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Guidance for evaluating exposure from multiple electromagnetic sources

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GUIDANCE FOR EVALUATING EXPOSURE FROM MULTIPLE ELECTROMAGNETIC SOURCES

FOREWORD

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IEC/TR 62630, which is a technical report, has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
106/173/DTR	106/196/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

INTRODUCTION

This Technical Report provides guidance to IEC TC 106 project teams on how to evaluate the combined exposures from multiple electromagnetic (EM) sources in the frequency range 100 kHz to 300 GHz when *specific absorption rate* (*SAR*) and *equivalent power density* (*S*) are the relevant exposure metrics, as defined by the main international guidelines recommending limits on human exposure to EM fields.

SAR and power density are energy-intensive exposure metrics related to tissue heating. Other metrics have been defined in some exposure guidelines to regulate different effects, e.g., electro-stimulation. Guidance on evaluating exposure from multiple EM sources based on these other exposure metrics requires separate further study

This Technical Report considers the combination of exposures from multiple EM sources

a) which reside on the same electronic device (e.g. multi-band mobile phone);

b) arising from multiple devices (e.g. multiple base station antennas);

c) arising from temporally uncorrelated fields (e.g., transmitters operating in different bands);

d) arising from temporally correlated fields (e.g., adaptive (beam-steering) antenna arrays).

Only intentional EM-energy transmitters are considered.

NOTE Evaluation of spurious radiation from non-intentional emitters is addressed in electromagnetic compatibility (EMC) standards dealing with unwanted EM emissions from electronic devices. The guidance in this Technical Report is not specifically intended for combining exposures from non-intentional radiating sources, such as EM leakages from electronic devices that are not designed for purpose of radiated RF emission. However, it may be possible to use some of the methods in this Technical Report to evaluate multiple exposures when some of the sources are not designed to radiate EM energy, e.g. microwave ovens or RF welders and dryers.

This Technical Report establishes basic, rigorous techniques to estimate accurately and conservatively the combined exposure from multiple EM sources. In developing International Standards, it is anticipated that IEC Project Teams may deviate from or further evolve these techniques as required to better address specific device or evaluation requirements.

The techniques established in this Technical Report allow summing internal fields for the purpose of determining *SAR* and external fields for determining the power density. They do not describe how to perform the volume or surface averaging procedures that would be required to derive the compliance metrics (e.g., 10-g *SAR* or spatially-averaged power density) most commonly employed in national or international exposure guidelines.

This Technical Report does not define any test method or algorithm to determine product compliance with exposure limits, leaving that task to product compliance standards. Even though an effort is made to provide guidance consistent with the most referenced international exposure guidelines, the Technical Report does not establish or imply any requirement to follow any specific national or international exposure guideline since that is a regulatory matter. Rather, imposition of requirements depends on the policy of national regulators.

GUIDANCE FOR EVALUATING EXPOSURE FROM MULTIPLE ELECTROMAGNETIC SOURCES

1 Scope

This Technical Report describes exposure evaluation concepts and techniques for the overall exposure level in spatial regions and occupants caused by the simultaneous exposure to multiple narrowband electromagnetic (EM) sources. Throughout this Technical Report, it is assumed that the exposure evaluation occurs under static conditions, i.e., the source position and transmit-mode characteristics (e.g. emitted power, modulation scheme, etc.) of the device(s) under test do not vary significantly over the time required to carry out the evaluation using the chosen evaluation technique (e.g., field measurements).

The vast majority of wireless communication systems worldwide employ signalling schemes featuring narrowband waveforms, hereinafter defined as signal waveforms occupying a frequency band not broader than 10 % of its central frequency (justification of this threshold is provided below). For information, Annex A presents the operating system bands and channel bandwidths of several common wireless services.

Wide-band communication systems, e.g., ultra-wideband (UWB) systems employing impulsive waveforms with fractional bandwidth well in excess of 10 %, are relatively new to the marketplace, have experienced limited deployment so far, and are not typically regarded as significant contributors to EM exposure levels due to low transmit power levels.

NOTE Present exposure evaluation standards for fixed or mobile wireless communication devices, e.g., IEC 62209-1, are mostly tailored towards defining suitable techniques for narrowband waveforms. For instance, they recommend the use of scalar E-field or H-field sensors, e.g., miniature diode-detector probes, which typically provide accurate readings for narrowband waveforms, as defined herein. The paucity of UWB wireless communication systems, which have only very recently been introduced in the marketplace, as well as the low power levels associated with the corresponding signals to avoid interfering with coexisting electronic systems, has so far reduced the priority to standardize suitable evaluation techniques and to develop the relevant test instrumentation.

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 62209-1:2005, *Human exposure to radio frequency fields from handheld 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)*