



STATUTORY INSTRUMENTS.

**S.I. No. 337 of 2016**

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SAFETY, HEALTH AND WELFARE AT WORK  
(ELECTROMAGNETIC FIELDS) REGULATIONS 2016

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I, MARY MITCHELL O'CONNOR, Minister for Jobs, Enterprise and Innovation, in exercise of the powers conferred on me by section 58 of the Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005) (as adapted by the Enterprise, Trade and Innovation (Alteration of Name of Department and Title of Minister) Order 2011 (S.I. No. 245 of 2011)) and for the purpose of giving effect to Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013<sup>1</sup>, after consultation with the Health and Safety Authority, hereby make the following regulations:

*Citation and commencement*

1. (1) These Regulations may be cited as the Safety, Health and Welfare at Work (Electromagnetic Fields) Regulations 2016.

(2) These Regulations come into operation on 1 July 2016.

*Interpretation*

2. (1) In these Regulations—

“Act” means the Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005);

“action levels (ALs)” means operational levels established for the purpose of simplifying the process of demonstrating the compliance with relevant exposure limit values (ELVs) or, where appropriate, to take relevant protection or prevention measures specified in these Regulations, and—

(a) for electric fields, “low ALs” and “high ALs” means levels which relate to the specific protection or prevention measures specified in these Regulations, and

(b) for magnetic fields, “low ALs” means levels which relate to the sensory effects ELVs and “high ALs” means levels which relate to the health effects ELVs;

“Authority” means the Health and Safety Authority;

“direct biophysical effects” means effects in the human body directly caused by its presence in an electromagnetic field, including—

(a) thermal effects, such as tissue heating through energy absorption from electromagnetic fields in the tissue,

<sup>1</sup>OJ No. L 179, 29.6.2013, p. 1.

*Notice of the making of this Statutory Instrument was published in  
“Iris Oifigiúil” of 5th July, 2016.*

(b) non-thermal effects, such as the stimulation of muscles, nerves or sensory organs. These effects might have a detrimental effect on the mental and physical health of exposed employees. Moreover, the stimulation of sensory organs may lead to transient symptoms, such as vertigo or phosphenes. These effects might create temporary annoyance or affect cognition or other brain or muscle functions, and may thereby affect the ability of an employee to work safely, and

(c) limb currents;

“Directive” means Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013<sup>1</sup>;

“electromagnetic fields” means static electric, static magnetic and time-varying electric, magnetic and electromagnetic fields with frequencies up to 300 GHz;

“exposure limit values (ELVs)” means values established on the basis of biophysical and biological considerations, in particular on the basis of scientifically well-established short-term and acute effects, i.e. thermal effects and electrical stimulation of tissues;

“General Application Regulations” means the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016;

“health effects ELVs” means those ELVs above which employees might be subject to adverse health effects, such as thermal heating or stimulation of nerve and muscle tissue;

“indirect effects” means effects caused by the presence of an object in an electromagnetic field which may become the cause of a safety or health hazard, such as—

(a) interference with medical electronic equipment and devices, including cardiac pacemakers and other implants or medical devices worn on the body,

(b) the projectile risk from ferromagnetic objects in static magnetic fields,

(c) the initiation of electro-explosive devices (detonators),

(d) fires and explosions resulting from the ignition of flammable materials by sparks caused by induced fields, contact currents or spark discharges, and

(e) contact currents;

“sensory effects ELVs” means those ELVs above which employees might be subject to transient disturbed sensory perceptions and minor changes in brain functions

“worker” has the meaning assigned to the term “employee” under the Act;

“workplace” has the meaning assigned to the term “place of work” under the Act.

(2) In these Regulations, the physical quantities used to describe the exposure to electromagnetic fields are those indicated and explained in Schedule 1.

*Application*

3. (1) These Regulations apply to activities in which employees are, or are likely to be, exposed to risks to their safety and health arising from exposure to electromagnetic fields during their work.

(2) These Regulations cover all known direct biophysical effects and indirect effects caused by electromagnetic fields.

(3) The exposure limit value (ELVs) laid down in these Regulations cover only scientifically well-established links between short-term direct biophysical effects and exposure to electromagnetic fields.

(4) These Regulations do not cover suggested long-term effects.

(5) These Regulations do not cover the risks resulting from contact with live conductors.

(6) Obligations and duties arising under these Regulations are in addition to obligations and duties arising under any other enactment.

(7) In this Regulation, “enactment” means—

(a) an Act of the Oireachtas,

(b) a statute that was in force in Saorstát Éireann immediately before the date of the coming into operation of the Constitution and that continues in force by virtue of Article 50 of the Constitution, or

(c) an instrument made under—

(i) an Act of the Oireachtas, or

(ii) a statute referred to in subparagraph (b).

*Exposure limit values and action levels*

4. (1) An employer shall ensure that exposure of his or her employees to electromagnetic fields is limited to the health effects ELVs and sensory effects ELVs set out in Schedule 2, for non-thermal effects, and in Schedule 3, for thermal effects, unless the conditions under paragraph (4), (6) or (7), or Regulation 9, are fulfilled.

(2) An employer shall establish compliance with paragraph (1) by use of the relevant exposure assessment procedures referred to in Regulation 5.

(3) An employer shall take immediate action in accordance with Regulation 6(5) where the exposure of his or her employees to electromagnetic fields is not in compliance with paragraph (1).

(4) An employer is deemed to be in compliance with paragraph (1) where it is demonstrated that the relevant ALs set out in Schedules 2 and 3 are not exceeded.

(5) Where the exposure of his or her employees to electromagnetic fields exceeds the ALs set out in Schedules 2 and 3, an employer shall act in accordance with Regulation 6(2), unless the risk assessment carried out in accordance with Regulation 5 demonstrates that the relevant ELVs are not exceeded and that safety risks can be excluded.

(6) Notwithstanding paragraphs (1) to (5), exposure of employees may exceed—

(a) low ALs for electric fields (Schedule 2, Table B1), where justified by the practice or process, provided that—

(i) the sensory effects ELVs (Schedule 2, Table A3) are not exceeded, or

(ii) the following three requirements have been satisfied:

(I) the health effects ELVs (Schedule 2, Table A2) are not exceeded;

(II) the excessive spark discharges and contact currents (Schedule 2, Table B3) are prevented by specific protection measures as set out in Regulation 6(8); and

(III) information on the situations referred to in Regulation 7(2)(f) has been given to employees, and

(b) low ALs for magnetic fields (Schedule 2, Table B2), where justified by the practice or process, including in the head and torso, during the shift, provided that—

(i) the sensory effects ELVs (Schedule 2, Table A3) are not exceeded, or

(ii) the following four requirements have been satisfied:

(I) the sensory effects ELVs are exceeded only temporarily;

(II) the health effects ELVs (Schedule 2, Table A2) are not exceeded;

(III) action is taken, in accordance with Regulation 6(10), where the transient symptoms referred to in Regulation 6(11)(a) are reported; and

(IV) information on the situations referred to in Regulation 7(2)(f) has been given to employees.

(7) Notwithstanding paragraphs (1) to (6), exposure may exceed—

- (a) the sensory effects ELVs set out in Table A1 in Schedule 2, during the shift, where justified by the practice or process, provided that—
  - (i) they are exceeded only temporarily,
  - (ii) the health effects ELVs set out in that table are not exceeded,
  - (iii) specific protection measures have been taken in accordance with Regulation 6(9),
  - (iv) action is taken in accordance with Regulation 6(10), where the transient symptoms referred to in Regulation 6(11)(b) are reported, and
  - (v) information on the situations referred to in Regulation 7(2)(f) has been given to employees, and
- (b) the sensory effects ELVs set out in Table A3 in Schedule 2 and Table A2 in Schedule 3, during the shift, where justified by the practice or process, provided that—
  - (i) they are exceeded only temporarily,
  - (ii) the health effects ELVs set out in Table A2 in Schedule 2 and Tables A1 and A3 in Schedule 3 are not exceeded,
  - (iii) action is taken in accordance with Regulation 6(10), where the transient symptoms referred to in Regulation 6(11)(a) are reported, and
  - (iv) information on the situations referred to in Regulation 7(2)(f) has been given to employees.

*Assessment of risks and determination of exposure*

5. (1) Subject to paragraph (8), an employer shall carry out a suitable and appropriate assessment of the risks arising from activities where his or her employees are liable to be exposed to electromagnetic fields at work.

(2) An employer shall, if necessary, in carrying out the risk assessment referred to in paragraph (1), measure or calculate the levels of electromagnetic field to which his or her employees are exposed.

- (3) (a) Without prejudice Regulation 7, the risk assessment referred to in paragraph (1) can be made public on request in accordance with relevant European Union laws and laws of the State, and, in particular, in the case of processing the personal data of employees in the course

of such an assessment, any publication shall comply with the Data Protections Acts 1998 and 2003.

- (b) Unless there is an overriding public interest in disclosure, public authorities that are in possession of a copy of the risk assessment referred to in paragraph (1) may refuse a request for access to it or a request to make it public, where disclosure would undermine the protection of commercial interests of the employer, including those relating to intellectual property.
- (c) Employers may refuse to disclose or make public the risk assessment referred to in paragraph (1) under the conditions referred to in subparagraph (b) in accordance with the relevant European Union laws and laws of the State.

(4) An employer, in carrying out the risk assessment referred to in paragraph (1), shall identify and assess electromagnetic fields at the place of work, taking into account the relevant practical guides made available by the European Commission in accordance with Article 14 of the Directive and other relevant standards or guidelines in the State, including exposure databases.

(5) Where compliance with the ELVs cannot be reliably determined on the basis of readily accessible information, an employer shall ensure that the assessment of the levels of electromagnetic fields to which his or her employees are exposed is carried out on the basis of measurements or calculations, and, in such a case, the assessment shall take into account uncertainties concerning the measurements or calculations, such as numerical errors, source modelling, phantom geometry and the electrical properties of tissues and materials, determined in accordance with relevant good practice.

(6) An employer shall ensure that—

- (a) the assessment, measurement and calculations referred to in paragraphs (1) to (5) are planned and carried out by competent persons at suitable intervals, taking into account the guidance given under the Directive and taking particular account of sections 18, 25 and 26 of the Act, and
- (b) the data obtained from such assessment, measurement and calculations are recorded in the safety statement drawn up pursuant to section 20 of the Act.

(7) When carrying out the risk assessment referred to in paragraph (1), an employer shall give particular attention to the following:

- (a) the health effects ELVs, the sensory effects ELVs and the ALs referred to in Regulation 4 and Schedules 2 and 3;
- (b) the frequency, the level, duration and type of exposure, including the distribution over the employee's body and over the volume of the place of work;

- (c) any direct biophysical effects;
  - (d) any effects on the health and safety of employees at particular risk, in particular employees who wear active or passive implanted medical devices, such as cardiac pacemakers, employees with medical devices worn on the body, such as insulin pumps, and pregnant employees;
  - (e) any indirect effects;
  - (f) the existence of replacement equipment designed to reduce the level of exposure to electromagnetic fields;
  - (g) appropriate information obtained from the health surveillance referred to in Regulation 8;
  - (h) information provided by the manufacturer of equipment;
  - (i) other relevant health and safety related information;
  - (j) multiple sources of exposure; and
  - (k) simultaneous exposure to multiple frequency fields.
- (8) (a) In places of work open to the public it is not necessary to carry out the risk assessment referred to in paragraph (1) if—
- (i) an evaluation has already been undertaken in accordance with the provisions on the limitation of exposure of the general public to electromagnetic fields,
  - (ii) the restrictions specified in those provisions are respected for employees, and
  - (iii) the health and safety risks are excluded.
- (b) Where equipment intended for the public use is used as intended and complies with relevant European Union law that establishes stricter safety levels than those provided for by these Regulations, and no other equipment is used, the conditions in subparagraph (a) are deemed to be met.
- (9) An employer shall review the risk assessment referred to in paragraph (1) and, if necessary measurements or calculations under this Regulation, at suitable intervals and, in particular, where either of the conditions specified in section 19(3)(a) and (b) of the Act are met, or if the results of the health surveillance referred to in Regulation 8 show this to be necessary.
- (10) Without prejudice to his or her obligations under this Regulation, an employer may, where relevant, take into account the emission levels and other appropriate safety-related data provided by the manufacturer or distributor for the equipment in accordance with relevant European Union law, including an



assessment of risks, if applicable to the exposure conditions at the place of work or place of installation.

*Avoiding and reducing risks*

6. (1) An employer shall ensure, so far as is reasonably practicable, that the risk from exposure of his or her employees to electromagnetic fields is either eliminated at source or reduced to a minimum, taking account of—

- (a) technical progress and the availability of measures to control the production of electromagnetic fields at source, and
- (b) the general principles of prevention set out in Schedule 3 to the Act.

(2) Where the risk assessment carried out under Regulation 5 for employees exposed to electromagnetic fields indicates that—

- (a) the relevant ALs set out in Schedules 2 and 3 are exceeded,
- (b) the relevant ELVs are exceeded, and
- (c) safety risks cannot be excluded,

the employer shall prepare and implement an action plan comprising either or both technical and organisational measures designed to prevent the exposure exceeding the health effects ELVs and sensory effects ELVs, taking into account in particular the matters set out in paragraph (3).

(3) The matters to be taken into account under paragraph (2) are the following:

- (a) other methods of work which reduce the risk from exposure to electromagnetic fields;
- (b) the choice of work equipment which, taking account of the work to be done, emits less intense electromagnetic fields including the possibility of making available to employees work equipment in compliance with section 16 of the Act with the aim or effect of limiting exposure to electromagnetic fields;
- (c) technical measures to reduce the emission of electromagnetic fields, including, where necessary, the use of interlocks, shielding or similar health protection mechanisms;
- (d) appropriate delimitation and access measures, such as signals, labels, floor markings or barriers, in order to limit or control access;
- (e) in case of exposure to electric fields, measures and procedures to manage spark discharges and contact currents through technical means and through the training of employees;
- (f) appropriate maintenance programmes for work equipment, the place of work, workstations and systems of work;

- (g) the design and layout of places of work and workstations;
- (h) limitations of the duration and intensity of the exposure to electromagnetic fields; and
- (i) provision of appropriate personal protection equipment.

(4) An employer shall, where a risk assessment carried out pursuant to Regulation 5 indicates that there is a workstation within his or her place of work where employees are likely to be exposed to electromagnetic fields that exceed a relevant AL set out in Schedule 2 or 3—

- (a) display mandatory signs, in accordance with Chapter 1 of Part 7 of the General Application Regulations, which convey that the electromagnetic field is likely to exceed that AL, and
- (b) ensure that such workstations are identified and are protected from unauthorised access, by barriers or other suitable measures, where such measures are technically feasible and where there is a risk that the AL could be exceeded,

unless access to such workstations is suitably restricted for other reasons and employees are informed of the risks from electromagnetic fields.

(5) If, despite the measures taken to comply with this Regulation, the health effects ELVs and sensory effect ELVs set out in Schedules 2 and 3 are exceeded, the employer shall—

- (a) take immediate action to reduce exposure to electromagnetic fields to below those ELVs,
- (b) as soon as practicable, identify the reason for those ELVs being exceeded, and
- (c) amend the measures taken in accordance with paragraph (2) to prevent those ELVs being exceeded again.

(6) An employer shall adapt any measures taken in compliance with the requirements of this Regulation to take account of any employee whose safety or health is at particular risk from exposure to electromagnetic fields and to take account of any risks due to indirect effects, referred to in Regulation 5(7)(e).

(7) In addition to providing the information set out in Regulation 7, an employer shall adapt the measures referred to in this Regulation to the requirements of employees at particular risk and, where applicable, to individual risks assessments, in particular in respect of—

- (a) employees who have declared the use of active or passive implanted medical devices, such as cardiac pacemakers, or the use of medical devices worn on the body, such as insulin pumps, and

(b) pregnant employees who have informed their employer of their condition.

(8) An employer shall take specific protection measures where Regulation 4(6)(a) applies, such as—

(a) the training of employees in accordance with Regulation 7, and

(b) the use of technical means and personal protection, such as—

(i) the grounding of work objects,

(ii) the bonding of workers with work objects (equipment bonding), and

(iii) where appropriate, the use of insulating shoes, gloves and protective clothing in accordance with Chapter 3 of Part 2 of the General Application Regulations.

(9) An employer shall take specific protection measures where Regulation 4(7)(a) applies, such as controlling movements.

(10) Where Regulation 4(4), (6) or (7) applies and where the employee reports transient symptoms, the employer shall, if necessary, update the risk assessment and the prevention measures.

(11) For the purposes of paragraph (10), transient symptoms may include—

(a) sensory perceptions and effects in the functioning of the central nervous system in the head evoked by time varying magnetic fields, and

(b) static magnetic field effects, such as vertigo and nausea.

*Employee information, training and consultation*

7. (1) An employer shall, where his or her employees are exposed to risk from electromagnetic fields at work, provide them with suitable and sufficient information and training relating to the outcome of the risk assessment made pursuant to Regulation 5.

(2) Without prejudice to the generality of paragraph (1), the information and training provided under this Regulation shall include—

(a) the technical and organisational measures taken in order to comply with these Regulations,

(b) the values and concepts of the ELVs and ALs, the associated potential risks and the preventive measures taken,

(c) the possible indirect effects of exposure,

(d) the results of the assessment and either or both the measurement or calculations of the levels of exposure to electromagnetic fields carried

out in accordance with Regulation 5 and an explanation of their significance and potential risks,

- (e) how to detect and report signs of adverse health effects,
- (f) the possibility of transient symptoms and sensations related to effects in the central or peripheral nervous system,
- (g) the circumstances in which health surveillance is made available to employees and its purpose, in accordance with Regulation 8,
- (h) safe working practices to minimise risks from exposure to electromagnetic fields,
- (i) employees at particular risk, as referred to in Regulation 5(7)(d) and Regulation 6(6) and(7), and
- (j) proper use of appropriate personal protective equipment.

#### *Health surveillance*

8. (1) An employer shall ensure that appropriate health surveillance, intended to prevent or diagnose rapidly any adverse health effects due to exposure to electromagnetic fields, is made available to those employees for whom a risk assessment referred to in Regulation 5 reveals a risk to their health.

(2) An employer shall ensure that a health record in respect of each of his or her employees who undergoes health surveillance is made and maintained and that that record or a copy thereof is kept available in a suitable form so as to permit appropriate access at a later date, taking into account any confidentiality concerns.

(3) An employer shall—

- (a) on request, allow an employee access to his or her personal health record,
- (b) provide the Authority, or a person designated in writing by the Authority under section 63 of the Act, including an inspector, who is a registered medical practitioner, with copies of such health records as the Authority may require,
- (c) provide the registered medical practitioner, under whose responsibility an employee receives health surveillance, with the results of the risk assessment referred to in Regulation 5 where such results may be relevant to the health surveillance, and
- (d) if he or she ceases to trade, notify the Authority forthwith in writing and make available to the Authority all health records kept by him or her in accordance with this Regulation.

(4) An employer shall, without prejudice to the generality of paragraph (1), in the case of an employee whose exposure exceeds the relevant ELVs set out in Schedules 2 and 3, make available to that employee the services of a registered medical practitioner to carry out, or to have carried out at his or her responsibility, a medical examination.

(5) Without prejudice to the generality of paragraph (1), where as a result of health surveillance an employee is found to have an identifiable illness or adverse health effect which, in the opinion of a registered medical practitioner, is as a result of exposure at work to electromagnetic fields—

(a) the registered medical practitioner shall—

- (i) inform the employee of the results which relate to him or her personally, including information and advice regarding such health surveillance which he or she should undergo following the end of the exposure, and
- (ii) inform the employer of any significant findings of the health surveillance, taking into account any medical confidentiality, and

(b) the employer shall—

- (i) review the risk assessment made under Regulation 5,
- (ii) review the measures provided to eliminate or reduce the risk under Regulation 6,
- (iii) take account of the advice of the registered medical practitioner or a relevant competent person, or the Authority, in implementing any measures required to eliminate or reduce risk in accordance with Regulation 6,
- (iv) arrange continued health surveillance and provide for a review of the health status of any employee who has been similarly exposed, and
- (v) take account of the recommendations of the registered medical practitioner or a relevant competent person regarding further medical examination.

#### *Exemptions*

9. Notwithstanding Regulation 4(1), but without prejudice to Regulation 6(1), exposure of employees to electromagnetic fields may exceed the ELVs set out in Schedules 2 and 3 if the exposure is related to the installation, testing, use, development, maintenance of or research related to magnetic resonance imaging (MRI) equipment for patients in the health sector, provided that all the following conditions are met:

- (a) the risk assessment carried out in accordance with Regulation 5 has demonstrated that the ELVs are exceeded;

- (b) given the state of the art, either or both the technical and organisational measures have been applied;
- (c) the circumstances duly justify exceeding the ELVs;
- (d) the characteristics of the place of work, work equipment, or work practices have been taken into account; and
- (e) the employer demonstrates that workers are still protected against adverse health effects and against safety risks, including by ensuring that the instructions for safe use provided by the manufacturer in accordance with Council Directive 93/42/EEC of 14 June 1993 concerning medical devices are followed.

## SCHEDULE 1

(ANNEX I to the Directive)

PHYSICAL QUANTITIES  
REGARDING THE EXPOSURE TO ELECTROMAGNETIC FIELDS

The following physical quantities are used to describe the exposure to electromagnetic fields:

Electric field strength (E) is a vector quantity that corresponds to the force exerted on a charged particle regardless of its motion in space. It is expressed in volt per metre ( $\text{Vm}^{-1}$ ). A distinction has to be made between the environmental electric field and the electric field present in the body (in situ) as a result of exposure to the environmental electric field.

Limb current ( $I_L$ ) is the current in the limbs of a person exposed to electromagnetic fields in the frequency range from 10 MHz to 110 MHz as a result of contact with an object in an electromagnetic field or the flow of capacitive currents induced in the exposed body. It is expressed in ampere (A).

Contact current ( $I_C$ ) is a current that appears when a person comes into contact with an object in an electromagnetic field. It is expressed in ampere (A). A steady state contact current occurs when a person is in continuous contact with an object in an electromagnetic field. In the process of making such contact, a spark discharge may occur with associated transient currents.

Electric charge (Q) is an appropriate quantity used for spark discharge and is expressed in coulomb(C).

Magnetic field strength (H) is a vector quantity that, together with the magnetic flux density, specifies a magnetic field at any point in space. It is expressed in ampere per metre ( $\text{Am}^{-1}$ ).

Magnetic flux density (B) is a vector quantity resulting in a force that acts on moving charges, expressed in tesla (T). In free space and in biological materials, magnetic flux density and magnetic field strength can be interchanged using the magnetic field strength of  $H = 1\text{Am}^{-1}$  equivalence to magnetic flux density of  $B = 4\pi \cdot 10^{-7}\text{T}$  (approximately 1.25 microtesla).

Power density (S) is an appropriate quantity used for very high frequencies, where the depth of penetration in the body is low. It is the radiant power incident perpendicular to a surface, divided by the area of the surface. It is expressed in watt per square metre ( $\text{Wm}^{-2}$ ).

Specific energy absorption (SA) is an energy absorbed per unit mass of biological tissue, expressed in joule per kilogram ( $\text{Jkg}^{-1}$ ). In the Directive, it is used for establishing limits for effects from pulsed microwave radiation.

Specific energy absorption rate (SAR), averaged over the whole body or over parts of the body, is the rate at which energy is absorbed per unit mass of body tissue and is expressed in watt per kilogram ( $\text{Wkg}^{-1}$ ). Whole-body SAR is a widely accepted quantity for relating adverse thermal effects to radio frequency (RF) exposure. Besides the whole-body average SAR, local SAR values are necessary to evaluate and limit excessive energy deposition in small parts of the body resulting from special exposure conditions. Examples of such conditions include: an individual exposed to RF in the low MHz range (e.g. from dielectric heaters) and individuals exposed in the near field of an antenna.

Of these quantities, magnetic flux density (B), contact current ( $I_C$ ), limb current ( $I_L$ ), electric field strength (E), magnetic field strength (H), and power density (S) can be measured directly.



## SCHEDULE 2

(ANNEX II to the Directive)

## NON-THERMAL EFFECTS

EXPOSURE LIMIT VALUES AND ACTION LEVELS  
IN THE FREQUENCY RANGE FROM 0 Hz TO 10 MHz

## A. EXPOSURE LIMIT VALUES (ELVs)

ELVs below 1 Hz (Table A1) are limits for static magnetic field which is not affected by the tissue of the body.

ELVs for frequencies from 1 Hz to 10 MHz (Table A2) are limits for electric fields induced in the body from exposure to time-varying electric and magnetic fields.

ELVs for external magnetic flux density from 0 to 1 Hz

The sensory effects ELV is the ELV for normal working conditions (Table A1) and is related to vertigo and other physiological effects related to disturbance of the human balance organ resulting mainly from moving in a static magnetic field

The health effects ELV for controlled working conditions (Table A1) is applicable on a temporary basis during the shift when justified by the practice or process, provided that preventive measures, such as controlling movements and providing information to workers, have been adopted.

	Sensory effects ELVs
Normal working conditions	2 T
Localised limbs exposure	8 T
	Health effects ELVs
Controlled working conditions	8 T

Health effects ELVs for internal electric field strength from 1 Hz to 10 MHz

Health effects ELVs (Table A2) are related to electric stimulation of all peripheral and central nervous system tissues in the body, including the head.

Frequency range	Health effects ELVs
$1 \text{ Hz} \leq f < 3 \text{ kHz}$	$1.1 \text{ Vm}^{-1}$ (peak)
$3 \text{ kHz} \leq f \leq 10 \text{ MHz}$	$3.8 \times 10^{-4} f \text{ Vm}^{-1}$ (peak)

Note A2-1:  $f$  is the frequency expressed in hertz (Hz).

Note A2-2: The health effects ELVs for internal electric field are spatial peak values in the entire body of the exposed subject.

Note A2-3: The ELVs are peak values in time which are equal to the Root-Mean-Square (RMS) values multiplied by  $\sqrt{2}$  for sinusoidal fields. In the case of non-sinusoidal fields, exposure evaluation carried out in accordance with Regulation 5 shall be based on the weighted peak method (filtering in time domain), explained in the practical guides produced by the European Commission, but other scientifically proven and validated exposure evaluation procedures can be applied, provided that they lead to approximately equivalent and comparable results.

Sensory effects ELVs for internal electric field strength from 1 Hz to 400 Hz

The sensory effects ELVs (Table A3) are related to electric field effects on the central nervous system in the head, i.e. retinal phosphenes and minor transient changes in some brain functions.

Frequency range	Sensory effects ELVs
$1 \leq f < 10$ Hz	$0.7/f \text{ Vm}^{-1}$ (peak)
$10 \leq f < 25$ Hz	$0.07 \text{ Vm}^{-1}$ (peak)
$25 \leq f \leq 400$ Hz	$0.0028 f \text{ Vm}^{-1}$ (peak)

Note A3-1:  $f$  is the frequency expressed in hertz (Hz).

Note A3-2: The sensory effects ELVs for internal electric field are spatial peak values in the head of the exposed subject.

Note A3-3: The ELVs are peak values in time which are equal to the Root-Mean-Square (RMS) values multiplied by  $\sqrt{2}$  for sinusoidal fields. In the case of non-sinusoidal fields, the exposure evaluation carried out in accordance with Article 4 shall be based on the weighted peak method (filtering in time domain), explained in the practical guides referred to in Article 14, but other scientifically proven and validated exposure evaluation procedures can be applied, provided that they lead to approximately equivalent and comparable results.

## B. ACTION LEVELS (ALs)

The following physical quantities and values are used to specify the action levels (ALs), the magnitude of which are established to ensure by simplified assessment the compliance with relevant ELVs or at which relevant protection or prevention measures specified in Article 5 must be taken:

- Low ALs(E) and high ALs(E) for electric field strength E of time varying electric fields as specified in Table B1;
- Low ALs(B) and high ALs(B) for magnetic flux density B of time varying magnetic fields as specified in Table B2;
- ALs(I<sub>C</sub>) for contact current as specified in Table B3;
- ALs(B<sub>0</sub>) for magnetic flux density of static magnetic fields as specified in Table B4.

ALs correspond to calculated or measured electric and magnetic field values at the workplace in the absence of the worker.

Action levels (ALs) for exposure to electric fields

Low ALs (Table B1) for external electric field are based on limiting the internal electric field below the ELVs (Tables A2 and A3) and limiting spark discharges in the working environment.

Below high ALs, the internal electric field does not exceed the ELVs (Tables A2 and A3) and annoying spark discharges are prevented, provided that the protection measures referred to in Article 5(6) of the Directive are taken.

Frequency range	Electric field strength Low ALs (E)[Vm <sup>-1</sup> ] (RMS)	Electric field strength High ALs (E) [Vm <sup>-1</sup> ] (RMS)
$1 \leq f < 25$ Hz	$2.0 \times 10^4$	$2.0 \times 10^4$
$25 \leq f < 50$ Hz	$5.0 \times 10^5 / f$	$2.0 \times 10^4$
$50 \text{ Hz} \leq f < 1.64$ kHz	$5.0 \times 10^5 / f$	$1.0 \times 10^6 / f$
$1.64 \leq f < 3$ kHz	$5.0 \times 10^5 / f$	$6.1 \times 10^2$
$3 \text{ kHz} \leq f \leq 10$ MHz	$1.7 \times 10^2$	$6.1 \times 10^2$

Note B1-1: f is the frequency expressed in hertz (Hz).

Note B1-2: The low ALs (E) and high ALs (E) are the Root-Mean-Square (RMS) values of the electric field strength which are equal to the peak values divided by  $\sqrt{2}$  for sinusoidal fields. In the case of non-sinusoidal fields, the exposure evaluation carried out in accordance with Article 4 shall be based on the weighted peak method (filtering in time domain), explained in the practical guides referred to in Article 14, but other scientifically proven and validated exposure evaluation procedures can be applied, provided that they lead to approximately equivalent and comparable results.

Note B1-3: ALs represent maximum calculated or measured values at the workers' body position. This results in a conservative exposure assessment and automatic compliance with ELVs in all non-uniform exposure conditions. In order to simplify the assessment of

compliance with ELVs, carried out in accordance with Article 4, in specific non-uniform conditions, criteria for the spatial averaging of measured fields based on established dosimetry has been laid down in the practical guides referred to in Article 14 of the Directive. In the case of a very localised source within a distance of a few centimetres from the body, the induced electric field shall be determined dosimetrically, case by case.

#### Action levels (ALs) for exposure to magnetic fields

Low ALs (Table B2) are, for frequencies below 400 Hz, derived from the sensory effects ELVs (Table A3) and, for frequencies above 400 Hz, from the health effects ELVs for internal electric field (Table A2).

High ALs (Table B2) are derived from the health effects ELVs for internal electric field related to electric stimulation of peripheral and autonomous nerve tissues in head and trunk (Table A2). Compliance with the high ALs ensures that health effects ELVs are not exceeded, but the effects related to retinal phosphenes and minor transient changes in brain activity are possible, if the exposure of the head exceeds the low ALs for exposures up to 400 Hz. In such a case, Article 5(6) of the Directive applies.

ALs for exposure of limbs are derived from the health effects ELVs for internal electric field related to electric stimulation of the tissues in limbs by taking into account that the magnetic field is coupled more weakly to the limbs than to the whole body.

Frequency range	Magnetic flux density Low ALs(B)[ $\mu$ T] (RMS)	Magnetic flux density High ALs(B) [ $\mu$ T] (RMS)	Magnetic flux density ALs for exposure of limbs to a localised magnetic field [ $\mu$ T] (RMS)
$1 \leq f < 8$ Hz	$2.0 \times 10^5 / f^2$	$3.0 \times 10^5 / f$	$9.0 \times 10^5 / f$
$8 \leq f < 25$ Hz	$2.5 \times 10^4 / f$	$3.0 \times 10^5 / f$	$9.0 \times 10^5 / f$
$25 \leq f < 300$ Hz	$1.0 \times 10^3$	$3.0 \times 10^5 / f$	$9.0 \times 10^5 / f$
$300 \text{ Hz} \leq f < 3 \text{ kHz}$	$3.0 \times 10^5 / f$	$3.0 \times 10^5 / f$	$9.0 \times 10^5 / f$
$3 \text{ kHz} \leq f \leq 10 \text{ MHz}$	$1.0 \times 10^2$	$1.0 \times 10^2$	$3.0 \times 10^2$

Note B2-1: f is the frequency expressed in hertz (Hz).

Note B2-2: The low ALs and the high ALs are the Root-Mean-Square (RMS) values which are equal to the peak values divided by  $\sqrt{2}$  for sinusoidal fields. In the case of non-sinusoidal fields the exposure evaluation carried out in accordance with Article 4 shall be based on the weighted peak method (filtering in time domain), explained in practical guides referred to in Article 14 of the Directive, but other scientifically proven and validated exposure evaluation procedures can be applied, provided that they lead to approximately equivalent and comparable results.

Note B2-3: ALs for exposure to magnetic fields represent maximum values at the workers' body position. This results in a conservative exposure assessment and automatic compliance with ELVs in all non-uniform exposure conditions. In order to simplify the assessment of compliance with ELVs, carried out in accordance with Article 4 of the Directive, in specific non-uniform conditions, criteria for the spatial averaging of measured fields based on established dosimetry has been laid down in the practical guides referred to in Article 14 of the Directive. In the case of a very localised source within a distance of a few centimetres from the body, the induced electric field shall be determined dosimetrically, case by case.

Table B3. ALs for contact current $I_c$	
Frequency	ALs ( $I_c$ ) steady state contact current [mA] (RMS)
up to 2.5 kHz	1.0
$2.5 \leq f < 100$ kHz	0.4 f
$100 \leq f \leq 10000$ kHz	40

Note B3-1: f is the frequency expressed in kilohertz (kHz).

Action levels (ALs) for magnetic flux density of static magnetic fields

Table B4. ALs for magnetic flux density of static magnetic fields	
Hazards	ALs( $B_0$ )
Interference with active implanted devices, e.g. cardiac pacemakers	0.5 mT
Attraction and projectile risk in the fringe field of high field strength sources (>100 mT)	3 mT

## SCHEDULE 3

(ANNEX III to the Directive)

## THERMAL EFFECTS

EXPOSURE LIMIT VALUES AND ACTION LEVELS  
IN THE FREQUENCY RANGE FROM 100 kHz TO 300 GHz

## A. EXPOSURE LIMIT VALUES (ELVs)

Health effects ELVs for frequencies from 100 kHz to 6 GHz (Table A1) are limits for energy and power absorbed per unit mass of body tissue generated from exposure to electric and magnetic fields.

Sensory effects ELVs for frequencies from 0.3 to 6 GHz (Table A2) are limits on absorbed energy in a small mass of tissue in the head from exposure to electromagnetic fields.

Health effects ELVs for frequencies above 6 GHz (Table A3) are limits for power density of an electromagnetic wave incident on the body surface.

Table A1. Health effects ELVs for exposure to electromagnetic fields from 100 kHz to 6 GHz	
Health effects ELVs	SAR values averaged over any six-minute period
ELVs related to whole body heat stress expressed as averaged SAR in the body	0.4 Wkg <sup>-1</sup>
ELVs related to localised heat stress in head and trunk expressed as localised SAR in the body	10 Wkg <sup>-1</sup>
ELVs related to localised heat stress in the limbs expressed as localised SAR in the limbs	20 Wkg <sup>-1</sup>

Note A1-1: Localised SAR averaging mass is any 10 g of contiguous tissue; the maximum SAR so obtained should be the value used for estimating exposure. This 10 g of tissue is intended to be a mass of contiguous tissue with roughly homogeneous electrical properties. In specifying a contiguous mass of tissue, it is recognised that this concept may be used in computational dosimetry but may present difficulties for direct physical measurements. A simple geometry such as cubic or spheric tissue mass can be used.

Sensory effects ELVs from 0.3 GHz to 6 GHz

This sensory effects ELVs (Table A2) is related to avoiding auditory effects caused by exposures of the head to pulsed microwave radiation.

Table A2. Sensory effects ELVs for exposure to electromagnetic fields from 0.3 to 6 GHz	
Frequency range	Localised specific energy absorption (SA)
$0.3 \leq f \leq 6$ GHz	10 mJkg <sup>-1</sup>

Note A2-1: Localised SA averaging mass is 10 g of tissue.

Table A3. Health effects ELVs for exposure to electromagnetic fields from 6 to 300 GHz	
Frequency range	Health effects ELVs related to power density
$6 \leq f \leq 300$ GHz	50 Wm <sup>-2</sup>

Note A3-1: The power density shall be averaged over any 20 cm<sup>2</sup> of exposed area. Spatial maximum power densities averaged over 1 cm<sup>2</sup> should not exceed 20 times the value of 50 Wm<sup>-2</sup>. Power densities from 6 to 10 GHz are to be averaged over any six-minute period. Above 10 GHz, the power density shall be averaged over any  $68/f^{1.05}$ -minute period (where  $f$  is the frequency in GHz) to compensate for progressively shorter penetration depth, as the frequency increases.

## B. ACTION LEVELS (ALs)

The following physical quantities and values are used to specify the action levels (ALs), the magnitude of which are established to ensure by simplified assessment the compliance with the relevant ELVs or at which relevant protection or prevention measures specified in Article 5 of the Directive shall be taken:

- ALs(E) for electric field strength  $E$  of time varying electric field, as specified in Table B1;
- ALs(B) for magnetic flux density  $B$  of time varying magnetic field, as specified in Table B1;
- ALs(S) for power density of electromagnetic waves, as specified in Table B1;
- ALs(I<sub>C</sub>) for contact current, as specified in Table B2;
- ALs(I<sub>L</sub>) for limb current, as specified in Table B2;

ALs correspond to calculated or measured field values at the workplace in absence of the worker, as maximum value at the position of the body or specified part of the body.

Action levels (ALs) for exposure to electric and magnetic fields

ALs(E) and ALs(B) are derived from the SAR or power density ELVs (Tables A1 and A3) based on the thresholds related to internal thermal effects caused by exposure to (external) electric and magnetic fields.

Table B1. ALs for exposure to electric and magnetic fields from 100 kHz to 300 GHz.			
Frequency range	Electric field strength ALs(E) [ $\text{Vm}^{-1}$ ] (RMS)	Magnetic flux density ALs(B) [ $\mu\text{T}$ ] (RMS)	Power density ALs(S) [ $\text{Wm}^{-2}$ ]
$100 \text{ kHz} \leq f < 1 \text{ MHz}$	$6.1 \times 10^2$	$2.0 \times 10^6 / f$	-
$1 \leq f < 10 \text{ MHz}$	$6.1 \times 10^8 / f$	$2.0 \times 10^6 / f$	-
$10 \leq f < 400 \text{ MHz}$	61	0.2	-
$400 \text{ MHz} \leq f < 2 \text{ GHz}$	$3 \times 10^{-3} f^{\frac{1}{2}}$	$1.0 \times 10^{-5} f^{\frac{1}{2}}$	-
$2 \leq f < 6 \text{ GHz}$	$1.4 \times 10^2$	$4.5 \times 10^{-1}$	-
$6 \leq f \leq 300 \text{ GHz}$	$1.4 \times 10^2$	$4.5 \times 10^{-1}$	50

Note B1-1: f is the frequency expressed in hertz (Hz).

Note B1-2:  $[\text{ALs(E)}]^2$  and  $[\text{ALs(B)}]^2$  are to be averaged over a six-minute period. For RF pulses, the peak power density averaged over the pulse width shall not exceed 1000 times the respective ALs(S) value. For multi-frequency fields the analysis shall be based on summation, as explained in the practical guides referred to in Article 14 of the Directive.

Note B1-3: ALs(E) and ALs(B) represent maximum calculated or measured values at the workers' body position. This results in a conservative exposure assessment and automatic compliance with ELVs in all non-uniform exposure conditions. In order to simplify the assessment of compliance with ELVs, carried out in accordance with Article 4 of the Directive, in specific non-uniform conditions, criteria for the spatial averaging of measured fields based on established dosimetry has been laid down in the practical guides referred to in Article 14 of the Directive. In the case of a very localised source within a distance of a few centimetres from the body, compliance with ELVs shall be determined dosimetrically, case by case.

Note B1-4: The power density shall be averaged over any  $20 \text{ cm}^2$  of exposed area. Spatial maximum power densities averaged over  $1 \text{ cm}^2$  should not exceed 20 times the value of  $50 \text{ Wm}^{-2}$ . Power densities from 6 to 10 GHz are to be averaged over any six-minute period. Above 10 GHz the power density shall be averaged over any  $68/f^{1.05}$ -minute period (where f is the frequency in GHz) to compensate for progressively shorter penetration depth as the frequency increases.



Table B2. ALs for steady state contact currents and induced limb currents		
Frequency range	Steady state contact current, ALs(I <sub>C</sub> ) [mA] (RMS)	Induced limb current in any limb, ALs(I <sub>L</sub> ) [mA] (RMS)
100 kHz ≤ f < 10 MHz	40	-
10 ≤ f ≤ 110 MHz	40	100

Note B2-1: [ALs(I<sub>L</sub>)]<sup>2</sup> is to be averaged over a six-minute period.



GIVEN under my Official Seal,  
29 June 2016.

MARY MITCHELL O'CONNOR,  
Minister for Jobs, Enterprise and Innovation.

## EXPLANATORY NOTE

*(This note is not part of the Instrument and does not purport to be a legal interpretation)*

The purpose of these Regulations is to transpose into Irish law the provisions of Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 implementing the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC and repealing Directive 2004/40/EC).

The Regulations apply the same principles as contained in the Safety, Health and Welfare at Work Act 2005 and the Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2016, specifically to the issue of electromagnetic fields (EMFs) but are more explicit with regard to exposure limit values and action levels, the assessment of risks and determination of exposure, the provisions aimed at avoiding or reducing risks, worker information and training, consultation and the participation of workers and health surveillance.

The Regulations require employers to carry out an initial assessment of the risks from EMF in the place of work. This can be done with reference to an EU Commission guide and most employers will not be required to take any further action. Employers whose employees are routinely exposed to EMF at work are required to carry out a more detailed risk assessment and this shall include the calculation or measurement of EMF levels in the place of work.

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(Teil: 01 - 6476834 nó 1890 213434; Fax: 01 - 6476843)  
nó trí aon díoltóir leabhar.

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DUBLIN  
PUBLISHED BY THE STATIONERY OFFICE  
To be purchased from  
GOVERNMENT PUBLICATIONS,  
52 ST. STEPHEN'S GREEN, DUBLIN 2.  
(Tel: 01 - 6476834 or 1890 213434; Fax: 01 - 6476843)  
or through any bookseller.

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€6.60



Wt. (B32089). 305. 7/16. Essentra. Gr 30-15.