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DRAFT COMPROMISE AMENDMENTS A-U

Draft report
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(PE474.084v02-00)

on the proposal for a directive of the European Parliament and of the Council on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (XXth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)

Proposal for a directive
(COM(2011)0348 – C7-0191/2011 – 2011/0152(COD))

Compromise A

Replacing amendments 19, 20, 21, 25, 30, 177, 185

Proposal for a directive
Recital 6

(6) Directive 2004/40/EC should be repealed and more appropriate and proportionate measures protecting workers from the risks associated with electromagnetic fields should be introduced. However, it does not address the long-term effects, including possible carcinogenic effects of exposure to time-varying electric, magnetic and electromagnetic fields, for which there is currently no conclusive scientific evidence establishing a causal relationship. The present measures should be intended not only to ensure the health and safety of each worker on an individual basis, but also to create a minimum basis of protection for all Union workers, while reducing possible distortions of competition.	(6) Directive 2004/40/EC should be repealed and more appropriate and proportionate measures protecting workers from the risks associated with electromagnetic fields should be introduced. However, it does not address long-term effects, including possible carcinogenic effects of exposure to time-varying electric, magnetic and electromagnetic fields, for which there is currently no conclusive scientific evidence establishing a causal relationship. The present measures should be intended ***to adresses all known direct and indirect biophysical effects provoked by electromagnetic fields in order*** not only to ensure the health and safety of each worker on an individual basis, but also to create a minimum basis of protection for all Union workers, while reducing possible distortions of competition. ***The Commission and the Member States should step up research and the collection of data on the long-term effects of exposure to electromagnetic fields.The Commission will present a new proposal to address the long- term effects within 8 years by taking into account the acquired knowledge.***

Compromise B

Replacing amendments 1, 22

Proposal for a directive
Recital 7

Text proposed by the Commission	*Amendment*
(7) ***This Directive lays down minimum requirements,*** thus giving Member States the option of maintaining or adopting more favourable provisions for the protection of workers, in particular the fixing of lower values for the ***orientation values and*** action ***values*** or the exposure limit values for electromagnetic fields. However, the implementation of this Directive ***should*** not serve to justify any regression in relation to the situation already prevailing in each Member State.	(7) ***Minimum requirements should be laid down,*** thus giving Member States the option of maintaining or adopting more favourable provisions for the protection of workers, in particular the fixing of lower values for the ***action levels (AL)*** or the exposure limit values ***(ELV)*** for electromagnetic fields. However, the implementation of this Directive ***must*** not serve to justify any regression in relation to the situation already prevailing in each Member State.

Compromise C

Replacing am. 24

Proposal for a directive
Recital 10

Text proposed by the Commission	*Amendment*
(10) The undesired effects on the human body are dependent on the frequency of the electromagnetic field or radiation to which it is exposed***, from 0 Hz until 100 kHz and above 100 kHz***, therefore ***two different*** exposure limitation systems need to be ***considered to*** protect workers exposed to electromagnetic fields.	10) The undesired effects on the human body are dependent on the frequency of the electromagnetic field or radiation to which it is exposed, therefore exposure limitation systems need to be ***frequency and exposure pattern dependent to adequatelly*** protect workers exposed to electromagnetic fields.

Compromise D, intorducing a new text

Proposal for a directive
Recital 13 a (new)

Text proposed by the Commission	*Amendment*
	13a. The physical quantities, limit values and action levels laid down in the annexes of this Directive are based on the

	recommendations of the International Commission on Non- Ionising Radiation (ICNIRP) and should be considered in accordance with its concept, as long as this directive does not provide for specific provisions.

Compromise E

Replacing am 26

Proposal for a directive
Recital 14

Text proposed by the Commission	*Amendment*
(14) The power to adopt acts in accordance with Article 290 of the Treaty on the Functioning of the European Union should be delegated to the Commission in order to empower it to make purely technical amendments of the Annexes to this Directive, in line with the adoption of directives in the field of technical harmonisation and standardisation and as a result of the technical progress, changes in the most relevant ***harmonised European*** standards or specifications and new scientific findings concerning electromagnetic fields, as well as to adjust ***the orientation and action values and the related lists of activities, workplaces and types of equipments***. It is of particular importance that the Commission carry out appropriate consultations during its preparatory work, including at expert level. The Commission, when preparing and drawing-up delegated acts, should ensure a simultaneous, timely and appropriate transmission of relevant documents to the European Parliament and Council.	(14) The power to adopt acts in accordance with Article 290 of the Treaty on the Functioning of the European Union should be delegated to the Commission in order to empower it to make purely technical amendments of the Annexes to this Directive, in line with the adoption of directives in the field of technical harmonisation and standardisation and as a result of the technical progress, changes in the most relevant standards or specifications and new scientific findings concerning electromagnetic fields ***hazards*** as well as to adjust the ***action levels.*** It is of particular importance that the Commission carry out appropriate consultations during its preparatory work, including at expert level. The Commission, when preparing and drawing-up delegated acts, should ensure a simultaneous, timely and appropriate transmission of relevant documents to the European Parliament and Council.

Compromise F, introducing new text

Recital 15a (new)

Text proposed by the Commission	*Amendment*
	(15a) In accoprdance with the Joint Political Declaration of 28 September 2011of member states and the Commission on explanatory documents of (.....date), member States have undertaken to accompany, in justified cases, the notification of their transposition measures with one or more documents explaining the relationship between the components of a directive and the corresponding parts of national transposition instruments. With regard to this Directive, the legislator considers the transmission of such documents to be justified.

Compromise G

Replacing am. 3, 27, 28, 235

Proposal for a directive
Recital 16

Text proposed by the Commission	*Amendment*
(16) A system including exposure limit values***, orientation values*** and action ***values***, wherever applicable, should be seen as a means to facilitate the provision of a high level of protection against the ***established*** adverse health effects that may result from exposure to electromagnetic fields. But such a system may conflict with specific conditions in certain activities, such as ***medical procedures using*** magnetic resonance ***techniques or military operations where interoperability is required and where internationally accepted standards providing an***	(16) A system including exposure limit values and action ***levels***, wherever applicable, should be seen as a means to facilitate the provision of a high level of protection against the adverse health ***or safety risks*** that may result from exposure to electromagnetic fields. But such a system may conflict with specific conditions in certain activities, such ***as the use of*** magnetic resonance ***technique in medical sector***. It is therefore necessary to take these particular conditions into account.

equivalent protection of workers subject to specific exposure situations are already in place. It is therefore necessary to take these particular conditions into account.

Compromise H

Replacing am. 3, 31, 32, 33, 34, 35, 36, 37, 239 , 240

Proposal for a directive
Article 1

Text proposed by the Commission	*Amendment*
1. This Directive, which is the 20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC, lays down minimum requirements for the protection of 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.	1. This Directive, which is the 20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC, lays down minimum requirements for the protection of 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.
2. This Directive ***relates to the direct risks to the health and safety of workers due to known short-term adverse effects in the human body caused by induced electric or magnetic fields, by energy absorption and by contact currents. It also covers indirect health and safety effects.***	2. This Directive ***addresses all known direct biophysical effects and indirect effects provoked by electromagnetic fields***.
3. ***This*** Directive does not address long-term effects.	***3. The exposure limit values set in this Directive only address scientifically well-established relations between short term direct biophysical effects and exposure to electromagnetic fields.*** ***Therefore this Directive does not address suggested long-term effects.*** ***On the basis of new scientific evidence, the Commission will present whithin 8 years a new proposal to address the long-***

	term effects.
4. This Directive does not address the risks resulting from contact with live conductors.	4. This Directive does not address the risks resulting from contact with live conductors.
5. Directive 89/391/EEC shall apply fully to the whole area referred to in paragraph 1, without prejudice to more stringent and/or more specific provisions contained in this Directive.	5. Directive 89/391/EEC shall apply fully to the whole area referred to in paragraph 1, without prejudice to more stringent and/or more specific provisions contained in this Directive.

Compromise I

Replacing am. 4, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54

Proposal for a directive
Article 2

Text proposed by the Commission	*Amendment*
1. For the purposes of this Directive, the following definitions apply:	For the purposes of this Directive, the following definitions apply:
(a) 'electromagnetic fields'***:*** static electric, static magnetic and time-varying electric, magnetic and electromagnetic fields with frequencies up to 300 GHz;	(a) "electromagnetic fields" ***means*** static electric, static magnetic and time-varying electric, magnetic and electromagnetic fields with frequencies up to 300 GHz;
(b) 'adverse health effects': biological effects that have a detrimental effect on mental, physical and/or general well-being of exposed workers. In this Directive, only short-term effects are considered;	***(b) "direct biophysical effects" means effects directly provoked in the human body by the presence in electromagnetic field, in particular:***
	(i) thermal effects, such as tissue heating through energy absorption from electromagnetic fields in the tissue; and
	(ii) non-thermal effects, such as the stimulation of muscles, nerves or sensory organs. These effects might have a detrimental effect on mental and physical health of exposed workers. Moreover, the

	stimulation of sensory organs may lead to transient symptoms such as vertigo or phosphenes. These might create temporary annoyance or affecting cognition or other brain or muscle functions and may thereby affect the ability of a worker to work safely ***(safety risks);***
	(iii) limb currents;
(c) "adverse safety effects": effects creating temporary annoyance or affecting cognition or other brain or muscle functions and may thereby affect the ability of a worker to work safely;	***(c) "indirect effects" means effects provoked*** by the presence of an object ***in electromagnetic field,*** which may become the cause of a safety or health hazard***, such as:***
(c) 'direct effect': effect on the human body directly provoked by the presence of a strong magnetic or electric field, for example the stimulation of muscles, nerves or sensitory organs, tissue heating, vertigo or headaches;	***(i) interference with medical electronic equipment and devices (including cardiac pacemakers and other implanted or body worn devices);***
	(ii) the projectile risk from ferromagnetic objects in static magnetic fields;
(d) 'indirect effect': effect on an object, due to the presence of a strong electric or magnetic field, which may become the cause of a safety or health hazard, for example contact currents, ferromagnetic projectiles or interference with active implantable medical devices;	***(iii) the initiation of electro-explosive devices (detonators);***
	(iv) fires and explosions resulting from the ignition of flammable materials by sparks caused by induced fields, contact currents or spark discharges; and
	(v) contact currents;
(e) 'exposure limit values'***: limits on exposure to electromagnetic fields which have been established on the basis of known health effects and biological considerations.Compliance with the exposure limits values for health effects will ensure that workers exposed to electromagnetic fields are protected against all known adverse health effects. Compliance with the exposure limits values for safety effects will ensure that workers exposed to electromagnetic fields are protected against all known adverse health and safety effects;***	***(d)*** "exposure limit values (ELV***)" means values established on the basis of biophysical and biological considerations, in particular on scientifically well-established short term and acute direct effects, i.e. thermal effects and electrical stimulation of tissues.***
	(***i) "sensory effects ELV" means exposure limit values above which workers might be subject to transient disturbed sensory perceptions and minor changes in brain functions; and***

(f) 'orientation value' and 'action value': directly measurable — frequency-dependent — parameters, the magnitude of which is established in terms of electric field strength (E), magnetic field strength (H), magnetic flux density (B) and power density (S), and at which one or more of the measures specified in this Directive must be taken.

2. The "orientation value" referred to in point (f) of paragraph 1 corresponds to a field level where no adverse health effect should be noticed under normal working conditions and for persons not being part of a group at particular risk. As a consequence, the depth of the risk assessment procedure can be reduced to a minimum. Compliance with the orientation value will ensure compliance with the relevant exposure limit values for safety and health effects.

The "action value" referred to in point (f) of paragraph 1 corresponds to the maximum directly measurable field for which automatic compliance with the exposure limit value is guaranteed. Any exposure level between the "orientation value" and the "action value" requires more extensive evaluations and preventive measures. Compliance with the action value will ensure compliance with the

(ii) "health effects ELV" means exposure limit values above which workers might be subject to adverse health effects, such as thermal heating or stimulation of nerve and muscle tissue;

(e) "action levels (AL)" means operational levels established for the purpose of simplifying the process of demonstrating the compliance with relevant exposure limit values or, where appropriate, to take relevant protection or prevention measures specified in this Directive. The terminology used in Annex II is as follows:

(i) for electric fields, "low AL" and "high AL" means levels which relate to the specific protection or prevention measures specified in this Directive; and

(ii) for magnetic fields, "low AL" means levels which relate to the sensory effects ELV and "high AL" to the health effects ELV.

relevant exposure limit values for health effects.

Compromise J

Replacing am 55

Proposal for a directive
Article 3 - Title

Exposure limit values, ***orientation values*** and action ***values***	Exposure Limit Values ***and Action Levels***

Compromise K

Replacing amendments 5, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91

Proposal for a directive
Article 3

Text proposed by the Commission	*Amendment*
1. ***Exposure limit values as well as orientation and action values for both electric and magnetic fields in the frequency range from 0 to 100 kHz shall be as set out in Annex II.*** ***For exposure levels above the action value, appropriate verifications shall demonstrate that the exposure level is not exceeding the relevant exposure limit value for health effects. For exposure levels above the orientation value, appropriate verifications shall demonstrate that the exposure is not exceeding the relevant exposure limit values for safety and health effects or by demonstrating that the exposure level is below the action value. In the latter case, preventive measures and information to workers shall be adapted.***	1. ***Physical quantities regarding the exposure to electromagnetic fields are indicated in Annex I. Health effects ELV, sensory effects ELV and action levels are set out in Annexes II and III.***
2. ***Exposure limit values and action values for both electric and magnetic***	2. ***Member Sates shall require that the employer ensures that exposure of***

fields in the frequency range from 100 kHz to 300 GHz shall be as set out in Annex III. ***For exposure of levels above the action level, appropriate verifications shall demonstrate that the exposure is not exceeding the relevant exposure limit value for health effects.***	***workers to electromagnetic fields is limited to the health effects ELV and sensory effects ELV for non thermal effects set out in Annex II and for thermal effects set out in Annex III. Compliance with health effects ELV and sensory effects ELV must be shown with the use of relevantexposure assessment procedures referred to in Article 4. Should the exposure exceed the exposure limit values, the employer shall take immediate action in accordance with Article 5(8).***
3. ***For the assessment, measurement and/or calculation of workers' exposure levels to electromagnetic fields likely to be significantly below the action value, simple methods may be used. For the other cases where the exposure level is likely to be close or above the action value, Member States shall give guidance based on available harmonised European standards established by the European Committee for Electrotechnical Standardisation (CENELEC) or on other scientifically-based standards or guidelines.***	3. ***For the purpose of this Directive, when it is demonstrated that the relevant action levels set out in Annex II and III are not exceeded, the employer complies with the health effects ELV and sensory effects ELV. Should the exposure exceed the action levels, the employer shall take action in accordance with Article 5(2), unless the assessment carried out in accordance with article 4(1), (2) and (3) demonstrates that the relevant ELV are not exceeded and that safety risks can be excluded. Nevertheless, without prejudice to this paragraph, exposure may exceed:*** ***(a) low AL for electric fields (Annex II, Table B1), where justified by the practice or*** ***process, provided that the sensory effects ELV (Annex II, Table A3) are not exceeded;*** ***or*** ***(i) the health effects ELV (Annex II, Table A2) are not exceeded;*** ***(ii) excessive spark discharges and contact currents (Annex II, Table B3) are prevented by specific protection measures as set out in Article 5(6); and*** ***(iii) information to workers has been given in accordance with Article 6(f);*** ***(b) low AL for magnetic fields (Annex II, Table B2) where justified by the practice or***

process, also in the head and torso, during the shift, provided that the sensory effects ELV (Annex II, Table A3) are not exceeded; or

(i) the exceedance is temporary;

(ii) the health effects ELV (Annex II, Table A2) are not exceeded;

(iii) action is taken in accordance with Article 5(9), subject to transient symptoms under (a) of that Article; and

(iv) information to workers has been given in accordance with Article 6(f);

4. ***Without prejudice to paragraphs 2 and 3, exposure may exceed:***
(a) the sensory effects ELV (Annex II, Table A1) during the shift, where justified by the practice or process, provided that:

(i) the exceedance is temporary;

(ii) health effects ELV are not exceeded;

(iii) specific preventive measures have been adopted in accordance with Article 5(7);

(iv) action is taken in accordance with Article 5(9), subject to transient symptoms under letter (b) of that Article; and

(v) information has been given to workers in accordance with Article 6(f).

(b) the sensory effects ELV (Annex II, Table A3 and Annex III, Table A2) during the shift,where justified by the practice or process, provided that:

(i) the exceedance is temporary;

(ii) health effects ELV are not exceeded;
(iii) action is taken in accordance with Article 5(9), subject to transient symptoms; and

(iv) information has been given to workers in accordance with Article 6(f).

4. ***By way of derogation, paragraphs 1 and 2 shall not apply to medical applications using the magnetic resonance effect and the following related activities: integral system testing before release for shipment, installation, cleaning, maintenance, research and development activities. In these particular cases, specific protection measures shall be put in place. For this purpose the Commission shall consult the existing working groups and proceed according to the measures set out in Annex IV.***

5. By way of derogation, paragraphs 1 and 2 shall not apply to the armed forces in Member States where an equivalent and more specific protection system such as NATO standard STANAG 2345 is already in place and implemented. Member States shall inform the Commission of the existence and effective implementation of such protection systems when notifying the transposition of the provisions of this Directive into national legislation in accordance with Article 14.

6. Without prejudice to paragraphs 4 and 5, workers may not be exposed above the exposure limit values for health effects. For specific situations where these values may temporarily be exceeded, Member States may put in place a system authorising work under controlled conditions and on the basis of a comprehensive risk assessment setting out the actual exposure levels and their likelihood and comparing them to the exposure limit values defined inAnnexes II and III. Such specific situations shall be reported to the Commission in the report referred to rin Article 17a of Directive 89/391/EEC.

Compromise L

Replacing amendments 6, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 114, 115, 117, 118, 119, 120, 121, 122, 123

Proposal for a directive
Article 4

Text proposed by the Commission	*Amendment*
1. In carrying out the obligations laid down in Articles 6(3) and 9(1) of Directive 89/391/EEC***,*** the employer shall assess and***,*** if necessary, measure and/or calculate the levels of electromagnetic fields to which workers are exposed. ***Assessment***, ***measurement*** and ***calculation*** may ***be carried out using*** the ***guidance provided in Annexes II*** and ***III. For specific cases not referred to in these Annexes,*** the ***employer may use harmonised European standards established by CENELEC for relevant*** assessment***, measurement and calculation situations***. The ***employer*** shall ***also*** be ***entitled to use other scientifically based standards or guidelines*** if ***required by the Member State concerned. When relevant***, the ***employer shall also take into account the emission levels and other safety-related data provided by the manufacturers*** of ***equipment in accordance with relevant Union legislation***.	1. In carrying out the obligations laid down in Articles 6(3) and 9(1) of Directive 89/391/EEC, the employer shall assess ***all risks for workers arising from electromagnetic fields at the workplace and***, if necessary, measure or calculate the levels of electromagnetic fields to which workers are exposed. ***This assessment coould be made public on request.***
2. ***On the basis*** of the assessment ***of the levels of*** electromagnetic fields ***undertaken in accordance with paragraph 1, if any of the action values referred to in Annexes II or III is exceeded,*** the employer shall ***further*** assess ***and, if necessary, calculate whether the exposure limit values for health effects are exceeded***.	2. ***For the purpose*** of the assessment, the employer shall ***identify and*** assess electromagnetic fields ***at the workplace, taking into account relevant guidance specified in Article 13 or other relevant standards or guidelines provided by the Member State, including exposure databases. Without prejudice to this article and when relevant, the employer shall be also entitled to take into account***

[1] OJ L 199, 30.7.1999, p. 59.

	the emission levels and other appropriate safety-related data provided with the equipment by the manufacturer or distributor in accordance with relevant Union legislation, including assessment of risks, if applicable to the exposure conditions at the workplace or place of installation.
3. ***The assessment, measurement and/or calculations referred to in paragraphs 1 and 2 need not be carried out in workplaces open to the public provided that an evaluation has already been undertaken in accordance with the provisions of 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)[1], and the restrictions as specified therein are respected for workers and safety risks are excluded. Where equipment, intended for the public and complying with EU product legislation and especially Directives 1999/5/EC and 2006/95/EC are being used as intended these conditions are met.***	3. ***If compliance with the exposure limit values cannot be reliably determined on the basis of readily accessible information, the assessment of the exposure shall be carried out on the basis of measurements or calculations. In such a case, the assessment shall take into account the measurements or calculations (e.g. numerical errors, source modelling, phantom geometry, electrical properties of tissues and materials) uncertainties determined in accordance with relevant good practice.***
4. The assessment, measurement and/or calculations referred to in paragraphs 1 and 2 shall be planned and carried out by competent services or persons at suitable intervals, taking into account the guidance ***given in Annexes II and III*** and taking particular account of Articles 7 and 11 of Directive 89/391/EEC concerning the necessary competent services or persons and the consultation and participation of workers. The data obtained from the assessment, measurement and/or calculation of the level of exposure shall be preserved in a suitable form so as to permit consultation at a later stage.	4. The assessment, measurement and/or calculations referred to in paragraph 1, 2 ***and 3*** shall be planned and carried out by competent services or persons at suitable intervals, taking into account the guidance and taking particular account of Articles 7 and 11 of Directive 89/391/EEC concerning the necessary competent services or persons and the consultation and participation of workers. The data obtained from the assessment, measurement and/or calculations of the level of exposure shall be preserved in a suitable form so as to permit consultation at a later stage***, according to national law and practice.***
5. Pursuant to Article 6(3) of Directive 89/391/EEC, the employer shall give particular attention, when carrying out the risk assessment, to the following:	5. Pursuant to Article 6(3) of Directive 89/391/EEC, the employer shall give particular attention, when carrying out the

(a) the frequency spectrum and the level, duration and type of exposure;

(b) the exposure limit values and action values referred to in Article 3 and Annexes II and III to this Directive;

(c) any effects concerning the health and safety of workers at particular risk such as workers who have declared to the employer that they wear an Active Implanted Medical Device and women who have declared that they are pregnant;

(d) any indirect effects, such as:

(i) interference with medical electronic equipment and devices (including cardiac pacemakers and other implanted devices as referred to in point (c));

(ii) the projectile risk from ferromagnetic objects in static magnetic fields with a magnetic flux density greater than 30 mT;

(iii) the initiation of electro-explosive devices (detonators);

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

(e) the existence of replacement equipment designed to reduce the level of exposure to electromagnetic fields;

(f) appropriate information obtained from health surveillance, including published information;

(g) multiple sources of exposure;

(h) simultaneous exposure to multiple frequency fields.

risk assessment, to the following:

(a) the health effects ELV, the sensory effects ELV and the action levels referred to in Article 3 and Annexes II and III of this Directive;

(b) the frequency, the level, duration and type of exposure, including distribution over the workers body and the space of workplace;

(c) any direct biophysical effects in the human body directly provoked by the presence in electromagnetic field, referred to in Article 2(b).

(d) any effects concerning the health and safety of workers at particular risk, in particular workers who wear an active or passive implanted medical device (such as cardiac pacemakers), workers who wear body worn medical devices (such as insulin pumps), and pregnant workers;

(e) any indirect effects on an object, due to the presence in electromagnetic field, which may become the cause of a safety or health hazard, referred to in Article 2(c);

(f) the existence of replacement equipment designed to reduce the level of exposure to electromagnetic fields;

(g) appropriate information obtained from health surveillance;

(h) information provided by the manufacturer of equipment and other relevant available health and safety related information;

(i) multiple sources of exposure;

(j) simultaneous exposure to multiple frequency fields;

6. ***The employer shall be in possession of an*** assessment ***of the risks in accordance with Article 9(1)(a) of Directive 89/391/EEC and shall identify which measures must be taken in accordance with Articles 5 and 6 of this Directive. The risk assessment shall be recorded on a suitable medium, according to national law and practice. It may include a justification by the employer that the nature and the extent of the risks related to electromagnetic fields make a further detailed risk assessment unnecessary. The risk assessment shall be updated on a regular basis, particularly if there have been significant changes which could render it out of date, or when the results of health surveillance show this to be necessary.***	6. ***The exposure*** assessment ***need not be carried out in workplaces open to the public provided that an evaluation has already been undertaken in accordance with the provisions on the limitation of exposure of the general public to electromagnetic fields, and the restrictions as specified therein are respected for workers and health and safety risks are excluded. Where only equipment, intended for the public use and complying with EU product legislation, that establishes stricter safety levels than those provided for by this Directive, are being used as intended for the public these conditions are met.***
	7. The employer shall be in possession of an assessment of the risks in accordance with Article 9(1)(a) of Directive 89/391/EEC and shall identify which measures must be taken in accordance with Article 5 of this Directive. It may include a justification by the employer that the nature and the extent of the risks related to electromagnetic fields make a further detailed risk assessment unnecessary. The risk assessment shall be updated on a regular basis, particularly if there have been significant changes which could render it out of date, or when the results of health surveillance show this to be necessary.

Compromise M

Replacing amendments 7, 8, 9, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152

Proposal for a directive
Article 5

Text proposed by the Commission	*Amendment*
1. Taking account of technical progress and the availability of measures to control the production of electromagnetic fields at the source***, the exposure to electromagnetic fields shall be*** eliminated or reduced to a minimum. The reduction of risks arising from exposure to electromagnetic fields shall be based on the general principles of prevention set out in Directive 89/391/EEC.	1. Taking account of technical progress and the availability of measures to control the production of electromagnetic fields at the source, ***the employer shall take the necessary actions to ensure that risks arising from electromagnetic fields at the work place are*** eliminated or reduced to a minimum. The reduction of risks arising from exposure to electromagnetic fields shall be based on the general principles of prevention set out in Directive 89/391/EEC.
2. On the basis of the risk assessment referred to in Article 4, once the action values referred to in Article 3 and Annexes II and III are exceeded***, the employer,*** unless the assessment carried out in accordance with Article ***4(2) demonstrates that*** the ***exposure limit values*** are not exceeded and that safety risks can be excluded, shall devise and implement an action plan comprising technical and/or organisational measures to prevent exposure exceeding ***the exposure limit values,*** taking into account in particular:	2. On the basis of the risk assessment referred to in Article 4, once relevant action ***levels*** referred to in Article 3 and Annexes II and III are exceeded***,*** unless the assessment carried out in accordance with article ***4(1), (2) and (3)*** demonstrates that ***the relevant ELV*** are not exceeded ***and*** that safety risks can be excluded***, the employer*** shall devise and implement an action plan comprising technical and/or organisational measures to prevent exposure exceeding ***the health effects ELV and sensory effects ELV,*** taking into account in particular:
(a) other working methods that entail less exposure to electromagnetic fields;	(a) other working methods that entail less exposure to electromagnetic fields;
(b) the choice of equipment emitting less electromagnetic fields, taking account of the work to be done;	(b) the choice of equipment emitting less electromagnetic fields, taking account of the work to be done;
(c) technical measures to reduce the emission of electromagnetic fields, including, where necessary, the use of	(c) technical measures to reduce the emission of electromagnetic fields,

[1] OJ L 245, 26.8.1992, p. 23.

interlocks, shielding or similar health protection mechanisms;

(d) ***appropriate maintenance programmes for work equipment, workplaces and workstation systems***;

(e) the design and layout of workplaces and workstations;

(f) limitation of the duration and intensity of the exposure;
(g) the availability of adequate personal protection equipment.

3. On the basis of the risk assessment referred to in Article 4, workplaces where workers ***could*** be exposed to electromagnetic fields exceeding the ***orientation or action values*** shall be indicated by appropriate signs in accordance with Annexes II and III and with Council Directive 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work (ninth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) [1]. The areas in question shall be identified and access to them limited as appropriate. Where access to these areas is suitably restricted for other reasons then signs and access restrictions specific to electropmagnetic fields are not required.

4. ***In any event, workers*** shall not be

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, fences) 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 the training of workers;

(f) appropriate maintenance programmes for work equipment, workplaces and workstation systems;

(g) the design and layout of workplaces and workstations;

(h) limitation of the duration and intensity of the exposure; ***and***

(i) the availability of adequate personal protection equipment***.***

3. On the basis of the risk assessment referred to in Article 4***, the employer shall devise and implement an action plan comprising technical and/or organisational measures to prevent any risks to workers at particular risk and any risks due to indirect effects referred to in Article 4.***

exposed above ***the exposure limit values for health effects*** unless the conditions under Article ***3(6)*** are fulfilled. If, despite the measures taken by the employer to comply with this Directive, ***the exposure limit values for health effects*** are exceeded, the employer shall take immediate action to reduce exposure below these exposure limit values. The employer shall identify the reasons why ***the exposure limit values for health effects*** have been exceeded, and shall amend the protection and prevention measures accordingly in order to prevent them being exceeded again.

5. ***Pursuant to Article 15 of Directive 89/391/EEC, the employer shall adapt the measures referred to in this Article and in Annexes II and III to the requirements of workers at particular risk.***

4. ***Pursuant to Article 15 of Directive 89/391/EEC, the employer shall adapt the measures referred to in this Article to the requirements of workers at particular risk and individual risks assessments as appropriate, in particular for workers who have declared the use of active or passive implanted medical devices (such as cardiac pacemakers), the use of body worn medical devices (such as insulin pumps) or to be pregnant, following the information as set out in Article 6 of this Directive.***

5. On the basis of the risk assessment referred to in Article 4, workplaces where workers ***are likely*** to be exposed to electromagnetic fields exceeding the ***action levels*** shall be indicated by appropriate signs in accordance with Annexes II and III and with Council Directive 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work (ninth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).15 The areas in question shall be identified and access to them limited as appropriate. Where access to these areas is suitably restricted for other reasons and workers informed on the electromagnetic risks, then signs and access restrictions specific to electromagnetic fields shall not be required.

6. In application of Article 3(3)(a), specific protection measures, cf. training of workers in accordance with Article 6 and the use of technical means and personal protection, such as grounding of work objects, bonding of workers with work objects (equipotential bonding) and, where appropriate and in accordance with Article 4(1)(a) of Directive 89/656/EEC, using insulating shoes,

gloves and protective clothing shall be adopted.

7. In application of Article 3(4)(a), specific protection measures, such as controlling movements, shall be adopted.

8. Workers shall not be exposed above ***the sensory effects ELV and health effects ELV***, unless the conditions under ***Articles 3(3), 3(4), 10(2) or 10(4)*** are fulfilled***.*** If, despite the measures taken by the employer to comply with this Directive***, the health effects ELV and sensory effects ELV*** are exceeded, the employer shall take immediate action to reduce exposure below these exposure limit values***.*** The employer shall identify the reasons why ***the health effects limit values and sensory effects limit values*** have been exceeded, and shall amend the protection and prevention measures accordingly in order to prevent them being exceeded again, ***ensuring that the changes made are traceable.***

9. In application of Articles 3(3) and 3(4), in case of occurrence of transient symptoms referred to in Article 2(b) reported by the worker, the employer shall update, if necessary, the risk assessment and the prevention measures. Transient symptoms might be related to:

(a) sensory perceptions and effects in the function 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.

Compromise N

Replacing amendments 10, 11,153, 154, 155, 156, 157

Proposal for a directive
Article 6

Text proposed by the Commission	*Amendment*
Without prejudice to Articles 10 and 12 of Directive 89/391/EEC, the employer shall ensure that workers who are exposed to risks from electromagnetic fields at work and/or their representatives receive any necessary information and training relating to the outcome of the risk assessment provided for in Article 4(1) of this Directive, concerning in particular:	Without prejudice to Articles 10 and 12 of Directive 89/391/EEC, the employer shall ensure that workers who are likely to be exposed to risks from electromagnetic fields at work and/or their representatives, ***appointed in accordance with national practices and legislation,*** to receive any necessary information and training relating to the outcome of the risk assessment provided for in Article 4 of this Directive, concerning in particular:
(a) measures taken to implement this Directive;	(a) measures taken to implement this Directive;
(b) the values and concepts of the exposure limit values, ***orientation values*** and action ***values,*** the associated potential risks and the preventive measures taken;	(b) the values and concepts of the exposure limit values and action ***leve***ls, the associated ***possible*** risks and the preventive measures taken;
	(c) the possible indirect effects of exposure;
(c) the results of the assessment, measurement and/or ***calculations*** of the levels of exposure to electromagnetic fields carried out in accordance with Article 4 ***(1) and (2)*** of this Directive;	(d) the results of the assessment, measurement and/or ***computations*** of the levels of exposure to electromagnetic fields carried out in accordance with Article 4 of this Directive;
(d) how to detect adverse health effects of exposure and how to report them;	***(e)*** how to detect adverse health effects of exposure and how to report them;
	(f) the possibility of transient symptoms and sensations related to effects in the central or peripheral nervous system;
(e) the circumstances in which workers are entitled to health surveillance;	***(g)*** the circumstances in which workers are entitled to health surveillance;
(f) safe working practices to minimise risks from exposure.	(h) safe working practices to minimise risks from exposure;

(i) workers at particular risk, as refered to in Articles 4(5)(d), 5(3) and (4) of this Directive.

Compromise O

Replacing amendments 12, 13, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176

Proposal for a directive
Article 8

Text proposed by the Commission	*Amendment*
1. With the objective of prevention and early diagnosis of any adverse health effects due to exposure to electromagnetic fields, appropriate health surveillance shall be carried out in accordance with Article 14 of Directive 89/391/EEC.	1. With the objective of prevention and early diagnosis of any adverse health effects due to exposure to electromagnetic fields, appropriate health surveillance shall be carried out in accordance with Article 14 of Directive 89/391/EEC. ***Those provisions, including the requirements specified for health records and their availability, shall be introduced with national law and/or practice.***
For exposures in the frequency range up to 100 kHz, any undesired or unexpected health effect reported by a worker shall be transmitted to the person in charge of the medical surveillance who will take appropriate action in accordance with national law and practice.	
For exposure in the range from 100 kHz up to 300 GHz, and in any event where exposure above the exposure limit values is detected, a medical examination shall be made available to the worker(s) concerned in accordance with national law and practice. If health damage resulting from such exposure is detected, a reassessment of the risks shall be carried out by the employer in accordance with Article 4.	
2. ***The employer shall take appropriate measures to ensure that the doctor and/or the medical authority responsible for health surveillance have access to the results of the risk assessment referred to in Article 4.***	2. ***In accordance with national law and practice,*** the results of health surveillance shall be preserved in a suitable form so as to permit consultation at a later date, taking account of confidentiality requirements. Individual workers shall, at their request,

3. ***The*** results of health surveillance shall be preserved in a suitable form so as to permit consultation at a later date, taking account of confidentiality requirements. Individual workers shall, at their request, have access to their own personal health records.	have access to their own personal health records. ***In any event where exposure above the exposure limit values is detected, a medical examination shall be made available to the worker(s) concerned in accordance with national law and practice.***

Compromise P

Replacing amendments 14, 180, 181

Proposal for a directive
Article 10

Text proposed by the Commission	*Amendment*
The Commission shall be empowered to adopt delegated acts in accordance with Article 11 in order to make amendments to the Annexes of a purely technical nature so as to:	The Commission shall be empowered to adopt delegated acts in accordance with Article 11 in order to make amendments to the Annexes ***II and III*** of a purely technical nature so as to:
(a) take into account the adoption of Directives in the field of technical harmonisation and standardisation with regard to the design, building, manufacture or construction of work equipment or workplaces;	(a) take into account the adoption of Directives in the field of technical harmonisation and standardisation with regard to the design, building, manufacture or construction of work equipment or workplaces;
(b) take into account the technical progress, changes in the most relevant ***harmonised European*** standards or specifications, and new scientific findings concerning electromagnetic fields;	(b) take into account the technical progress, changes in the most relevant standards or specifications, and new scientific findings concerning electromagnetic fields;
(c) make adjustments to the ***orientation and*** action ***values*** provided that compliance with the existing exposure limit values ***is maintained, and of the related lists of activities, workplaces and types of equipments*** mentioned in Annexes	(c) make adjustments to the action ***levels*** provided that compliance with the existing exposure limit values mentioned in Annex II and III is maintained ***and where there is new scientific evidence.***
	Where, in the case of purely technical

II and III.

Where, in the case of purely technical amendments of the Annexes referred to in the first subparagraph, imperative grounds of urgency so require, the procedure provided for in Article 12 shall apply to delegated acts adopted pursuant to this Article.

amendments of the Annexes referred to in the first subparagraph, imperative grounds of urgency so require, the procedure provided for in Article 12 shall apply to delegated acts adopted pursuant to this Article.

Compromise Q

Replacing amendments 17, 182

Proposal for a directive
Article 13

Text proposed by the Commission	*Amendment*
In order to facilitate implementation of this Directive, in particular ***the conduct of the risk assessment, the Commission shall draw up practical guides to the provisions of Articles 4 and 5 and Annexes II to IV.*** The Commission shall work in close cooperation with the Advisory Committee for Safety and Health at Work.	The Commission shall draw up practical guides before (*date...)* in order to facilitate the implementation of this Directive ***and medical examination***, in particular on the following issues: ***a) determination of exposure taking into account appropriate European or international standards, including:*** ***· calculation methods for limit value exposure assessment,*** ***· spatial averaging of external electric and magnetic fields,*** ***· guidance for dealing with measurements and calculations uncertainties;*** ***b) guidance on demonstrating compliance in special types of non-uniform exposure in specific situations, based on well established dosimetry;*** ***c) description of the "weighted peak method" for the low frequency fields and***

	of the "multifrequency fields summation" for high frequency fields;
	d) conduct of the risk assessment and, wherever possible, provision of simplified techniques, considering in particular the needs of SMEs;
	e) measures aimed at avoiding or reducing risks, including specific prevention measures depending on the level of exposure and the workplace characteristics;
	f) establishment of documented working procedures as well as specific information and training measures for workers exposed to EMF during MRI related activities falling under Article 10 (2);
	g) evaluation for exposure in the range of 100 kHz and 10 MHz where both thermal and nonthermal effects have to be considered.
	The Commission shall work in close cooperation with the Advisory Committee for Safety and Health at Work.
	These practical guides shall be adopted in accordance with the procedure laid down in Article 11.

Compromise R

Replacing amendments 18, 183, 184

Proposal for a directive
Article 14

Text proposed by the Commission	*Amendment*
The report to be established in accordance to Article 17(a) of Directive 89/391/EEC shall notably report on the effectiveness of the Directive in reducing exposure to	***Without prejudice to the*** report to be established in accordance to Article 17(a) of Directive 89/391/EEC***, the Commission shall establish a specific report within***

electromagnetic fields and the percentage of workplaces that required corrective action.

eight years form ... (the date of entry into force of this Directive). ***This specific report*** shall notably report on the effectiveness of the Directive in reducing exposure to electromagnetic fields and the percentage of workplaces that required corrective action.

Compromise S

Replacing amendments 186, 187, 188, 189

Proposal for a directive
Annex I

Text proposed by the Commission	*Amendment*
The following physical quantities are used to describe the exposure to electromagnetic fields:	The following physical quantities are used to describe the exposure to electromagnetic fields:
Contact current ***(I_C) between a person and an object is*** expressed in ampere***s*** (A). A steady state contact current occurs when a person is in contact with a conductive object in an ***electric*** field. In the process of making such a contact, a spark discharge may occur with associated transient currents.	*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 meter (V/m). ***It has to be distinguished between the environmental electric field E and the electric field present in the body Ei(in situ) as a result of exposure to environmental one.***
Electric field strength is a vector quantity ***(E)*** that corresponds to the force exerted on a charged particle regardless of its motion in space. It is expressed in volts per metre (V/m).	***Limb current (IL) is a current in 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 exposed body. It is expressed in ampere (A).***
Magnetic field strength is a vector quantity ***(H)*** that, together with the magnetic flux density, specifies a magnetic field at any point in space. It is expressed in amperes per metre (A/m).	*Contact current* (***IC) is a current that appears when a person gets in contact with an object in an electromagnetic field***. It is expressed in ampere (A). A steady
Magnetic flux density is a vector quantity ***(B)*** resulting in a force that acts on moving	

charges, expressed in teslas (T). In free space and in biological materials, magnetic flux density and magnetic field strength can be interchanged using the equivalence 1 A/m = $4\pi\ 10^{-7}$ T.

Power density (S) is the 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, and is expressed in watts per square metre (W/m^2).

Specific energy absorption (SA) is the energy absorbed per unit mass of biological tissue, expressed in joules per kilogram (J/kg). In this Directive, it is used for establishing limits for ***non-thermal*** 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 watts per kilogram (W/kg). 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 are: a ***grounded*** individual exposed to RF in the low MHz range and individuals exposed in the near field of an antenna.

Of these quantities, magnetic flux density, contact current, electric and magnetic field strengths and power density can be measured directly.

state contact current occurs when a person is in a ***continuous*** contact with an object in an ***electromagnetic*** field. In the process of making such a contact, a spark discharge may occur with associated transient currents.

Electric charge (Q) is an appropriate quantity used for sparks 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 meter (A/m).

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 = 1A/m equivalence to magnetic flux density of B= 4π 10–7 T (it means app. 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 meter (W/m2).

Specific energy absorption (SA) is an energy absorbed per unit mass of biological tissue, expressed in joule per kilogram (J/kg). In this 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 a rate, at which energy is absorbed per unit mass of body tissue. It is expressed in watt per kilogram (W/kg). 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 are: an individual exposed to RF in the low MHz range ***(eg. from dielectric heaters)*** and individuals exposed in the near field of an antenna. Of these quantities, magnetic flux density ***(B),*** contact current ***(IC), limb current (IL), electric field strength (E), magnetic field strength (H)*** and power density ***(S)*** can be measured directly.

Compromise T

Replacing amendments 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226

Proposal for a directive
Annex II

Text proposed by the Commission	*Amendment*
Exposure ***to electromagnetic fields in the frequency range from 0 Hz to 100 kHz***	Annex II - ***NON-THERMAL EFFECTS*** EXPOSURE ***LIMIT VALUES AND ACTION LEVELS IN THE FREQUENCY RANGE FROM 0 HZ TO 10 MHZ***
A. EXPOSURE ***LIMITATION SYSTEM***	A. EXPOSURE ***LIMIT VALUES (ELV)***
The main principles underlying the	***Exposure limit values below 1 Hz (Table***

protection system adopted for the range of frequencies up to 100 kHz (100 thousand cycles per second) are as follows:
- taking due account of the latest international recommendations published by the specialised organisations recognised worldwide
- introducing appropriate and 'limited to purpose' simplifications in order to facilitate the understanding and 'in field' implementation of the protection system
- introducing in practice a 'zoning system' in which each activity can be classified, whereby the location of an activity in a determined zone has a direct impact on the extent of the risk assessment to be carried out by the employer and on the recommended preventive measures
- limiting the number of cases where compliance with the actual exposure limits must be ensured because the measured exposure level is higher than the upper limit of the highest permitted zone (action level).

A1) are limits for static magnetic field which is not affected by the tissue of the body.
Exposure limits values for frequencies from 1 Hz up to 10 MHz (Table A2) are limits for electric fields induced in the body from exposure to time varying electric and magnetic fields.

Exposure limit values (ELV) for external magnetic flux density up 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 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.

Table A1 Exposure limit values for external magnetic flux density (B_0) from 0 to 1 Hz

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Note A1-1:

Health effects ELV for internal electric field strength from 1 Hz to 10 MHz
Health effects ELV (Table A2) are related to electric stimulation of all peripheral and central nervous system tissues in the body, including head.

Table A2 Health effects ELV for internal electric field strength from 1 Hz to 10

[1] OJ L 199, 30.7.1999, p. 59.
[2] OJ L 348, 28.11.1992, p. 1.

MHz

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

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

Note A2-3: The exposure limit values are peak values in time which are equal to the Root-Mean-Square (RMS) values multiplied by square root of 2 for sinusoidal fields. In the case of nonsinusoidal fields, exposure evaluation carried out in accordance with Article 4shall be based on the weighted peak method (filtering in time domain), explained in the practical guide set out 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.

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

The sensory effects ELV (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.

Table A3. Sensory effects ELV for internal electric field strength from 1 Hz to 400 Hz

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Note A3-1: f is the frequency expressed in

	hertz (Hz).
	Note A3-2: The sensory effects ELV for internal electric field are spatial peak values in the head of the exposed subject.
	Note A3-3: The exposure limit values are peak values in time which are equal to the Root-Mean-Square (RMS) values multiplied by square root of 2 for sinusoidal fields. In the case of nonsinusoidal 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 guide set out 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. EXPOSURE LEVELS AND EXPOSURE LIMITS	***B. ACTION LEVELS (AL)***
In line with the most recent recommendations the following options have been taken:	***The following physical quantities and values are used to specify the Action Levels (AL), the magnitude of which are established to ensure by simplified assessment the compliance with relevant exposure limit values or at which relevant protection or prevention measures specified in Article 5 of this Directive must be taken:***
- Actions values and Orientation values correspond to estimated or measured field values at the workplace in absence of the worker.	***- Low AL(E) and high AL(E) for electric field strength E of time varying electric fields as specified in Table B1;***
- Exposure limit values for health effects and exposure limit values for safety effects are expressed as electric fields generated in nervous tissue in the body (in V/m)	***- Low AL(B) and high AL(B) for magnetic flux density B of time varying magnetic fields as specified in Table B2;***
- For a worker at particular risk, as defined in Article 4 (5c), an individual assessment must be made in accordance with Annex II point E.	***- AL(IC) for contact current as specified in Table B3;***
Note 1: any situation where the measured value is higher than the action value, a thorough verification must be made according to Article 4(2).	
Note 2: for any situation where the shape	

of the signal differs sufficiently from a sinusoid to affect the outcome, then peak values should be used as follows. For exposure limit values the peak value should be compared with the peak value of the induced electric field obtained by multiplying the values of table 2.1 by 1.41. For magnetic and electric field levels outside the body, peak values of their rate of change with time should be compared with the values of table 2.2 or 2.3 multiplied by 8.9f (which is √2 2πf).

For complex pulsed signals a thorough verification must be made according to Article 3(3).

Table 2.1 Exposure Limit Values (expressed in RMS values)

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f is the frequency expressed in Hertz (Hz)
The exposure limit value for safety effects is derived from the effect threshold for effects on the central nervous system in the head (CNS).
The exposure limit value for health effects is derived from the effect threshold for effects on the peripheral nervous system (PNS) and it also prevents stimulation of nerve fibres in the central nervous system.
Exposure limit values for static magnetic fields are given in table 2.3

Table 2.2 Orientation and action values for exposure to an electric field (RMS values)

- AL(B0) for magnetic flux density of static magnetic fields as specified in Table B4.

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

Action Levels (AL) for exposure to electric fields

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

Below high AL, the internal electric field does not exceed the exposure limit values (Tables A2 and A3) and annoying spark discharges are prevented, provided that the protection measures in 5(3a) are adopted.

Table B1. Action Levels for exposure to electric fields from 1 Hz to 10MHz

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

Note B1-2: The low AL (E) and high AL (E) are the Root-Mean-Square (RMS) values of the electric field strength which are equal to the peak values divided by √2 for a sinusoidal field. In the case of a non-sinusoidal field, 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 guide as set out in Article 14, but other

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Note 1: The action value for electric fields for the frequency range 1-90 Hz is limited to 20 kV/m to limit the risk of indirect effects which are spark discharges which may occur when a worker comes into contact with a conducting object at a different electrical potential. Where the risk of spark discharges is managed using technical means and the training of workers, exposures in excess of action values can be accepted provided that the exposure limit values are not exceeded, in accordance with Article 4(2).

Table 2.3 Orientation and action values for exposure to a magnetic field (RMS)

Note 1: Values for 0 Hz in this table are exposure limit values. Above 8 T Article 3(6) shall apply.
Note 2: The action value above 9 kHz and the orientation value above 20 kHz result from the exposure limit values for whole-body average SAR as defined in Annex III.
In addition to the values given in Tables 2.1, 2.2 and 2.3, steady-state contact currents resulting from a worker being in contact with conductive objects shall be limited to.
From 0 Hz up to 2.5 kHz: 1.0 mA;
From 2.5 kHz up to 100 kHz: 0.4 10^{-3}f mA (frequency, f in Hz).

C. CATEGORIES OF WORK EQUIPMENT OR ACTIVITIES
1) The following work equipment or activities are, in normal conditions, considered to expose the worker under the orientation value.

scientifically proven and validated exposure evaluation procedures can be applied, provided that they lead to approximately equivalent and comparable results.

Note B1-3: AL represent maximum calculated or measured values at workers body position. This results in a conservative exposure assessment and automatic compliance with ELV in all nonuniform exposure conditions. In order to simplify the assessment of compliance with ELV, carried out in accordance with Article 4, in specific non-uniform conditions, criteria of spatial averaging of measured fields based on established dosimetry will be laid down in the practical guide referred to in Article 14. In the case of a very localized source with a distance of a few centimetres from the body, the induced electric field shall be determined dosimetrically, case by case.

Action Levels (AL) for exposure to magnetic fields Low AL (Table B2) are for frequencies below 400 Hz derived from the sensory effects ELV (Table A3) and action levels above 400 Hz from the health effects ELV for internal electric field (Table A2).

High AL (Table B2) are derived from the health effects ELV for internal electric field related to electric stimulation of peripheral and autonomous nerve tissues in head and trunk (Table A2).

Compliance with the high AL ensures that health effects ELV 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 AL for exposures up to 400 Hz. In such a case, Article 5(6) applies.

AL for exposure of limbs are derived from the health effects ELV for internal

- *Activities using equipment complying with Directives 1999/5/EC and 2006/95/EC when used as intended and notably:*
  - *household and similar electrical appliances (incl. mobile equipment fitted with heating elements; battery chargers; heaters; vacuum cleaners for dirt and water; cookers, ovens and cooking elements for industrial and commercial use; heating elements for waterbeds; microwave ovens for industrial and commercial use)*
  - *offices (incl. computer equipment, cable networks, radio communication equipment; exc. tape erasers)*
  - *operation of electrical installations:*
    - *low voltage network < 1000 V*
    - *low voltage components with power less than 200 kVA*
    - *workplaces at min. 60 cm distance from low voltage components with power not exceeding 1000 kVA*
    - *power transformers connected to low voltage networks (<1000 V between phases) with power up to 200 kVA*
    - *workplaces at min. 60 cm from power transformers*

electric field related to electric stimulation of the tissues in limbs by taking into account that magnetic field is coupled weaker to the limbs than to the whole body.

Table B2. Action Levels for exposure to magnetic fields from 1 Hz to 10 MHz

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

Note B2-2: The low AL and the high AL are the Root-Mean-Square (RMS) values which are equal to the peak values divided by √2 for sinusoidal field. In case of non-sinusoidal field 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 Commissions practical guide as set out 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 B2-3: AL for exposure to magnetic fields represent maximum values at workers body position. This results in a conservative exposure assessment and automatic compliance with ELV in all non-uniform exposure conditions. In order to simplify the assessment of compliance with ELV, carried out in accordance with Article 4, in specific non-uniform conditions, criteria of spatial averaging of measured fields based on established dosimetry will be laid down in the practical guide referred to in Article 14. In the case of a very localized source with a distance of a few centimetres from the body, the induced electric field shall be determined dosimetrically, case by

connected to low voltage networks (< 1000 V between phases) with power not higher than 1000 kVA

- *electric motors and electric pumps, subject to*
  - *the power being lower than 200 kVA*
  - *the workplace being at least 60 cm distance and the power not exceeding 1000 kVA*
- *detection of articles and people*
  - *RFID 1 Hz - 100 kHz*
- *tape erasers (if instructions of manufacturer available and followed).*
- *induction heating*
  - *automated systems (if instructions of manufacturer available and followed)*
- *detection of articles and people*
  - *EAS 0.01 - 20 kHz (magnetic)*
  - *EAS 20 - 100 kHz (resonant inductive)*
  - *metal detectors*
- *induction hobs in hotel & catering industry (food preparation)*

- *hand-held motor-operated electric tools*
- *transportable motor operated electric tools (incl. electrically*

case.

Table B3. Action Levels for contact current IC

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Note B3-1: f is the frequency in kHz. Action Levels (AL) for magnetic flux density of static magnetic fields

Table B4. Action Levels for magnetic flux density of static magnetic fields

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operated garden appliances)

- *testing instruments (exc. non-destructive magnetic testing)*
- *installation and maintenance*
  - *electrical hand-held tools (exc. welding equipment)*
- *electricity production and distribution*
  - *bus bars/conductor rails in substations*
  - *above ground high voltage cables*
  - *electricity substations*
  - *switch gear*
- *welding*
  - *automated systems (if instructions of manufacturer available and followed)*
  - *arc welding – cable (if instructions of manufacturer available and followed)*
- *medical applications*
  - *shallow hyperthermia (if instructions of manufacturer available and followed)*
  - *pain control, stimulation of bone growth etc.*
  - *incubators, lamps for phototherapy, wireless communication systems etc.*
  - *deep hyperthermia (if instructions of manufacturer available and followed)*
  - *electrosurgery (if instructions of manufacturer available and*

followed)

- *transport and traction systems*
  - *rail transport powered by direct current*
  - *vehicles, ships, aircraft*
  - *(large) electric motors*
- *transport and haulage systems*
  - *rail transport powered by alternating current (50 Hz)*
- *electricity production and distribution*
- *electrochemical processes (except specific places)*

2) The following activities may expose the worker above the orientation value but in normal conditions are considered to expose them under the action value.

– *plastic sealers*

– *induction heating*

– *wood gluing equipment*

– *power stations*

– *air cooled coils in capacitor banks*

– *current supply systems (bus bars)*

– *electrolysis hall (parts of)*

– *larger furnaces*

– *arc welding – cable*

– *use of - 'open magnetron'*

– *non-destructive magnetic testing*

3) The following activities may exceed the action value and require special assessment to ensure that the exposure limit values for health effects are not exceeded:

- *trouble shooting during installation and maintenance*
- *proximity of rectifiers in electrochemical processes*

- ***non-automated induction heating (small melting furnaces)***
- ***semi-automated spot and induction welding***
- ***research activities.***

D. PREVENTION MEASURES and other conditions
1) For persons at particular risk referred to in Article 4(5)(c), individual assessments must be made in accordance to point E.
2) Zone of exposures under the orientation value:
- Signage as appropriate
3) Zone of exposures above the orientation value but under the action value
- Signage as appropriate
- Delimitation measures (e.g. floor markings, fences) in order to limit or control access, as appropriate
- Information and specific training of relevant workers
- Verification of compliance with exposure limit values for safety effects or alternatively procedures to ensure adverse safety effects are managed.
4) Exposures above the action value:

- Signage as appropriate
- Delimitation measures (e.g. floor markings, fences) in order to limit or control access, as appropriate
- Verification of compliance with

exposure limit values for health effects.

- Procedure to manage spark discharges through technical means and the training of workers. (Applies only where electric field exposures are in this zone.)
- Appropriate delimitation and access measures
- Information and specific training of relevant workers.
E. PERSONS AT PARTICULAR RISK
Workers having declared themselves as wearing an Active Implantable Medical

Device (AIMD) and women having declared themselves to be pregnant are considered to be persons at particular risk, as stated in Article 4(5)(c).
Where a worker has declared to their employer that he or she wears an AIMD the employer shall carry out an assessment to determine what restriction on where they can work is needed to avoid interference to their implanted device. Advice on how to do this is provided by CENELEC (see EN 50527 and associate parts). It may be noted that principle underlying the CENELEC guidance is that interference will not occur when the fields is below the Reference Levels given in Council Recommendation 1999/519/EC on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)[1].
Where a worker has declared to her employer that she is pregnant then the requirements of Council Directive 92/85/EEC on the introduction of measures to encourage improvements in the safety and health at work of pregnant workers and workers who have recently given birth or are breastfeeding[2] apply. The employer shall enable the worker to avoid having to enter areas where exposures exceeding the exposure limits for the general public given in Council Recommendation 1999/519/EC, or its subsequent revisions.

Compromise U

Replacing amendments 227, 228, 229, 230, 231, 232, 233

Proposal for a directive
Annex III

Text proposed by the Commission	*Amendment*
EXPOSURE TO ELECTROMAGNETIC FIELDS IN THE FREQUENCY RANGE FROM 100 KHZ TO 300 GHZ	***ANNEX III – THERMAL EFFECTS***
	EXPOSURE LIMIT VALUES AND ACTION LEVELS IN THE FREQUENCY RANGE FROM 100 KHZ TO 300 GHZ
A. EXPOSURE LIMITATION SYSTEM	***A. EXPOSURE LIMIT VALUES (ELV)***
Depending on the frequency of the field or radiation to which the worker is exposed, the following physical quantities are used to specify the exposure limit values for electromagnetic fields:	***Health effects ELV for frequencies from 100 kHz up 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 (EMF).***
– between 100 kHz and 10 MHz exposure limit values are provided both on SAR to prevent heat stress and on induced electric fields to prevent effects on central and peripheral nervous system functions;	***Sensory effects ELV (Table A2) for frequencies from 0.3 to 6 GHz are limits on absorbed energy in a small mass of tissue in the head from exposure to electromagnetic fields.***
– between 10 MHz and 10 GHz exposure limit values are provided on SAR to prevent whole-body heat stress and excessive localised heating of tissues;	***Health effects ELV for frequencies above 6 GHz (Table A3) are limits for power density of an electromagnetic wave incident on the body surface.***
– between 10 GHz and 300 GHz an exposure limit value on power density is provided to prevent excessive tissue heating at or near the body surface;	***<u>Health effects ELV for frequencies from 100 kHz up to 6 GHz</u>***
- in the frequency range of this annex, 100 kHz to 300 GHz, only exposure limit values for health effects need to be considered and consequently	***<u>Table A1 Health effects ELV for exposure to electromagnetic fields from 100 kHz to 6 GHz</u>***
B. EXPOSURE LEVELS AND EXPOSURE LIMITS	***–***
Table 3.1 Action values and exposure limit values for exposure to high frequency electric field (RMS values)	***–***
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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 ELV from 0.3 GHz to 6 GHz

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

Table A2 Sensory effects limit ELV for exposure to electromagnetic fields from 0.3 to 6 GHz

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

Table A3 Health effects ELV for exposure to electromagnetic fields from 6 GHz to 300 GHz

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Note A3-1: The power density shall be averaged over any 20 cm2 of exposed area. Spatial maximum power densities averaged over 1 cm2 should not exceed 20 times the value of 50 W/m2.
Power densities from 6 to 10 GHz are to be averaged over any six-minutes 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 (AL)

The following physical quantities and values are used to specify the Action Levels (AL), the magnitude of which are established to ensure by simplified assessment the compliance with the relevant exposure limit values or at which relevant protection or prevention measures specified in Article 5 of this Directive must be taken:

- AL(E) for electric field strength E of time varying electric field as specified in Table B1;

- AL(B) for magnetic flux density B of time varying magnetic field as specified in Table B1;

- AL(S) for power density of electromagnetic waves as specified in Table B1;
- AL(Ic) for contact current as specified in Table B2;
- AL(IL) for limb current as specified in Table B2;
Action Levels 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.

<u>Action Levels (AL) for exposure to electric and magnetic fields</u>

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

<u>Table B1. Action Levels for exposure to electric and magnetic fields for exposure to electromagnetic fields from 100 kHz to 300 GHz.</u>
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Note B1-1: f is the frequency expressed in hertz (Hz).

Note B1-2: [AL(E)]2 and [AL(B)]2 are to be averaged over 6 min period. For RF pulses, the peak power density averaged over the pulse width shall not exceed 1000 times the respective AL(S) value. For multi-frequency fields the analysis shall be based on summation, as explained in the practical guide set out in Article 14.
Note B1-3: AL(E) and AL(B) represent maximum calculated or measured values at workers body position. This results in a conservative exposure assessment and automatic compliance with ELV in all non-uniform exposure conditions. In order to simplify the assessment of compliance with ELV, carried out in accordance with Article 4, in specific non-uniform conditions, criteria of spatial averaging of measured fields based on established dosimetry will be laid down in the practical guide referred to in Article 14. In the case of a very localized source with a distance of a few centimetres from the body, the induced electric field shall be determined dosimetrically, case by case.

Note B1-4: The power density shall be averaged over any 20 cm2 of exposed area. Spatial maximum power densities averaged over 1 cm2 should not exceed 20 times the value of 50 W/m2.
Power densities from 6 to 10 GHz are to be averaged over any six-minutes 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. Action Levels for steady state time varying contact currents and induced

limb currents

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Note B2-1: [AL(IL)] is to be averaged over 6 min period.