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Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (frequency range of 6 GHz to 300 GHz) –

Part 1: Measurement procedure

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Évaluation de la densité de puissance de l'exposition humaine aux champs radiofréquences provenant de dispositifs sans fil à proximité immédiate de la tête et du corps (plage de fréquences de 6 GHz à 300 GHz) –

Partie 1: Procédure de mesure



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CONTENTS

FOREWORD.....	9
INTRODUCTION.....	11
1 Scope.....	12
2 Normative references	13
3 Terms and definitions	13
3.1 Exposure metrics and parameters.....	13
3.2 Spatial, physical, and geometrical parameters associated with exposure metrics.....	16
3.3 Measurement instrumentation, field probe, and data-processing parameters.....	17
3.4 RF power parameters	20
3.5 Test device technical operating and antenna parameters	21
3.6 Test device physical configurations.....	23
3.7 Uncertainty parameters.....	24
4 Symbols and abbreviated terms.....	25
4.1 Symbols.....	25
4.1.1 Physical quantities.....	25
4.1.2 Constants	26
4.2 Abbreviated terms.....	26
5 Quick start guide and application of this document.....	27
5.1 Quick start guide.....	27
5.2 Application of this document	30
5.3 Stipulations	30
6 Measurement system and laboratory requirements.....	30
6.1 General requirements	30
6.2 Laboratory requirements.....	31
6.3 Field probe requirements	32
6.4 Measurement instrumentation requirements.....	32
6.5 Scanning system requirements	33
6.5.1 Single-probe systems	33
6.5.2 Multiple field-probe systems	33
6.6 Device holder requirements	34
6.7 Post-processing quantities, procedures, and requirements.....	35
6.7.1 Formulas for calculation of <i>sPD</i>	35
6.7.2 Post-processing procedure	37
6.7.3 Requirements	38
7 Protocol for PD assessment	39
7.1 General.....	39
7.2 Measurement preparation	39
7.2.1 Relative system check	39
7.2.2 DUT requirements	39
7.2.3 DUT preparation.....	40
7.2.4 Selecting evaluation surfaces	41
7.3 Tests to be performed.....	44
7.3.1 General	44
7.3.2 Tests to be performed when supported by simulations of the antenna array.....	46
7.3.3 Tests to be performed by measurements of the antenna array.....	48

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7.4	Measurement procedure	48
7.4.1	General measurement procedure	48
7.4.2	Power density assessment methods	49
7.4.3	Power scaling for operating mode and channel	51
7.4.4	Correction for DUT drift	53
7.5	Exposure combining	54
7.5.1	General	54
7.5.2	Combining power density and SAR results	55
8	Uncertainty estimation	58
8.1	General	58
8.2	Requirements for uncertainty evaluations	58
8.3	Description of uncertainty models	58
8.4	Uncertainty terms dependent on the measurement system	59
8.4.1	<i>CAL</i> – Calibration of the measurement equipment	59
8.4.2	<i>COR</i> – Probe correction	59
8.4.3	<i>FRS</i> – Frequency response	59
8.4.4	<i>SCC</i> – Sensor cross coupling	60
8.4.5	<i>ISO</i> – Isotropy	61
8.4.6	<i>LIN</i> – System linearity error	61
8.4.7	<i>PSC</i> – Probe scattering	61
8.4.8	<i>PPO</i> – Probe positioning offset	62
8.4.9	<i>PPR</i> – Probe positioning repeatability	62
8.4.10	<i>SMO</i> – Sensor mechanical offset	63
8.4.11	<i>PSR</i> – Probe spatial resolution	63
8.4.12	<i>FLD</i> – Field impedance dependence (ratio $ E / H $)	63
8.4.13	<i>MED</i> – Measurement drift	63
8.4.14	<i>APN</i> – Amplitude and phase noise	64
8.4.15	<i>TR</i> – Measurement area truncation	64
8.4.16	<i>DAQ</i> – Data acquisition	64
8.4.17	<i>SMP</i> – Sampling	64
8.4.18	<i>REC</i> – Field reconstruction	64
8.4.19	<i>SNR</i> – Signal-to-noise ratio	65
8.4.20	<i>TRA</i> – Forward transformation and backward transformation	65
8.4.21	<i>SCA</i> – Power density scaling	66
8.4.22	<i>SAV</i> – Spatial averaging	66
8.4.23	<i>COM</i> – Exposure combining	66
8.5	Uncertainty terms dependent on the DUT and environmental factors	66
8.5.1	<i>PC</i> – Probe coupling with DUT	66
8.5.2	<i>MOD</i> – Modulation response	67
8.5.3	<i>IT</i> – Integration time	67
8.5.4	<i>RT</i> – Response time	68
8.5.5	<i>DH</i> – Device holder influence	68
8.5.6	<i>DA</i> – DUT alignment	68
8.5.7	<i>AC</i> – RF ambient conditions	68
8.5.8	<i>TEM</i> – Laboratory temperature	68
8.5.9	<i>REF</i> – Reflections in laboratory	69
8.5.10	<i>MSI</i> – Measurement system immunity/secondary reception	69
8.5.11	<i>DRI</i> – DUT drift	69
8.6	Combined and expanded uncertainty	69

9	Measurement report	73
9.1	General.....	73
9.2	Items to be recorded in measurement reports	73
Annex A	(normative) Measurement system check and system validation tests	76
A.1	Overview	76
A.2	Normalization to total radiated power.....	77
A.2.1	General	77
A.2.2	Option 1: Accepted power measurement.....	77
A.2.3	Option 2: Total radiated power measurement.....	81
A.3	Relative system check	82
A.3.1	Purpose.....	82
A.3.2	Antenna and test conditions.....	82
A.3.3	Procedure.....	83
A.3.4	Acceptance criteria	83
A.4	Absolute system check	85
A.4.1	Purpose.....	85
A.4.2	Antenna and test conditions.....	85
A.4.3	Procedure.....	85
A.4.4	Acceptance criteria	85
A.5	System validation.....	86
A.5.1	Purpose.....	86
A.5.2	Procedure.....	86
A.5.3	Validation of modulation response.....	87
A.5.4	Acceptance criteria	87
Annex B	(normative) Antennas for system check and system validation tests	89
B.1	General.....	89
B.2	Pyramidal horn antennas for system checks	90
B.3	Cavity-fed dipole arrays for system validation	91
B.3.1	Description	91
B.3.2	Numerical target values for cavity-fed dipole arrays.....	94
B.3.3	Field and power density distribution patterns	94
B.3.4	Far-field radiation patterns.....	99
B.4	Pyramidal horns with slot arrays for system validation	101
B.4.1	Description	101
B.4.2	Numerical target values for pyramidal horns loaded with a slot array	103
B.4.3	Field and power density distribution patterns	104
B.4.4	Far-field radiation patterns.....	109
B.5	Antenna validation procedure.....	110
B.5.1	General	110
B.5.2	Objectives, scope, and usage specifications	111
B.5.3	Antenna design.....	111
B.5.4	Numerical targets	111
B.5.5	Reference antennas calibration	111
B.5.6	Antenna verification and life expectation.....	111
B.5.7	Uncertainty budget considerations	111
B.6	Validation procedure for wideband signals	112
B.6.1	General	112
B.6.2	Validation signals	112
B.6.3	Validation antennas and setup.....	112

IEC/IEEE 63195-1:2022
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B.6.4	Target values for validation antennas transmitting wideband signals	112
B.6.5	Wideband signal uncertainty	112
B.6.6	Validation procedure	113
Annex C (normative)	Calibration and characterization of measurement probes	114
C.1	General	114
C.2	Calibration of waveguide probes	114
C.2.1	General	114
C.2.2	Sensitivity	114
C.2.3	Linearity	114
C.2.4	Lower detection limit	115
C.2.5	Isotropy	115
C.2.6	Response time	115
C.3	Calibration for isotropic scalar E-field or H-field probes	115
C.3.1	General	115
C.3.2	Sensitivity	115
C.3.3	Isotropy	115
C.3.4	Linearity	116
C.3.5	Lower detection limit	116
C.3.6	Response time	116
C.4	Calibration of phasor E-field or H-field probes	116
C.4.1	General	116
C.4.2	Sensitivity	116
C.4.3	Isotropy	117
C.4.4	Linearity	117
C.4.5	Lower detection limit	117
C.5	Calibration uncertainty parameters	117
C.5.1	General	117
C.5.2	Input power to the antenna	117
C.5.3	Mismatch effect (input power measurement)	117
C.5.4	Gain and offset distance	118
C.5.5	Signal spectrum	118
C.5.6	Setup stability	118
C.5.7	Uncertainty for field impedance variations	119
C.6	Uncertainty budget template	119
Annex D (informative)	Information on use of square or circular shapes for power density averaging area in conformity evaluations	121
D.1	General	121
D.2	Method using computational analysis	121
D.3	Areas averaged with square and circular shapes on planar evaluation surface	121
D.4	Areas averaged with square and circular shapes on nonplanar evaluation surface	123
Annex E (informative)	Reconstruction algorithms	125
E.1	General	125
E.2	Methodologies to extract local field components and power densities	125
E.2.1	General	125
E.2.2	Phase-less approaches	126
E.2.3	Approaches using E-field polarization ellipse measurements	126
E.2.4	Direct near-field measurements	126

E.3	Forward transformation (propagation) of the fields	127
E.3.1	General	127
E.3.2	Field expansion methods	128
E.3.3	Field integral equation methods	128
E.4	Backward transformation (propagation) of the fields	129
E.4.1	General	129
E.4.2	Field expansion methods – the plane wave expansion	129
E.4.3	Inverse source methods	130
E.5	Analytical reference functions	131
Annex F (normative)	Interlaboratory comparisons	133
F.1	Purpose	133
F.2	Reference devices	133
F.3	Power setup	133
F.4	Interlaboratory comparison – procedure	133
Annex G (informative)	PD test and verification example	134
G.1	Purpose	134
G.2	DUT overview	134
G.3	Test system verification	134
G.4	Test setup	134
G.5	Power density results	134
G.6	Combined exposure (Total Exposure Ratio)	134
Annex H (informative)	Applicability of plane-wave equivalent approximations	135
H.1	Objective	135
H.2	Method	135
H.3	Results	135
H.4	Discussion	137
Annex I (informative)	Rationales for concepts and methods applied in this document and IEC/IEEE 63195-2	138
I.1	Frequency range	138
I.2	Calculation of <i>sPD</i>	138
I.2.1	Application of the Poynting vector for calculation of incident power density	138
I.2.2	Averaging area	139
Bibliography	140
Figure 1	– Quick Start Guide	29
Figure 2	– Simplified view of a generic measurement setup involving the use of reconstruction algorithms	38
Figure 3	– Cross-sectional view of SAM phantom for SAR evaluations at the reference plane, as described in IEC/IEEE 62209-1528:2020	42
Figure 4	– Cross-sectional view of SAM virtual phantom for PD evaluations at the reference plane (shell thickness is 2 mm everywhere, including at the pinna)	42
Figure 5	– Example reference coordinate system for the left-ear ERP of the SAM phantom	44
Figure 6	– Example reference points and vertical and horizontal lines on a DUT	44
Figure 7	– Flow chart for test procedure in 7.3	46
Figure 8	– Flow chart for general measurement procedure in 7.4.1	49
Figure 9	– Flow chart for power density assessment methods in 7.4.2	50

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Figure 10 – SAR and power density evaluation at a point r	57
Figure 11 – Combining SAR (top) and power density (bottom) for the SAM phantom	57
Figure A.1 – Recommended accepted power measurement setup for relative system check, absolute system check and system validation	78
Figure A.2 – Equipment setup for measurement of forward power P_f and forward coupled power P_{fc}	78
Figure A.3 – Equipment setup for measuring the shorted reverse coupled power P_{rCS}	78
Figure A.4 – Equipment setup for measuring the power with the reference antenna	79
Figure A.5 – Port numbering for the S -parameter measurements of the directional coupler	80
Figure B.1 – Main dimensions for the cavity-fed dipole arrays – 30 GHz design	92
Figure B.2 – 10 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the cavity-fed dipole arrays at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the dielectric substrate	95
Figure B.3 – 30 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the cavity-fed dipole arrays at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the dielectric substrate	96
Figure B.4 – 60 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the cavity-fed dipole arrays at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the dielectric substrate	97
Figure B.5 – 90 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the cavity-fed dipole arrays at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the dielectric substrate	98
Figure B.6 – Far-field radiation patterns of a) 10 GHz, b) 30 GHz, c) 60 GHz, and d) 90 GHz cavity-fed dipole arrays	100
Figure B.7 – Main dimensions for the 0,15 mm stainless steel stencil with slot array	101
Figure B.8 – Main dimensions for the pyramidal horn antennas	102
Figure B.9 – 10 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the pyramidal horn loaded with a slot array at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the slot array	105
Figure B.10 – 30 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the pyramidal horn loaded with a slot array at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the slot array	106
Figure B.11 – 60 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the pyramidal horn loaded with a slot array at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the slot array	107
Figure B.12 – 90 GHz patterns of $ E_{total} $ and $Re\{S\}_{total}$ for the pyramidal horn loaded with a slot array at distances of a) 2 mm, b) 5 mm, c) 10 mm, and d) 50 mm from the upper surface of the slot array	108
Figure B.13 – Far-field radiation patterns of a) 10 GHz, b) 30 GHz, c) 60 GHz, and d) 90 GHz pyramidal horn loaded with a slot array	110
Figure D.1 – Schematic view of the assessment of the variation of sPD using square shape by rotating AUT (antenna under test)	121
Figure D.2 – Comparison of $psPD$ averaged using square versus circular shaped areas on planar evaluation surfaces	122
Figure D.3 – Example PD distributions with device next to ear evaluation surface	123
Figure D.4 – Comparison of $psPD$ averaged using cube cross-section (square-like) versus sphere cross-section (circular-like) shaped areas for device next to ear evaluation surface	124

Figure E.1 – Simulation (left) and forward transformation from measurements applying methods described in [29] (right) of power density in the xz -plane (above) and yz -plane (below) at a distance of 2 mm for a cavity-fed dipole array at 30 GHz (see Annex B) 127

Figure H.1 – $psPD_{pwe} / psPD_{tot}$ as function of distance (in units of λ) from cavity-fed dipole array (CDA##G, left-side) and pyramidal horn with slot arrays (SH##G, right-side) operating at 10 GHz, 30 GHz, 60 GHz, and 90 GHz 137

Table 1 – Evaluation plan check-list 28

Table 2 – Minimum evaluation distance between the DUT antenna and the evaluation surface for which the plane wave equivalent approximation applies 50

Table 3 – Template of measurement uncertainty for power density measurements 70

Table 4 – Example measurement uncertainty budget for power density measurement results 72

Table A.1 – Example of power measurement uncertainty 81

Table A.2 – Communication signals for modulation response test 87

Table B.1 – Target values for pyramidal horn antennas at different frequencies 90

Table B.2 – Main dimensions for the cavity-fed dipole arrays at each frequency of interest 91

Table B.3 – Geometrical parameters of the cavity-fed dipole arrays at each frequency of interest 93

Table B.4 – Substrate and metallic block parameters for the cavity-fed dipole arrays at each frequency of interest 93

Table B.5 – Target values for the cavity-fed dipole arrays at 10 GHz, 30 GHz, 60 GHz, and 90 GHz 94

Table B.6 – Main dimensions for the stencil with slot array for each frequency 102

Table B.7 – Primary dimensions for the corresponding pyramidal horns at each frequency 103

Table B.8 – Target values for the pyramidal horns loaded with slot arrays at 10 GHz, 30 GHz, 60 GHz, and 90 GHz 104

Table C.1 – Uncertainty analysis of the probe calibration 119

Table D.1 – Phase shift values for the array antenna 123

Table E.1 – List of analytical reference functions and associated $psPD_{n+}$ target values 131

Table E.2 – List of analytical reference functions and associated $psPD_{tot+}$ target values 132

Table E.3 – List of analytical reference functions and associated $psPD_{mod+}$ target values 132

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

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

This document was drafted in accordance with the rules given in the ISO/IEC Directives, Part 2, available at www.iec.ch/members_experts/reidocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC/IEEE 63195 series, published under the general title *Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body*, can be found on the IEC website.

The IEC Technical Committee and IEEE Technical Committee have 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.

INTRODUCTION

This document provides methods to evaluate incident power density exposures due to any electromagnetic field (EMF) transmitting device 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. This document also addresses multi-band and multi-antenna devices. The overall applicable frequency range is from 6 GHz to 300 GHz. This document specifies:

- measurement system (Clause 6);
- power density measurement protocols (Clause 7);
- uncertainty evaluation (Clause 8);
- measurement report (Clause 9);
- system checks and system validation (Annex B).

To develop this document, IEC Technical Committee 106 (TC 106) and Technical Committee 34 (TC 34) Subcommittee 1 (SC 1) of IEEE International Committee on Electromagnetic Safety (ICES) formed Joint Working Group 12 (JWG 12) on measurement methods to assess the power density of electromagnetic fields from wireless devices in close proximity to the head and body.

This document is partly based on IEC TR 63170:2018.

NOTE System validation tests are specified in Annex B for 10 GHz, 30 GHz, 60 GHz, and 90 GHz to cover the frequency range from 6 GHz to 110 GHz. Additional validation antennas to cover the frequency range up to 300 GHz will be developed in a future revision of this document. Further discussion on rationales is given in Annex I.

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ASSESSMENT OF POWER DENSITY OF HUMAN EXPOSURE TO RADIO FREQUENCY FIELDS FROM WIRELESS DEVICES IN CLOSE PROXIMITY TO THE HEAD AND BODY (FREQUENCY RANGE OF 6 GHz TO 300 GHz) –

Part 1: Measurement procedure

1 Scope

This document specifies protocols and test procedures for repeatable and reproducible measurements of power density (PD) that provide conservative estimates of exposure incident to a human head or body due to radio-frequency (RF) electromagnetic field (EMF) transmitting communication devices, with a specified measurement uncertainty. These protocols and procedures apply for exposure evaluations of a significant majority of the population during the use of hand-held and body-worn RF transmitting communication devices. The methods apply for devices that can feature single or multiple transmitters or antennas, and can be operated with their radiating structure(s) at distances up to 200 mm from a human head or body.

The methods of this document can be used to determine conformity with applicable maximum PD requirements of different types of RF transmitting communication devices being used in close proximity to the head and body, including if combined with other RF transmitting or non-transmitting devices or accessories (e.g. belt-clip), or embedded in garments. The overall applicable frequency range of these protocols and procedures is from 6 GHz to 300 GHz.

The RF transmitting communication device categories covered in this document include but are not limited to mobile telephones, radio transmitters in personal computers, desktop and laptop devices, and multi-band and multi-antenna devices.

IEC/IEEE 63195-1:2022

NOTE 1 System validation tests are specified in Annex B for 10 GHz, 30 GHz, 60 GHz, and 90 GHz to cover the frequency range from 6 GHz to 110 GHz. Additional validation antennas to cover the frequency range up to 300 GHz will be developed in a future revision of this document. Further discussion on rationales is given in Annex I.

NOTE 2 The protocols and test procedures in this document can be adapted to evaluate exposure also due to non-communication types of devices operating in close proximity to the head and body, but these devices are not in the scope of this document.

NOTE 3 For the assessment of the combined exposure from simultaneous transmitters operating on frequencies below 6 GHz, the relevant standards for SAR measurements are IEC/IEEE 62209-1528:2020 and IEC/IEEE 62209-3:2019 [1].

NOTE 4 Between 6 GHz and 10 GHz, the scopes of this document and IEC/IEEE 62209-1528:2020 overlap. According to ICNIRP [2] guidelines and IEEE ICES C95.1 [3] standard, power density is the conformity metric in this frequency range. SAR can be used as conformity metric if local regulatory requirements allow it. (e.g. in case where a single transmit band includes test channels at both below and above 6 GHz).

The procedures of this document do not apply for EMF measurements of devices or objects intended to be implanted in the body.

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)*

IEC/IEEE 63195-2:2021¹, *Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (Frequency range of 6 GHz to 300 GHz) – Part 2: Computational procedure*

3 Terms and definitions

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

ISO, IEC, and IEEE maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEEE Dictionary Online: available at <http://dictionary.ieee.org>

3.1 Exposure metrics and parameters

3.1.1

power density
PD

<https://standards.iteh.ai/catalog/standards/sist/81024ca6-0757-4565-aa88-7be881467652/iec-ieee-63195-1-2022>

local power density

function of the complex Poynting vector S at the location r that is integrated over a surface to calculate the sPD

Note 1 to entry: Specifications of power density in terms of the integrands of Formula (4), Formula (5), and Formula (8) are provided in 6.7.1. See also rationales provided in Annex I for the PD specifications of 6.7.1.

Note 2 to entry: The formula used to calculate PD can depend on the applicable exposure guidelines or national regulations.

Note 3 to entry: Power density is also referred to as power flux density.

Note 4 to entry: The associated term incident power density refers to quantity of power per unit area that impinges on the body surface. The incident power density just outside the body surface is used to establish local exposure reference levels, which apply at frequencies above 6 GHz in some jurisdictions.

3.1.2

spatial-average power density

sPD

PD (3.1.1) averaged over a surface of area A_{av}

Note 1 to entry: sPD is a function of the location vector r . It is defined on the evaluation surface, except for the edges where no averaging area can be constructed.

Note 2 to entry: Example averaging area sizes specified in exposure limits are 1 cm² and/or 4 cm².

¹ To be published.