SLOVENSKI STANDARD
SIST EN 62233:2008

01-julij-2008

Nadomešča:
SIST EN 50366:2004
SIST EN 50366:2004/A1:2006

Metode merjenja elektromagnetnih sevanj gospodinjskih in podobnih električnih aparatov z vidika izpostavljenosti ljudi (IEC 62233:2005, spremenjen) (vsebuje popravek AC:2008)

Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure

Verfahren zur Messung der elektromagnetischen Felder von Haushaltgeräten und ähnlichen Elektrogeräten im Hinblick auf die Sicherheit von Personen in elektromagnetischen Feldern

Méthodes de mesures des champs électromagnétiques des appareils électrodomestiques et similaires en relation avec l'exposition humaine

Ta slovenski standard je istoveten z: **EN 62233:2008**

ICS:

97.030	Električni aparati za dom na splošno	Domestic electrical appliances in general

SIST EN 62233:2008 **en,de**

EUROPEAN STANDARD

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EN 62233

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ICS 97.030

Supersedes EN 50366:2003 + A1:2006
Incorporates corrigendum August 2008

English version

Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure
(IEC 62233:2005, modified)

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This European Standard was approved by CENELEC on 2007-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The text of the International Standard IEC 62233:2005, prepared by IEC TC 106, Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure, together with common modifications prepared by a Joint Editing Group of the Technical Committee CENELEC TC 61, Safety of household and similar electrical appliances, and CENELEC TC 106X, Electromagnetic fields in the human environment, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 62233 on 2007-12-01.

This European Standard supersedes EN 50366:2003 + A1:2006, to which it is technically equivalent.

The following dates are applicable:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2008-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-12-01

Annex ZA has been added by CENELEC.

The contents of the corrigendum of August 2008 have been included in this copy.

Endorsement notice

The text of the International Standard IEC 62233:2005 was approved by CENELEC as a European Standard with agreed common modifications as given below.

COMMON MODIFICATIONS

Contents

p Delete “and limit sets” from the title of Clause 4.

p Add:

Annex ZA (normative) Normative references to international publications with their corresponding European publications

1 Scope

Add the following note:

NOTE The methods are not suitable for comparing the fields of different appliances.

3 Definitions

p **3.2.1** Delete “(basic limitations)” in the term.

Add:

3.2.Z1
operator distance
distance between the surface of the appliance and the closest point of the head or torso of the operator

4 Choice of test method and limit sets

p Replace the title by:

4 Choice of test method

p Delete the first and third paragraphs.

p In the fifth paragraph, replace “alternative test methods” by “simplified test methods”.

5 Measuring methods

5.5.1 General

p Delete the second sentence of the first paragraph.

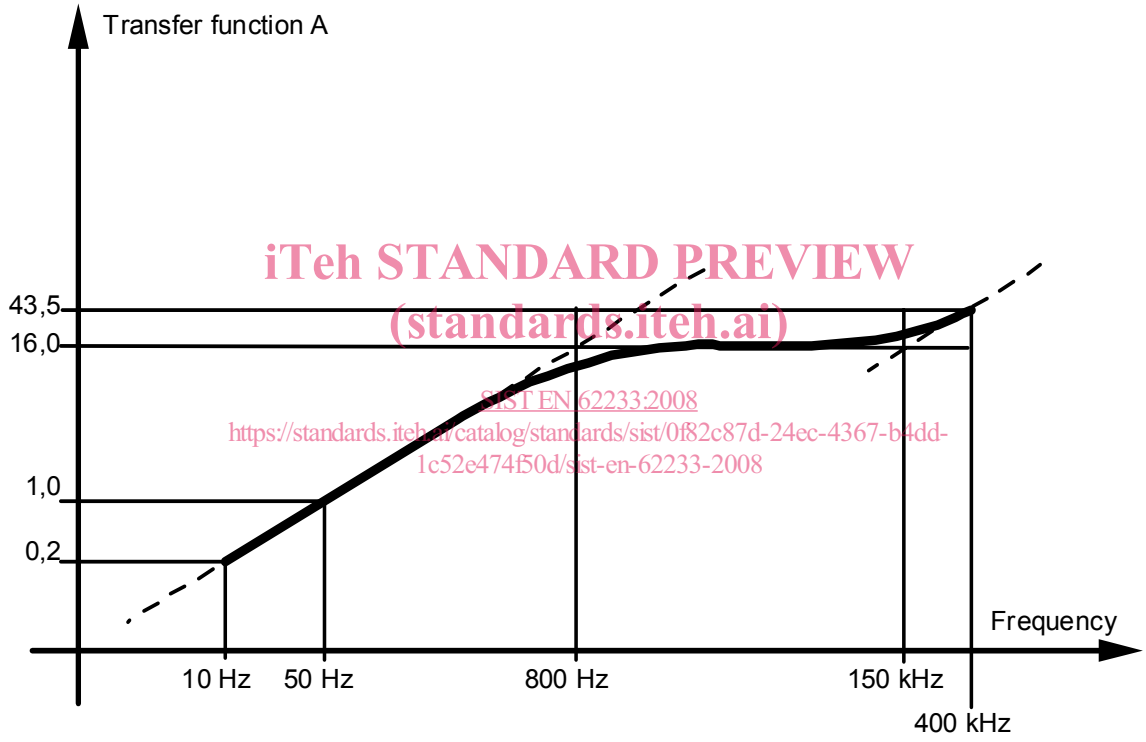
5.5.2 Time domain evaluation

p Replace the entire subclause by:

This is the reference method and is used in case of doubt.

Independent of the type of the signal, a time domain measurement of the value of the magnetic flux density can be carried out. For fields with several frequency components, the dependency on frequency of the reference levels is taken into account by implementing a transfer function A which is inverse of the reference level expressed as a function of the frequency.

The transfer function is to be established using a first order filter and shall have the characteristics shown in Figure Z1.



NOTE Logarithmic scales are used for both axes.

Figure Z1 - Transfer function

The following sequence is used for the measurements:

- perform a separate measurement of each coil signal;
- apply a weighting to each signal using the transfer function;
- square the weighted signals;
- add the squared signals;
- average the sum;
- obtain the square root of the average.

The result is the weighted r.m.s. value of the magnetic flux density.

This procedure is shown schematically in Figure Z2.

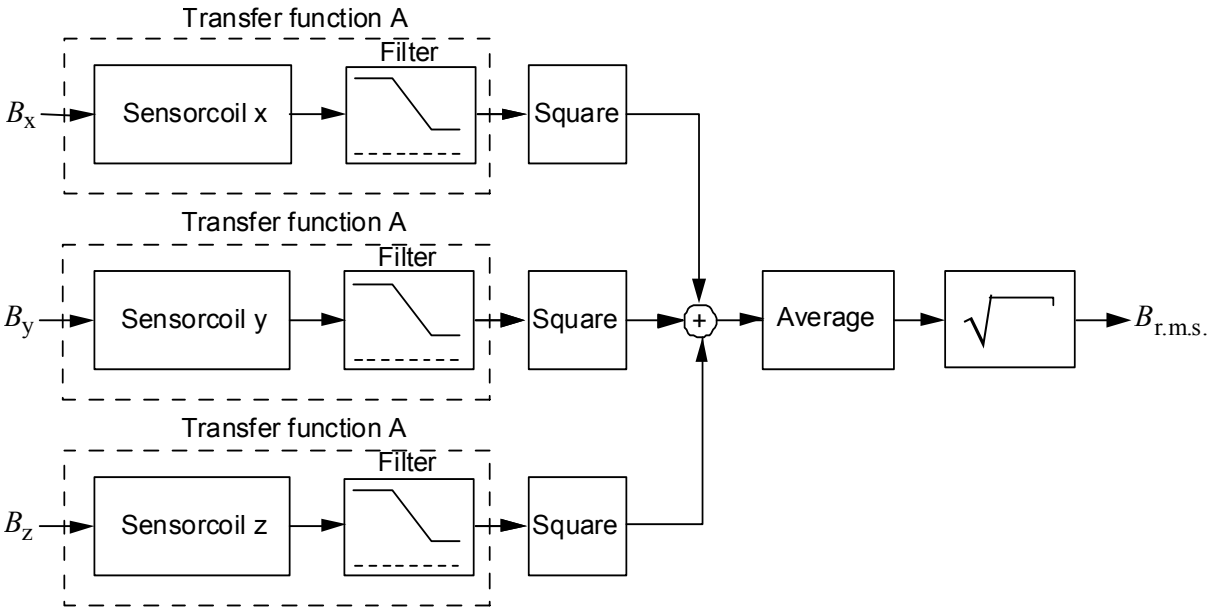


Figure Z2 - Schematic diagram of the reference method

NOTE Different ways that the transfer function can be applied to a time domain signal include: analog filter in an electronic circuit, pre-programmed DSP chip, a signal analyser, or a digital computer calculation with a spreadsheet package or a custom-written program.

The actual measured value shall be compared directly with the reference level B_{RL} of the flux density at 50 Hz. With appliances with highly localized fields, this has to be performed after taking the coupling factor $a_c(r_1)$ given in Annex C into account. The final weighted result, W, can be derived as follows:

$$W_n = \frac{B_{r.m.s.}}{B_{RL}}$$

or applying the coupling factor $a_c(r_1)$

$$W_{nc} = a_c(r_1).W_n$$

where

W_n weighted result for one measurement;

$B_{r.m.s}$ r.m.s. value of the magnetic flux density;

B_{RL} reference level of the magnetic flux density at f_{C0};

$a_c(r_1)$ coupling factor according to Annex C or Table D.3.

W_{nc} weighted result for one measurement taking the coupling of the inhomogeneous field into account by applying $a_c(r_1)$.

The determined weighted result W shall not exceed the value 1.

5.5.3 Line spectrum evaluation

p Delete the paragraph starting with “For drawing a comparison…” just before the last note.

5.5.4 Alternative test methods

p Replace the entire subclause by:

5.5.4 Simplified test methods

Appliances that are constructed so that they can only produce magnetic fields at mains frequency and its harmonics need only be tested in the frequency range below 2 kHz.

Appliances are considered to meet the requirements of this standard when all the following conditions are fulfilled:

– the currents, including the harmonic currents, generating the magnetic fields are known;

– all harmonic currents with amplitudes higher than 10 % of the amplitude of the mains frequency decrease continuously over the frequency range;

– the magnetic flux density measured at mains frequency is less than 50 % of the reference level specified for the mains frequency;

– the magnetic flux density measured during a broadband measurement over the frequency range, with the mains frequency suppressed, is less than 15 % of the reference level specified for the mains frequency.

NOTE An active notch filter is a suitable means for suppressing the mains frequency. If the conditions are not fulfilled another measurement according to the reference method is recommended.

Appliances that are constructed so that they only produce very weak magnetic fields, when the mains frequency is dominating, are considered to meet the requirements of this standard when all the following conditions are fulfilled:

– the currents, including the harmonic currents, generating the magnetic fields are known;

– all harmonic currents with amplitudes higher than 10 % of the amplitude of the mains frequency decrease continuously over the frequency range;

– the magnetic flux density measured over the whole frequency range is less than 30 % of the reference level specified for the mains frequency.

5.6 Measurement uncertainty

p Delete NOTE 2.

5.7 Test report

p Delete the bullet ‘applied limit set’.

Figures

p In Figure 1 replace “5.5.4 Alternative test methods” by “5.5.4 Simplified test methods”.

Annex A, Test conditions for the measurement of magnetic flux density

A.1 General

p Delete the second paragraph and the NOTE.

A.1.1 Operating condition

p Replace the title by:

A.1.1 Operating conditions, if not specified in Table A.1

p Replace the last-but one paragraph by:

Controls are adjusted to the highest setting. However, pre-set controls are used in the intended position. The measurements are made while the appliance is energized.

A.1.2 Measuring distance

p Replace the title by:

A.1.2 Measuring distance, if not specified in Table A.1

A.1.3 Sensor location

p Replace the title by:

A.1.3 Sensor location, if not specified in Table A.1

A.2.3 Measuring distance and sensor location

p Replace the first two paragraphs and Table A.1 by:

NOTE The measuring distances in Table A.1 have been defined based upon the expected location of the operator during normal operation, to protect against effects on central nervous system tissues in the head and trunk of the body.

Table A.1 - Measuring distances, sensor locations, operating conditions and coupling factors

Type of appliance	Measuring distance r_1 cm	Sensor locations	Operating conditions	Coupling factor $a_c(r_1)$ σ = 0,1 S/m 8 Hz .. 800 Hz [a]
Appliances not mentioned in the table	Operator distance	All surfaces	As specified in EN 55014-1	See Annex C
Air cleaners	30	All surfaces	Continuously	0,17
Air conditioners	30	Around	Continuously. When cooling lowest temperature setting. When heating highest temperature setting	0,18
Battery chargers (including inductive)	30	All surfaces	Charging a discharged battery having the highest capacity specified by the manufacturer	0,15
Blankets	0	Top	Spread out and laid on a sheet of thermal insulation	0,19
Blenders	30	Around	Continuously, no load	0,16
Citrus presses	30	Around	Continuously, no load	0,15
Clocks	30	Around	Continuously	0,15
Coffee makers	30	Around	As specified in 3.1.9 of EN 60335-2-15	0,16
Coffee mills	30	All surfaces	As specified in 3.1.9.108 of EN 60335-2-14	0,15
Convector heaters	30	Around	With highest output	0,20
Deep fat fryers	30	Around	As specified in 3.1.9 of EN 60335-2-13	0,16
Dental hygiene appliances	0	All surfaces	As specified in 3.1.9 of EN 60335-2-52	0,19
Depilators	0	Against cutter	Continuously, no load	0,30
Dishwashers	30	Top, front	Without dishes in the washing mode and drying mode	0,18
Egg boilers	30	Around	As specified in 3.1.9 of EN 60335-2-15	0,15
Electric and electronic controls for track sets	30	All surfaces	Continuously	0,17
Facial sauna appliances	10	Top	Continuously	0,12
Fans	30	Front	Continuously	0,16
Fan heaters	30	Front	Continuously, highest heat setting	0,16
Floor polishers	30	All surfaces	Continuously without any mechanical load on the polishing brushes	0,19
Food processors	30	Around	Continuously without load, highest speed setting	0,17
Food warming cabinets	30	Front	Continuously without load, highest heat setting	0,15

Type of appliance	Measuring distance r_1 cm	Sensor locations	Operating conditions	Coupling factor $a_c(r_1)$ σ = 0,1 S/m 8 Hz .. 800 Hz [a]
Foot warmers	30	Top	Continuously without load, highest heat setting	0,15
Gas heating appliances, wall mounted	30	Front, left and right side	Continuously, highest heat setting with pump in operation	0,16
Gas heating appliances, floor standing	30	Front, left and right side	Continuously, highest heat setting with pump in operation	0,20
Gas igniters	30	All surfaces	Continuously	0,15
Grills	30	Around	Continuously without load, highest heat setting	0,16
Hair clippers	0	Against cutter	Continuously without load	0,30
Hairdryers	10	All surfaces	Continuously, highest heat setting	0,12
Heat pumps	30	Around	Continuously. When cooling lowest temperature setting. When heating highest temperature setting	0,17
Heating mats	30	Top	Spread out and laid on a sheet of thermal insulation	0,15
Heating pads	0	Top	Spread out and laid on a sheet of thermal insulation	0,14
Hobs	30	Top, front	As specified in 3.1.9 of EN 60335-2-6 but with highest setting, each heating unit separately	0,18
Hotplates	30	Around	As specified in 3.1.9 of EN 60335-2-9 but with highest setting, each heating unit separately	0,17
Icecream makers	30	Around	Continuously without load, lowest temperature setting	0,18
Immersion heaters	30	Around	Heating element fully submerged	0,16
Induction hobs and hotplates	See A.3.1	See A.3.1	See A.3.2.	
Irons	30	All surfaces	As specified in 3.1.9 of EN 60335-2-3	0,15
Ironing machines	30	All surfaces	As specified in 3.1.9 of EN 60335-2-44	0,19
Juice extractors	30	Around	Continuously without load	0,17
Kettles	30	Around	Half-filled with water	0,17
Kitchen scales	30	Around	Continuously without load	0,14
Knives	30	All surfaces	Continuously without load	0,16
Massage appliances	0	Against the massage head	Continuously without load, highest speed setting	0,21

Type of appliance	Measuring distance r_1 cm	Sensor locations	Operating conditions	Coupling factor $a_c(r_1)$ σ = 0,1 S/m 8 Hz .. 800 Hz [a]
Microwave ovens	30	Top, front	Continuously with highest microwave power setting. Conventional heating elements, if available, are operated simultaneously at their highest setting. The load is 1 l of tap water, placed in the centre of the shelf. The water container is made of electrically non-conductive material such as glass or plastic.	0,17
Mixers	30	All surfaces	Continuously without load, highest speed setting	0,16
Oil filled radiators	30	Around	Continuously, highest heat setting	0,20
Ovens	30	Top, front	Oven empty with door closed, thermostat being at the highest setting. Also in the cleaning mode, if available, as described in the instructions for use.	0,20
Ranges	30	Top, front	Each function separately	0,20
Range hoods	30	Bottom, front	Controls at highest setting	0,19
Refrigeration appliances	30	Top, front	Continuously with the door closed. The thermostat is adjusted to lowest temperature setting. The cabinet is empty. The measurement is made after steady conditions have been reached but with active cooling in all compartments.	0,18
Rice cookers	30	Around	Half-filled with water, without lid and highest heat setting	0,16
Shavers	0	Against cutter	Continuously without load	0,30
Slicing machines	30	All surfaces	Continuously without load, highest speed setting	0,17
Solaria - parts touching the body - other parts	 0 30	 Around Around	 Continuously, highest settings Continuously, highest settings	 0,18 0,20
Spin extractors	30	Top, front	Continuously without load	0,18
Storage heaters	30	Around	Continuously, highest heat setting	0,20
Tea makers	30	Around	Continuously, no load	0,16
Toasters	30	Around	Without load, highest heat setting	0,16
Tools, hand-guided	30	Around, unless the same side is always towards the user	No-load, all settings e.g. speed set to maximum.	0,15
Tools, hand-held	30	Around, unless the same side is always towards the user	No-load, all settings e.g. speed set to maximum.	0,15

Type of appliance	Measuring distance r_1 cm	Sensor locations	Operating conditions	Coupling factor $a_c(r_1)$ σ = 0,1 S/m 8 Hz .. 800 Hz [a]
Tools, transportable	30	Top and side towards the user	No-load, all settings e.g. speed set to maximum.	0,16
Tools with heating elements	30	Around, unless the same side is always towards the user	Highest temperature setting. Glue guns with glue stick in working position	0,15
Tumble dryers	30	Top, front	Drum filled with textile material having a mass in the dry condition of 50 % of the maximum load. The textile material consists of pre-washed double-hemmed cotton sheets approximately 70 cm ×70 cm cm having a mass between 140 g/m² and 170 g/m² in the dry condition. The material is soaked with water of a mass of 60 % of that of the textile material.	0,18
Vacuum cleaners, handheld	30	All surfaces	As specified in 3.1.9 of EN 60335-2-2	0,16
Vacuum cleaners, body sling	0	All surfaces	As specified in 3.1.9 of EN 60335-2-2	0,13
Vacuum cleaners, others	30	Around	As specified in 3.1.9 of EN 60335-2-2	0,16
Washing machines and washer dryers	30	Top, front	Without textiles, in the spinning mode at highest speed	0,18
Water-bed heaters	10	Top	Spread out and laid on a sheet of thermal insulation	0,14
Water heaters	30	Around	Controls at highest setting, with water flowing, if necessary	0,17
Whirlpool baths - inside - outside	 0 30	 Around Around	 Continuously Continuously	 0,18 0,20

[a] The worst case coupling factors have been calculated for frequencies up to 800 Hz. For fundamental operating frequencies greater than 800 Hz and lower than 150 kHz, the coupling factor is $a_c(r_1)$ x 1,25.

p **A.3.2** Add after the fifth paragraph:

NOTE Z1 Stable operating conditions are reached after the water starts to boil and when the magnetic field or the power on the mains supply is stabilized.

Annex B

p Replace by:

Annex B
(informative)

Basic restrictions and reference levels

The following basic restrictions and reference levels of 1999/519/EC apply.

Table B.1 - Basic restrictions for electric, magnetic and electromagnetic fields (0 Hz to 300 GHz)

Frequency range	Magnetic flux density mT	Current density mA/m² r.m.s.	Whole body average SAR W/kg	Localized SAR (head and trunk) W/kg	Localized SAR (limbs) W/kg	Power density, S W/m²
0 Hz	40					
> 0 - 1 Hz		8				
1 - 4 Hz		8/*f*				
4 - 1 000 Hz		2				
1 000 Hz - 100 kHz		*f*/500				
100 kHz - 10 MHz		*f*/500	0,08	2	4	
10 MHz - 10 GHz			0,08	2	4	
10 - 300 GHz						10
f is the frequency in Hz.						

Table B.2 - Reference levels for electric, magnetic and electromagnetic fields (0 Hz to 300 GHz, unperturbed r.m.s. values)

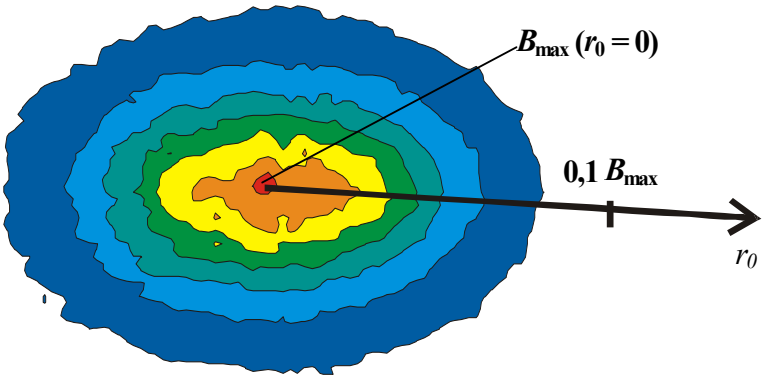
Frequency range	E-field strength V/m	H-field strength A/m	B-field μT	Equivalent plane wave power density S eq W/m²
0 Hz - 1 Hz	-	$3{,}2 \times 10^4$	4×10^4	-
1 Hz - 8 Hz	10 000	$3{,}2 \times 10^4 / f^2$	$4 \times 10^4 / f^2$	-
8 Hz - 25 Hz	10 000	4 000/*f*	5 000/*f*	-
0,025 kHz - 0,8 kHz	250/*f*	4/*f*	5/*f*	-
0,8 kHz - 3 kHz	250/*f*	5	6,25	-
3 kHz - 150 kHz	87	5	6,25	-
0,15 MHz - 1 MHz	87	0,73/*f*	0,92/*f*	-
1 MHz - 10 MHz	$87/f^{1/2}$	0,73/*f*	0,92/*f*	-
10 MHz - 400 MHz	28	0,073	0,092	2
400 MHz - 2 000 MHz	$1{,}375\ f^{1/2}$	$0{,}003\ 7\ f^{1/2}$	$0{,}004\ 6\ f^{1/2}$	*f*/200
2 GHz - 300 GHz	61	0,16	0,20	10
f is as indicated in the frequency range column.				

NOTE These limits do not apply for the protection of workers against exposure to electromagnetic fields.

Annex C, Determination of coupling factors

Step 1 Evaluation of the extent of the hot spot

Replace Figure C.1 by:



Step 4 Calculation of the coupling factor

Replace the complete text by:

The coupling factor $a_c(r)$ is the result of the re-scaled factor k and can be determined as followed:

$$a_c(r, r_{coil}, f, \sigma) = k(r, r_{coil}, f, \sigma) \cdot \frac{B_{RL}(f)}{J_{BR}(f)} \quad \text{(C.7)}$$

NOTE 1 The term $B_{RL}(f)/J_{BR}(f)$ is proportional $1/f$ from 8 Hz up to 800 Hz and from 1 kHz to 100 kHz. In consequence the factor $a_c(r)$ is frequency independent within these ranges (see Figure C.5).

In case of measuring according to 5.5.2 and 5.5.3 a f_{C0} equivalent is used. Therefore the coupling factor $a_c(r)$ evaluates to:

$$a_c(r, r_{coil}, f_{c0}, \sigma) = k(r, r_{coil}, f_{c0}, \sigma) \cdot \frac{B_{RL}(f_{c0})}{J_{BR}(f_{c0})} \quad \text{(C.8)}$$

NOTE 2 The coupling factor $a_c(r_1)$ can be determined from Figure C.5 using equation C.4.

Example for the re-scaling applying 1999/519/EC at f = 50Hz and σ = 0,1 S/m for the whole body and a coil of r_{Coil} = 10 mm in a distance r = 50 cm.

$$a_c(r = 50\,cm, r_{coil} = 10\,mm, f = 50\,Hz, \sigma = 0.1\,S/m) =$$

$$k(r = 50\,cm, r_{coil} = 10\,mm, f = 50\,Hz, \sigma = 0.1\,S/m) \cdot \frac{B_{RL}(f = 50\,Hz)}{J_{BR}(f = 50\,Hz)} =$$

$$3.271 \frac{A/m^2}{T} \frac{100\mu T}{2mA/m^2} = 0.1635$$

C.2 Graphical evaluation of coupling factors

Replace the first paragraph by:

The coupling factor can be determined from Figure C.5 using equation (C.4). This method provides a value for the coupling factor depending on the radius of the equivalent coil.