

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



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

**Détermination des champs de radiofréquences et du DAS aux environs des  
stations de base utilisées pour les communications radio dans le but d'évaluer  
l'exposition humaine**



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# DETERMINATION OF RF FIELD STRENGTH AND SAR IN THE VICINITY OF RADIOCOMMUNICATION BASE STATIONS FOR THE PURPOSE OF EVALUATING HUMAN EXPOSURE

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The text of this standard is based on the following documents:

FDIS	Report on voting
106/221/FDIS	106/228/RVD

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## INTRODUCTION

This standard addresses the evaluation of RF field strength or specific absorption rate levels in the vicinity of non-broadcast RF radiocommunication sources (i.e. RBS) intentionally radiating in the frequency range 300 MHz to 6 GHz according to the scope (see Clause 1). It does not address the evaluation of current density which exposure guidelines often do not consider to be relevant when evaluating RF fields in the intended RBS operating frequency range.

This standard defines how a suitably qualified surveyor shall select between the described evaluation methods in order to prepare specific or generic evaluation plans and how to validate their implementation. When using this standard to establish RBS compliance, the full set of limiting conditions needs to be defined. These may include for example limits on human exposure to RF fields; the likelihood that people may have access to a specific location; specific decision rules for interpretation of uncertainty. This standard does not define such limits or the associated requirements for a safety programme. Further, this standard recognises that national regulators (or the test client) may establish rules (termed “assessment schemes”) on how to interpret uncertainty when establishing compliance. However, this standard does provide guidance on how to apply the described evaluation methods consistent with such rules. Additional guidance can be found in Technical Report IEC 62669 [54]<sup>1)</sup> which includes a set of worked case studies giving practical examples of the application of this standard.

Clause 2, Clause 3 and Clause 4 address normative references, definitions and abbreviations respectively.

Clause 5, with Annex A, Annex B and Annex C, defines how to select the evaluation methods to be used and how to plan the evaluation task. The standard describes the alternative methods that may be included in the evaluation plan and defines a ranking to be applied in the event of dispute where the higher ranking evaluation takes precedence. Lower ranking evaluations are of course valid within their applicability and may be more practical to implement.

Clause 6 describes the evaluation methods to determine a measurand (SAR or RF field strength) value at a specified point. These cover both laboratory and *in situ* measurement methods for SAR and electric field strength and computation methods for SAR, power flux density, electric field strength and magnetic field strength. Annex C describes how the evaluation methods may be employed for specific purposes. Annex F and Annex G provide information on implementation of computation methods and Annex H with included referenced spread sheets provides computation validation information.

Clause 7 and Annex O address the estimation of uncertainty or the determination that the evaluated value meets a specified confidence level. Annex L and Annex M describe how to address uncertainty when determining compliance with limit values in accordance with relevant national regulatory requirements.

Clause 8 describes reporting requirements for the evaluation.

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

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1) Numerals in square brackets refer to the Bibliography.

# **DETERMINATION OF RF FIELD STRENGTH AND SAR IN THE VICINITY OF RADIOCOMMUNICATION BASE STATIONS FOR THE PURPOSE OF EVALUATING HUMAN EXPOSURE**

## **1 Scope**

This International Standard provides methods for the determination of radio-frequency (RF) field strength and specific absorption rate (SAR) in the vicinity of radiocommunication base stations (RBS) for the purpose of evaluating human exposure.

This standard:

- a) considers RBS which transmit on one or more antennas using one or more frequencies in the range 300 MHz to 6 GHz;
- b) describes several RF field strength and SAR measurement and computation methodologies with guidance on their applicability to address both the *in situ* evaluation of installed RBS and laboratory-based evaluations;
- c) describes how surveyors with a sufficient level of expertise shall establish their specific evaluation procedures appropriate for their evaluation purpose;
- d) considers the evaluation purposes, namely:
  - 1) product conformity: to establish that a RBS conforms to a defined set of limit conditions under its intended use;
  - 2) compliance boundary: to establish the compliance boundary or boundaries for a RBS in relation to a defined set of limit conditions;
  - 3) to evaluate RF field strength or SAR values at one or more evaluation locations, namely:
    - i) evaluation location(s) at arbitrary locations outside the control boundary to provide information for interested parties;
    - ii) evaluation location(s) at the control boundary to confirm validity of control boundary;
    - iii) evaluation location(s) within the control boundary with the specific conditions relevant to investigate an alleged over-exposure incident;
- e) 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;
- f) provides informative guidance on how to evaluate ambient RF field strength levels in the vicinity of a RBS from RF sources other than the RBS under evaluation and at frequencies within and outside the range 300 MHz to 6 GHz;
- g) provides short descriptions of the informative example case studies to aid the surveyor given in the companion Technical Report IEC 62669 [54].

## 2 Normative references

The following referenced documents are indispensable for the application 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 60215, *Safety requirements for radio transmitting equipment*

IEC 62209-1:2005, *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)*

IEC 62209-2:2010, *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)*

ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1 ambient fields

background electromagnetic fields in the frequency range from 100 kHz to 300 GHz other than the emissions from the EUT in the frequency range 300 MHz to 6 GHz

### 3.2 antenna factor

ratio of the electromagnetic field strength incident upon an antenna to the voltage (V) that is produced across a specified impedance (e.g. 50 Ω) terminating the line connection of the antenna

### 3.3 assessment

determination of a decision based on measurand value (e.g. comparison with a relevant limit)

### 3.4 assessment configuration

set of parameter values which together represent the RBS configuration to be assessed according to the evaluation purpose, e.g. for conformity assessment

### 3.5 average (temporal) transmitted power

rate of radiated energy transfer expressed in W given by

$$\bar{P}_{\text{avg}} = \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} P(t) dt$$

where

- $t_1$  is the start time of the observation in seconds;
- $t_2$  is the stop time of the observation in seconds;