BS EN 50499:2019

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Procedure for the assessment of the exposure of workers to electromagnetic fields

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National foreword

This British Standard is the UK implementation of EN 50499:2019. It supersedes BS EN 50499:2008, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/106, Human exposure to low frequency and high frequency electromagnetic radiation.

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English Version

Procedure for the assessment of the exposure of workers to electromagnetic fields

Procédure pour l'évaluation de l'exposition des travailleurs aux champs électromagnétiques

Verfahren für die Beurteilung der Exposition von Arbeitnehmern gegenüber elektromagnetischen Feldern

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Contents

European foreword 4
1 Scope 5
2 Normative references 5
3 Terms and definitions 6
4 General considerations on assessment 8
4.1 Introduction 8
4.2 Overview of risk assessment procedure 8
4.3 Indirect effects 14
4.4 Uncertainty for assessments using Clauses 7, 8 and 9 15
5 Initial assessment 15
6 Workplaces likely to require further assessment 19
7 Standards for specific workplaces 20
8 Methodology for assessing workplace exposure by comparison with the action levels 20
9 Methodology for assessing workplace exposure by comparison with the exposure limit values . 21
10 Methodology for taking measures 22
11 End of assessment 23
Annex A (normative) Other health and safety issues: indirect effects of fields and workers at particular risk 24
A.1 Introduction 24
A.2 Indirect effects of fields on workers 24
A.3 Indirect effects on workers with medical devices 24
A.4 Indirect effects on equipment and materials 25
A.5 Pregnant workers 25
A.6 Zoning 25
Annex B (informative) Documenting the risk assessment 26
B.1 General 26
B.2 Form 1: Workplace containing only equipment in Table 1 26
B.2.1 General information 26
B.2.2 Assessment 26
B.3 Form 2: Workplace requiring detailed risk assessment 27
B.3.1 General information 27
B.3.2 Assessment 27
Annex C (informative) CE-marked equipment 28
C.1 CE-marked equipment 28
C.2 Identifying equipment that has been assessed 29
Annex D (informative) Simultaneous exposure to multiple frequencies and multiple sources 30
D.1 Terms and definitions 30
D.1.1 Exposure Ratio (*ER* or *ER* %) 30

AVA Documents
Document Sharing Hub

Full document details: BS EN 50499:2019

D.1.2 Total Exposure Ratio (*TER* or *TER* %) ... 30
D.2 The *TER* approach ... 30
D.2.1 Explanation ... 30
D.2.2 *ER* for a single item of equipment ... 31
D.2.2.1 Obtaining or calculating the *ER* for a single item of equipment ... 31
D.2.2.2 Calculating single equipment *ER* from measured emission or exposure levels for non-thermal effects (below 10 MHz) ... 31
D.2.2.2.1 Simultaneous exposure to multiple frequency fields ... 31
D.2.2.2.2 Weighted peak method in time domain ... 31
D.2.2.3 Calculating single equipment *ER* from measured emission or exposure levels for thermal effects (above 100 kHz) ... 32
D.2.3 Combining the separate equipment *ER*s into a *TER* ... 33
D.2.3.1 Simple assessment of the *TER* ... 33
D.2.3.2 Assessment of low frequency (non-thermal effects) ... 33
D.2.3.3 Assessment of high frequency (thermal effects) ... 33
D.2.3.4 Assessment of intermediate frequencies 100 kHz to 10 MHz, or if the applicable frequency of measurement assessments covers both the stimulation effects and thermal effects, or is unknown ... 34
D.3 Example of multiple exposure using separate *TER* assessments ... 34
Annex E (informative) Zoning ... 35
E.1 Introduction ... 35
E.2 Workplace zones ... 35
E.3 Implementation of zoning ... 35
Bibliography ... 37

Documents
Document Sharing Hub
Full document details: BS EN 50499:2019

European foreword

This document (EN 50499:2019) has been prepared by CLC/TC 106X, "*Electromagnetic fields in the human environment*".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2020-08-20
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2022-08-20

This document supersedes EN 50499:2008 and all of its amendments and corrigenda (if any).

EN 50499:2019 includes the following significant technical changes with respect to EN 50499:2008:

— the replacement of directive 2004/40/EC by directive 2013/35/UE. The requirements in the document were modified accordingly, as for example the assessment process.

The latest editions of standards of basic and generic standards was also taken into account, for example in the annex D for multiple frequencies

This standard is intended to be a standard under which other standards related to the assessment of a workplace can be used.

The approaches outlined in this standard, are intended to be simple, allowing most employers to make an assessment with the minimum of technical knowledge and effort.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

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1 Scope

The scope of this document is to provide a general procedure for the assessment of workers' exposure to electric, magnetic and electromagnetic fields in a workplace in order to determine compliance with exposure limit values and/or action levels as stated in European Directive 2013/35/EU.

The purpose of this document is to

— specify how to perform an initial assessment of the levels of workers' exposure to electromagnetic fields (EMF), if necessary, including specific exposure assessment of such levels by measurements and/or calculations,

— determine whether it is necessary to carry out a detailed risk assessment of EMF exposure.

This document can be used by employers for the risk assessment and, where required, measurement and/or calculation of the exposure of workers. Based on specific workplace and other standards, it can be determined whether preventive measures/actions have to be taken to comply with the provisions of the Directive.

The frequencies covered are from 0 Hz to 300 GHz.

NOTE 1 This document relates to the exposure limits as specified in the Directive 2013/35/EU. It is intended to protect workers from risks to their health and safety arising or likely to arise from exposure to electromagnetic fields (0 Hz to 300 GHz) during their work. However, this and other Directives can include additional measures for the protection of specific groups of workers and/or specific workplaces for which the employer is required to investigate other protective measures as a part of the overall risk assessment. See Annex A.

NOTE 2 Directive 2013/35/EU has been transposed into national legislation in all the EU member countries. It is intended that users of this standard consult the national legislation related to this transposition in order to identify the national regulations and requirements. These national regulations and requirements can have additional requirements that are not covered by this standard.

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.

Council Recommendation 1999/519/EC of 12 July 1999, on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), Official Journal, L199, of 1999-7-30, p.59-70

Directive 2013/35/EU of 26 June 2013, on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields). Official Journal, L179, of 2013-6-29, p. 1–21

EN 50413:—,[1] *Basic standard on measurement and calculation procedures for human exposure to electric, magnetic and electromagnetic fields (0 Hz - 300 GHz)*

EN 50496, *Determination of workers' exposure to electromagnetic fields and assessment of risk at a broadcast site*

EN 50647:2017, *Basic standard for the evaluation of workers' exposure to electric and magnetic fields from equipment and installations for the production, transmission and distribution of electricity*

EN 50663:2017, *Generic standard for assessment of low power electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (10 MHz - 300 GHz)*

[1] Under preparation. Stage at the time of publication: FprEN 50413:2019.

Documents
Document Sharing Hub
Full document details: BS EN 50499:2019

EN 50664:2017, *Generic standard to demonstrate the compliance of equipment used by workers with limits on exposure to electromagnetic fields (0 Hz - 300 GHz), when put into service or in situ*

EN 60601-2-33:2010/A2:2015, *Medical electrical equipment – Part 2-33: Particular requirements for the basic safety and essential performance of magnetic resonance equipment for medical diagnosis (IEC 60601-2-33:2010/A2:2015)*

EN 62232:2017, *Determination of the RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure (IEC 62232)*

EN IEC 62311:—,[2] *Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz) (IEC 62311)*

EN 62479:2010, *Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz) (IEC 62479)*

EN 62822-2:2016, *Electric welding equipment – Assessment of restrictions related to human exposure to electromagnetic fields (0 Hz to 300 GHz) – Part 2: Arc welding equipment*

EN IEC 62822-3:2018, *Electric welding equipment – Assessment of restrictions related to human exposure to electromagnetic fields (0 Hz to 300 GHz) – Part 3: Resistance welding equipment*

3 Terms and definitions

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

ISO and IEC 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

3.1
action levels
ALs
operational levels of directly measurable parameters provided in terms of electric field strength (*E*), magnetic field strength (*H*), magnetic flux density (*B*) and power density (*S*), contact current and limb induced current established for the purpose of simplifying the process of demonstrating the compliance with relevant ELVs or, where appropriate, to take relevant protection or prevention measures specified in Directive 2013/35/EU

3.1.1
low ALs
<for electric fields> action levels which relate to the specific protection or prevention measures specified in Directive 2013/35/EU

<for magnetic fields> action levels which relate to the sensory effects ELVs

Note 1 to entry: the values of the low ALs are given in Table B.1 o Directive f2013/35/EU for electric field.

Note 2 to entry: The Low AL for external electric field is based both on limiting the internal electric field below ELVs and on limiting spark discharges in the working environment.

Note 3 to entry: the values of the low ALs are given in Table B.2 for magnetic field.

[2] Under preparation. Stage at the time of publication: FprEN IEC 62311:2019.

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3.1.2
high ALs
<for electric fields> action levels which relate to the specific protection or prevention measures specified in Directive 2013/35/EU

<for magnetic fields> action levels which relate to the health effects ELVs

Note 1 to entry: the values of the high ALs are given in Table B.1 of Directive 2013/35/EU for electric field.

Note 2 to entry: Below the High AL, the internal electric field does not exceed ELVs and annoying spark discharges are prevented, provided that the relevant protection measures are taken.

Note 3 to entry: the values of the high ALs are given in Table B.2 for magnetic field.

3.2
duty factor
ratio of pulse duration to the pulse period of a periodic pulse train

Note 1 to entry: A duty factor can also be considered as a measure of the temporal transmission characteristic of an intermittently transmitting RF source such as a paging antenna by dividing average transmission duration by the average period for transmissions.

Note 2 to entry: A duty factor of 1,0 corresponds to continuous operation.

[SOURCE: EN IEC 62311:—]

3.3
electromagnetic fields
static electric, static magnetic and time-varying electric, magnetic and electromagnetic fields with frequencies up to 300 GHz

[SOURCE: Directive 2013/35/EU]

3.4
employer
natural or legal person who has an employment relationship with the worker and has responsibility for the undertaking and/or establishment

[SOURCE: Directive 89/391/EEC]

3.5
equipment
source of electromagnetic emission, including devices, products, instrumentation, installations and prototypes under development

3.6
exposure
phenomenon occurring whenever and wherever a person is subjected to external electromagnetic fields or to contact current

3.7
exposure limits
guideline or restriction values on exposure that are given in international or national standards, guidelines or directives on human exposure to electromagnetic fields

Note 1 to entry: For Directive 2013/35/EU the exposure limits are the action levels and the exposure limit values and also the other specific requirements in that directive to avoid other risks related to workplace exposure to electromagnetic fields.

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3.8
exposure limit values
ELVs
limits on exposure to electromagnetic fields which are based on biophysical and biological considerations, in particular on the basis of scientifically well-established short-term and acute direct effects, i.e. thermal effects and non-thermal effects such as electrical stimulation of tissues

Note 1 to entry: Compliance with these limits will ensure that workers exposed to electromagnetic fields are protected against known adverse health effects (from Directive 2013/35/EU).

3.8.1
health effects ELVs
ELVs above which workers might be subject to adverse health effects, such as thermal heating or stimulation of nerve and muscle tissue

[SOURCE: Directive 2013/35/EU]

3.8.2
sensory effects ELVs
ELVs above which workers might be subject to transient disturbed sensory perceptions and minor changes in brain functions

[SOURCE: Directive 2013/35/EU]

3.9
risk assessment
process of determining compliance of a workplace environment with the limits set in the Directive 2013/35/EU by performing the actions stated in Article 4 of the Directive 2013/35/EU

3.10
workplace
location where workers have access as part of their duties

3.11
worker
person employed by an employer, including trainees and apprentices but excluding domestic servants

[SOURCE: Directive 89/391/EEC]

4 General considerations on assessment

4.1 Introduction

This clause describes the general concept of an initial assessment of a workplace, how to compare assessment results with the action levels and exposure limits, and further actions if needed.

The exposure to be assessed is at the workplace(s) where a worker is permitted or reasonably expected to be present. Workplace exposure level is assessed at locations to which a worker would have access as part of their duties, and its contributors are emissions from equipment affecting that location.

Other health and safety issues covered by the Directive, in particular workers with active implanted medical devices (AIMDs), pregnant workers, and indirect effects shall be addressed as outlined in Annex A.

4.2 Overview of risk assessment procedure

The flowchart presented in Figure 1 shows graphically the assessment process. Prior to commencing the assessment process, and in order to determine what level of workplace assessment, if any, is necessary the workplace shall first be characterized. This requires the employer to establish what electromagnetic field-emitting electrical equipment exists in the workplace.

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As a preliminary step, the employer shall assess if there are workers exposed to indirect effects or workers at particular risks and address them as described in Annex A.

The first decision box of Figure 1 relates to compliant equipment. Most workplaces will contain only electrical equipment which do not produce electromagnetic fields at levels above general public exposure limits. These workplaces will require no further assessment. Clause 5 defines which electrical equipment can be excluded from detailed exposure assessment. Table 1 defined in Clause 5 provides examples of such equipment. It includes in particular any equipment which has been placed on the European market in compliance with the relevant product performance Directives and tested against general public limits using an EMF harmonized standard. Examples of EMF related harmonized standards are listed in Annex C.

When assessing the compliance of equipment, the zoning concepts presented in Annex E may be used.

Table 2 in Clause 6 gives a non-exhaustive list of equipment which is likely to require further assessment. In preparation for this, the employer should identify the type of equipment in the workplace, characteristics (e.g. frequency, emitted power, duty factor) and its conditions of use (e.g. normal position of operator, position of other workers than the operator, time spent at normal position, operations or maintenance or repair at distances from the emitting equipment closer than normal etc.). See Clause 6.

The term “normal” covers the intended use, the use as specified in the employer’s instructions to the workers, the installation(s) used, the instructions from the employer on how maintenance and repair shall be performed, situations of foreseeable incidents. Wilful behaviour of the worker against instructions of the employer or safety instructions of device manufacturers is not required to be covered by the term „normal”.

Situations with simultaneous exposure to multiple sources and/or multiple frequencies shall be addressed according to EN IEC 62311:—. The employer may optionally use alternative appropriate methods such as those described in Annex D, which may include additional overestimation, but other scientifically proven and validated exposure evaluation procedures can be applied, provided that they lead to approximately equivalent and comparable results.

Optional measures to reduce exposure may be introduced at any point of the assessment in order to achieve compliance.

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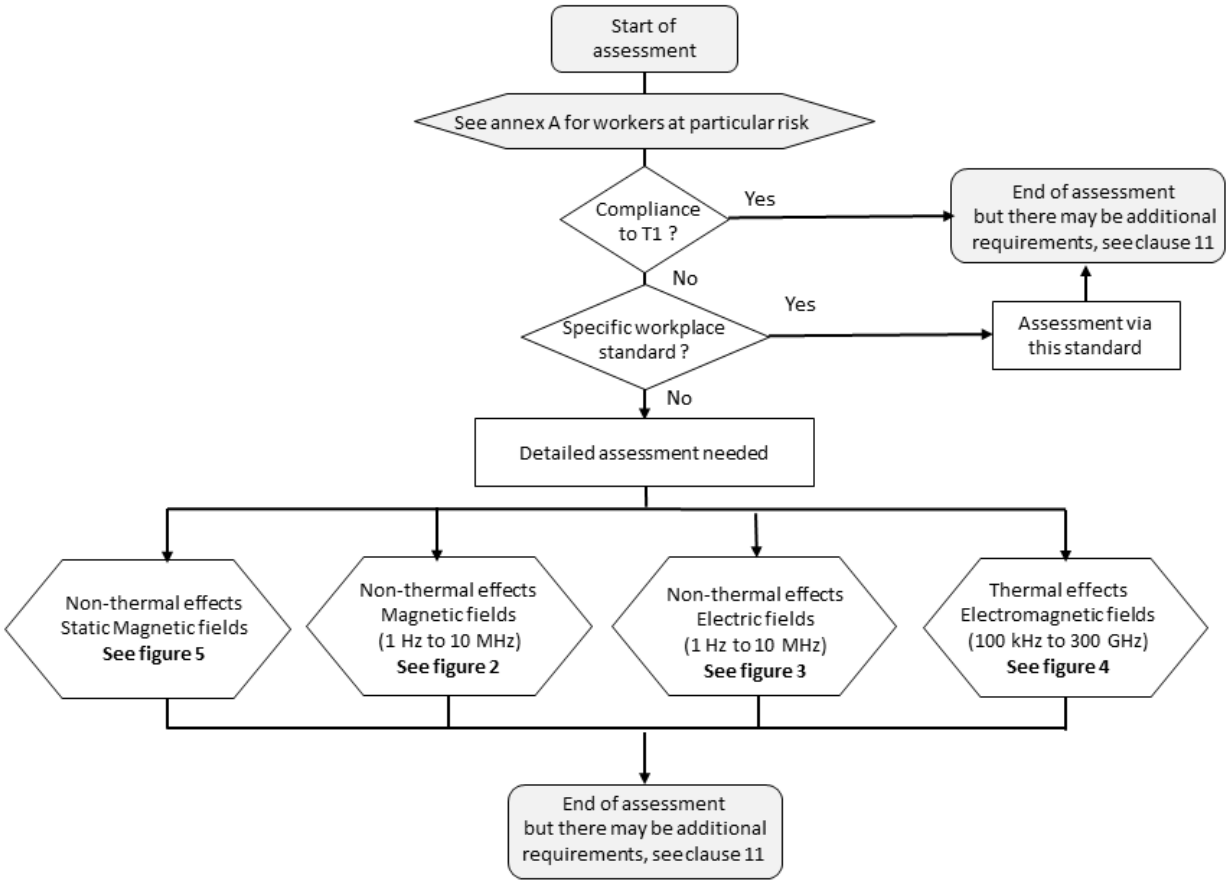

Figure 1 — Assessment process

If derogations under Article 10 of Directive 2013/35/EU ("Derogations") are applicable, then the exposure limit values may be exceeded provided that all the applicable conditions in Article 10 are met.

If a specific standard is applicable to the working environment or type of workplace, then this shall be used for the assessment unless employer considers it unsuitable, in which case a justification for its unsuitability shall be included in the assessment report (see Clause 7). If this specific workplace standard contains other exposure limits than those stated in Directive 2013/35/EU then the exposure limits from Directive 2013/35/EU shall be applied.

If no such standard exists or if the employer considers it unsuitable then a detailed exposure assessment shall be performed using the process defined in Figure 2 for exposure to magnetic fields between 1 Hz and 10 MHz, Figure 3 for exposure to electric fields between 1 Hz and 10 MHz, Figure 4 for exposure to electromagnetic fields between 100 kHz and 300 GHz and Figure 5 for exposure to magnetic field between 0 Hz and 1 Hz. In Figure 2 and Figure 3, sensory effects ELVs are relevant only between 1 Hz and 400 Hz. The exposure assessment is then performed either against action levels (see Clause 8) or directly against exposure limit values (see Clause 9) using procedures from other European basic, generic or product EMF standards. There are only ELVs between 0 Hz and 1 Hz.

For some equipment considered in the assessment of the workplace, it may be appropriate to undertake an assessment against the exposure limit values directly, and specific assessment standards for that equipment will indicate how that should be done. Other equipment in the same workplace may be assessed by comparison with the action levels.

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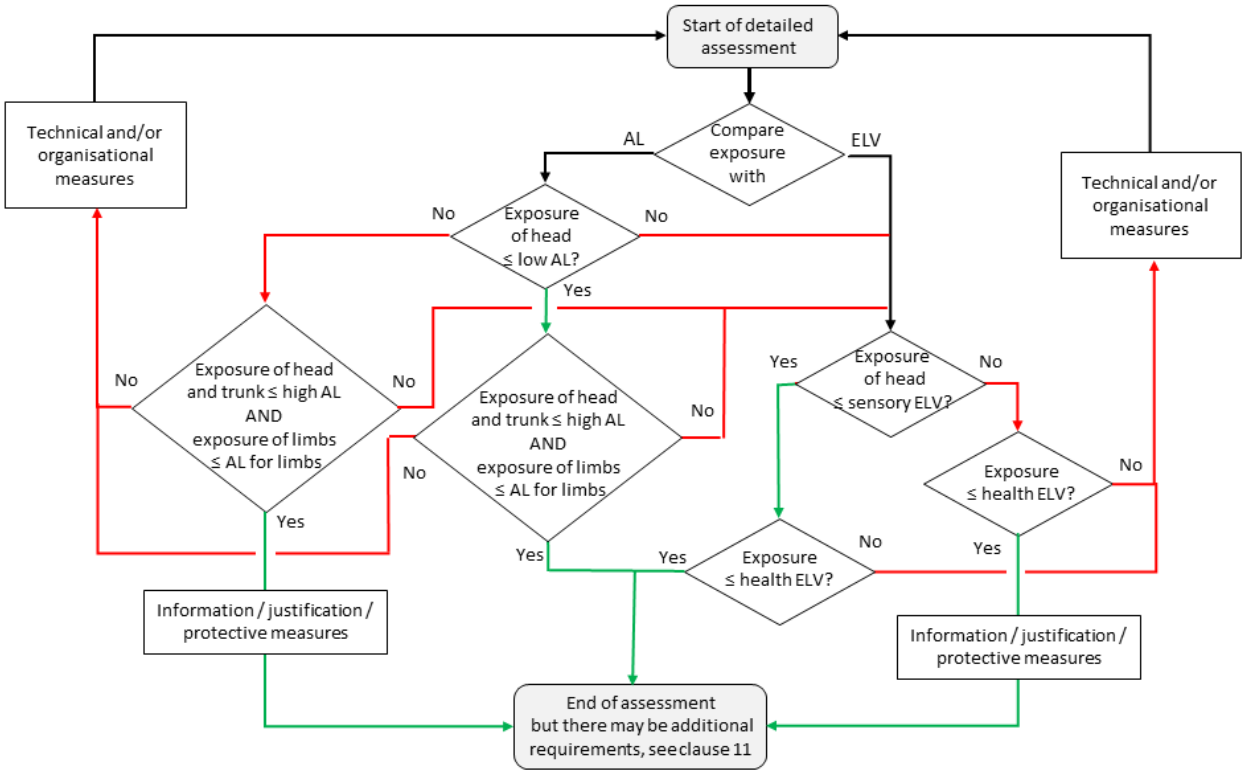

Figure 2 — Detailed assessment process for exposure to magnetic field between 1 Hz and 10 MHz

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