple-input, multiple-output (mMIMO) BSs, which are used more predominantly in 5G networks. In many clauses, RF exposure levels have been assessed using multiple methods for comparison purposes. These comparative studies are used to highlight the applicability and underlying principles of various implementations of IEC 62232 in order to propose improvements in the next edition.

Clause 19 is dedicated to the introduction of new assessment techniques dedicated to new exposure metrics specified in ICNIRP-2020 [2].

This document is informative. Each clause includes "lessons learned" and improvement suggestions for the next version of IEC 62232. Case studies are described in the main body of the document. Additional details, rationale, and test results can be found in the annexes and supporting documents.

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

1 Scope

This document, which is a Technical Report, presents a series of case studies in which electromagnetic field (EMF) exposure is evaluated in accordance with IEC 62232:2025 [1]. The case studies presented in this document involve intentionally radiating base stations (BSs). The BS transmits on one or more antennas using one or more frequencies in the range 110 MHz to 300 GHz. RF exposure assessments consider, as a minimum, the contribution of ambient sources in at least the 100 kHz to 300 GHz frequency range.

Case studies presented in this document illustrate typical usage of IEC 62232:2025 for the RF exposure assessments of the most common BS types, deployed in mobile and wireless networks, such as small cells, street cells, macro BSs, and parabolic dish antennas used for wireless transmission or mobile backhaul. Many case studies also illustrate the implementation of the actual maximum approach and RF exposure assessment of massive multiple-input, multiple-output (mMIMO) BSs, which are deployed in operational mobile networks, such as 5G.

The case studies are provided for guidance only and are not a substitute for a thorough understanding of the requirements of IEC 62232:2025. Based on the technical outcome and lessons learned from each case study, suggestions are made about RF assessment topics to be considered in the next edition of IEC 62232. New assessment techniques for metrics specified in ICNIRP-2020 [2], such as whole-body average SAR (wbSAR) above 10 GHz and absorbed power density (APD), are also introduced.

NOTE 1 Trade names and trademarks of measurement equipment and computation tools given in this document and in the attached test reports are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.

NOTE 2 The lower frequency considered for ambient sources, 100 kHz, is derived from ICNIRP-2020 [2] and ICNIRP-1998 [3]. Some applicable exposure limit guidelines, however, require ambient fields to be evaluated as low as 3 kHz, e.g. IEEE Std C95.1-2019 [4] and Safety Code 6 [5].

2 Normative references

There are no normative references in this document.

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