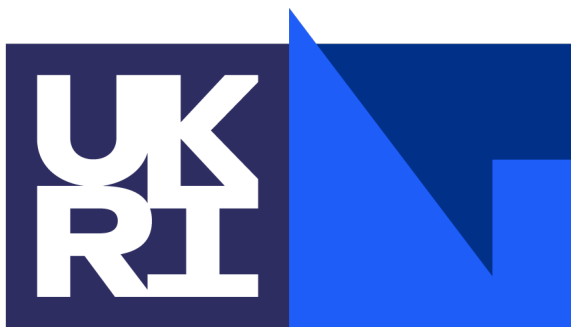




**Science and
Technology
Facilities Council**

Working with time-varying Electro-Magnetic Fields (EMF)

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Revisions

1	Initial release	February 2009
1.1	Update to action values	May 2011
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Working with time-varying Electro-Magnetic Fields (EMF)

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Working with time-varying Electro-Magnetic Fields (EMF)

1. PURPOSE

The purpose of this code is to ensure that hazards associated with strong and time-varying electromagnetic fields (EMFs) up to a frequency of 300 GHz are managed so as to minimise so far as is reasonably practicable the health and safety risks to staff and others. The code covers work with equipment operating at frequencies from 1 Hz to 300 GHz, which encompasses both power frequencies (and harmonics) and radiofrequencies (RF) (including microwaves).

Devices generating EMFs are widely used at the STFC laboratories. Typical applications can be found in the radio frequency systems of particle accelerators, radars, imaging systems and radio transmission systems. More general applications are found in high current power distribution systems, high output power supplies (particularly switched mode power supplies), uninterruptible power supplies (UPS), motors, microwave ovens and communication devices. It has been recognised that electromagnetic fields and radiations from these devices may, under certain conditions, give rise to health hazards. Since there are no established long-term risks, medical examination is unlikely to identify clinical findings from exposure and there is no benefit to routine health surveillance. The known adverse effects of exposure are briefly summarised in Appendix 1.

This document is an interpretation of relevant laws and standards and cannot cover all conceivable situations.

2. SCOPE

This code establishes requirements for controlling the exposure of STFC staff, visitors, facility users, tenants, contractors and the public to strong EMFs at all STFC sites.

This code is intended to cover operation of equipment capable of generating strong EMFs for example, high output switched mode power supplies or high-power RF systems driving particle accelerators and radar sets.

Any electrically-powered equipment will generate EMFs, but in most cases the fields will be very weak and will not give risk to significant risks. Hence this code does not require action to be taken in respect of equipment that is only capable of generating weak fields.

Examples include:

- communications equipment and networks, wired;
- Computer and IT equipment;
- Office equipment (e.g. photocopiers, paper shredders, electrically-operated staplers);
- Lighting equipment (e.g. area lighting and desk lamps);
- Domestic microwave ovens used for heating food;
-

Some common equipment can theoretically interfere with the function of active medical devices (e.g. cardiac pacemakers and defibrillators), but if used sensibly will not present an unacceptable risk to those reliant on these devices. Examples include:

- Mobile phones

- Cordless phones
- Standard WiFi/wireless internet systems

Although EMF generated by electrical supply/distribution networks fall within scope of relevant legislation, there is no need to implement additional access restrictions in respect of EMF if access is already adequately restricted due to high voltage.

The hazards associated with strong static magnetic fields are addressed by SHE code 39: 'Working with static magnetic fields'.

3. LEGISLATION

The STFC is required to comply with the Control of Electromagnetic Fields at Work Regulations 2016.

3.1 Exposure assessment

Like all employers, STFC has a duty under the regulations to carry out exposure assessments and record the results. It may not be necessary to measure or calculate exposure and the first approach should always be to consult the table in Appendix 3. It may be assumed that any equipment, workplace or activity with a 'no' in all three columns of the table in Appendix 3 requires no further assessment.

In contrast, any equipment with a 'yes' in the first column should be subject to a specific assessment to determine if exposures comply with the **exposure limit values** specified in the regulations (see below).

An action plan is required if the exposure assessment does not demonstrate that exposures are below the exposure limit values. This must include some or all of the items in the first part of Appendix 5.

3.2 Exposure limits

Exposure limit values are specified for frequencies from 1 Hz to 300 GHz and are intended to protect employees from the adverse effects of exposure. It is a legal requirement to comply with the exposure limit values, subject to certain specific exceptions. Further details of exposure limit values are given in Appendix 2

As exposure limit values are generally set in terms of internal body quantities that cannot be easily measured, the regulations also provide **action levels** set in terms of external field quantities. These are not limits, but may be used as a guide to compliance with limits. In addition, there are action levels that are intended to prevent or limit the consequences of specified indirect adverse effects. See Appendix 2 for further details of action levels.

3.3 Risk assessment

There is a legal requirement to carry out an EMF-specific risk assessment if any of the following apply:

- it cannot be demonstrated that the exposure limit values will not be exceeded
- it cannot be demonstrated that the indirect effects action levels are not exceeded
- there are 'employees at particular risk' in the workplace

An EMF-specific risk assessment must address the matters listed in Appendix 4.

Any risks identified in the EMF-specific risk assessment must be either completely eliminated or reduced to a minimum.

Anyone who may be exposed to risks identified in the EMF-specific risk assessment must be provided with information and training (see second part of Appendix 6).

3.4 Employees at particular risk

Some people are at increased risk from exposure to electromagnetic fields and may not be adequately protected by the exposure limit values and action levels. In the regulations, these people are called 'employees at particular risk' (see Section 4) and there is a specific requirement to consider them in the EMF-specific risk assessment. In general, it may be assumed that if exposures do not exceed the reference levels specified in Council Recommendation 1999/519/EC, then there will be no increased risk and no further action is necessary.

As a guide, the second and third columns in Appendix 3 indicate for some common equipment and activities whether further specific assessment is required.

3.5 Medical examination

If a member of staff is exposed above any health effects exposure limit value and reports experiencing a health effect as a result of the exposure, then they must be provided with a medical examination. A record of the examination must be retained.

4. DEFINITIONS

4.1 Exposure limit values

These are legal limits on exposure to electric, magnetic and electromagnetic fields and radiations. There are two types of exposure limit values:

- health effects exposure limit values are intended to prevent direct adverse health effects of exposure
- sensory effects exposure limit values are intended to prevent perception of the field

Further details are given in Appendix 2.

Exposure limit values are generally set in terms of internal body quantities and cannot be easily assessed.

4.2 Action levels

As compliance with exposure limit values cannot be easily assessed by direct measurement, the regulations provide action levels as a guide to compliance. These are specified in terms of external field quantities that can be directly assessed by measurement or calculation. Provided the action levels are not exceeded it can be assumed that exposures are compliant with the exposure limit values.

Further details are given in Appendix 2.

4.3 Reference levels

Reference levels are similar in principle to action levels, but are defined in Council Recommendation 1999/519/EC and are used as a framework to limit public exposures. Although similar to action levels they are generally simpler to apply.

In addition to being useful for limiting public exposures, reference levels are also helpful for assessing exposures of 'employees at particular risk', who may not be adequately protected by the action levels.

Further details are given in Appendix 2.

4.4 Employees at particular risk

Legally an employee at particular risk is anyone who declares to their employer a condition that may lead to a higher susceptibility to the potential effects of exposure, or any employee who works in close proximity to electro-explosive devices, explosive materials, or flammable atmospheres.

In practice, four groups are recognised as having a higher susceptibility to the potential effects of exposure:

- those reliant on active implanted medical devices
- those reliant on body-worn medical devices
- those with passive implanted medical devices
- pregnant women

5. RESPONSIBILITIES

5.1 Directors responsible for activities employing strong EMF sources shall:

- 5.1.1 Appoint in writing one or more suitably qualified and experienced EMF Protection Advisers (EPAs) for those areas employing EMF generating equipment or devices (see Appendix 6 for EPA training requirements). The appointment should be recorded in SHE Directory where the geographic/equipment scope of the appointment should be defined. It would be normal for the technical manager responsible for the day-to-day operation of the equipment to be appointed the EPA.

5.2 EMF Protection Advisers (EPAs) shall:

- 5.2.1 Provide advice to management on the need to undertake specific exposure assessments on equipment or activities within their areas of responsibility.
- 5.2.2 Provide advice to management responsible for strong EMF sources on technical modifications, changes to work practices or engineering controls that could eliminate EMF hazards or minimise their impact so far as reasonably practicable, including the use of appropriate signage for all areas where field strengths are above **reference or action levels**.
- 5.2.3 Where exposure or risk assessments identify potential for hazardous exposures, regularly survey the electric and/or magnetic field strength of equipment generating strong EMFs that could affect staff and others within their scope of responsibility and ensure that risk controls are appropriate and effective. Specific consideration should be

given to undertaking EMF measurements following any changes that could reasonably be expected to affect the emission characteristics of equipment, for example following maintenance/servicing or after modification. Surveys should be documented and identify all areas above the reference and action levels. It is recognised that monitoring equipment capable of magnetic field strength measurements at frequencies >1 GHz are not available. However, at higher frequencies it is normally possible to infer the magnetic field strength from the electric field strength.

- 5.2.4 Ensure that only monitoring equipment calibrated to recognised standards is used to measure strong EMFs and to determine compliance with the reference and action levels reproduced in Appendix 2.

5.3 Managers responsible for strong EMF radiation sources shall:

- 5.3.1 Ensure that exposure assessments are carried out for equipment and activities under their control
- 5.3.2 Ensure that no equipment capable of generating strong EMF fields and radiation is brought on to STFC sites without the approval of the relevant EPA, including equipment borrowed or provided by others, so that managers can ensure that suitable precautions are taken before the equipment is used.
- 5.3.3 Where equipment generating strong EMF radiation is designed and manufactured in house, ensure that the **reference and action levels** are considered and that the appropriate EPA is consulted before the equipment is brought into use.
- 5.3.4 Ensure that the advice of an EPA is sought and that documented EMF-specific risk assessments (see Appendix 4) are conducted for all work through which persons may be exposed to EMFs above '**Action Levels**' (see [SHE Code 6: Risk Management](#)) and that suitable controls are established to minimise exposure. These controls should include undertaking a suitable and documented EMF survey.
- 5.3.5 Where equipment generates EMFs above the **Action levels** (see Appendix 2) in places to which personnel have access, ensure that exposure is minimised through suitable engineering controls, work practices and local operating instructions, and that suitable warning signage is in place.
- 5.3.6 Ensure that all persons working in areas or with equipment where strong EMF radiation can be generated, in particular EMFs above **Action levels**, are aware of the hazards and of the need to follow the advice of the local EPA and local control measures.
- 5.3.7 Where equipment generates EMFs above the **reference levels** (see Appendix 2) in places to which personnel have access, ensure that appropriate measures are in place to restrict access and provide warning to groups of employees considered to be at particular risk.
- 5.3.8 Ensure suitable warning signs are posted at entrances to areas or on equipment where fields in excess of the reference levels have been identified.
- 5.3.9 Where employees at particular risk have been identified in the workplace, ensure EMF-specific risk assessments are undertaken for all equipment and activities with potential for exposure in excess of the **reference levels** (see Appendix 2).
- 5.3.10 Advise any staff identified as being at particular risk to seek a consultation with STFC Occupational Health Teams.

- 5.3.11 Establish control measures to ensure that all staff, visitors, facility users, and contractors are adequately protected from risks to safety through indirect effects of strong EMFs (see Appendix 5).
- 5.3.12 Ensure that all staff who may be exposed to risks identified in an EMF-specific risk assessment are provided with suitable information or training that includes the matters detailed in the second part of Appendix 6. This will include any staff working areas where field strengths may exceed any action level and any employees at particular risk working in areas where field strengths may exceed any reference level.
- 5.3.13 Ensure that all instances where staff or others are exposed to EMFs greater than the relevant **action levels** (see Appendix 2) are reported according to SHE Group ([SHE Code 5: Incident reporting and investigation](#)), and that any staff or others exposed to EMFs above the **action levels** and experiencing symptoms as a result are referred for professional medical assessment, for example the STFC Occupational Health teams.

5.4 STFC staff and tenants shall:

- 5.4.1 Comply with any local operating instructions relating to equipment which is capable of exposing staff and others to strong electromagnetic fields.
- 5.4.2 When responsible for visitors, facility users or contractors, ensure that the visitors/users/contractors comply with relevant local operating instructions and that the visitors/users/contractors make STFC staff aware of any devices/equipment they bring on to STFC sites capable of exposing personnel to strong electromagnetic fields.
- 5.4.3 When responsible for visitors, contractors or facility users in an area where strong EMFs are present, ensure that their attention is drawn to notices warning of access restrictions for those considered to be at particular risk.
- 5.4.4 Report all incidents relating to strong EMFs to SHE Group (see STFC SHE Code 5, Incident Reporting and Investigation).

5.5 SHE Group shall:

- 5.5.1 Maintain an STFC register of EPAs and their areas of responsibility.

5.6 Occupational Health advisers shall:

- 5.6.1 Undertake medical assessments of those who have been exposed to EMFs above the action levels and who have experienced symptoms as a result.
- 5.6.2 Provide advice for persons considered to be at particular risk, especially those reliant on active medical devices.

6. REFERENCES

- 6.1 This document should be read in conjunction with the following documents:

Control of Electromagnetic Fields at Work Regulations 2016. Statutory Instrument 2016 No. 588 (available to download free from <http://www.legislation.gov.uk>).

Non-binding guide to good practice for implementing Directive 2013/35/EU Electromagnetic Fields (available to download free from <https://publications.europa.eu>).

Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) 1999/519/EC. Official Journal of the European Communities L199/59 (available to download free from <https://publications.europa.eu>).

6.2 The following publications provide useful background information:

Review of the scientific evidence for limiting the exposure to electromagnetic fields (0-300GHz): Documents of the NRPB Volume 15 Number 3: 2004 (available from SHE Group).

ICNIRP Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz – 100 kHz). Health Phys., **99(6)**, 818-836 (2010) (Available to download free from <https://www.icnirp.org>).

ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). Health Phys., **74(4)**, 494-522 (1998) (Available to download free from <https://www.icnirp.org>). Note that the low frequency section of this document was superseded by the 2010 guidelines and that the high frequency section will shortly be superseded by new radiofrequency guidelines.

Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices. Part 1: General. BS EN 50527-1:2016.

Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices – Part 2-1: Specific assessment for workers with cardiac pacemakers. BS EN 50527-2-1:2016.

Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices – Part 2-2: Specific assessment for workers with cardioverter defibrillators (ICDs). BS EN 50527-2-2: 2018.

Appendices

APPENDIX 1. SUMMARY OF THE HEALTH EFFECTS AND SAFETY RISKS FROM ELECTROMAGNETIC FIELDS AND RADIATIONS

The type of effect that electromagnetic fields have in people depends primarily on the frequency and intensity: other factors such as the shape of the waveform may also be important in some situations. Some fields cause stimulation of sensory organs, nerves and muscle, while others cause heating. The effects caused by heating are termed thermal effects in the Control of EMF at Work Regulations 2016, while all other effects are termed non-thermal effects. Further details about health effects of exposure to electromagnetic fields can be found in Appendix B of the *Non-binding guide to good practice for implementing Directive 2013/35/EU Electromagnetic Fields*.

Importantly, all these effects show a threshold below which there is no risk, and exposures below the threshold are not cumulative in any way. The effects caused by exposure are transient being limited to the duration of exposure, and they will stop or decrease once exposure ceases. This means that there can be no further risk to health once exposure has ended.

Direct effects

Direct effects are changes that occur in a person as a result of being exposed to an electromagnetic field. The regulations only consider well-understood effects that are based on known mechanisms. They distinguish between sensory effects and health effects, which are considered to be more serious.

The direct effects are:

- effects on sense organs, nerves and muscles from low frequency fields (up to 100 kHz)
- heating of the whole body or parts of it from high frequency fields (10 MHz and above); above a few GHz heating is increasingly limited to the surface of the body
- effects on nerves, muscles and heating from intermediate frequencies (100 kHz – 10 MHz)

These concepts are illustrated in Figure 1.

Long-term effects

The regulations do not address suggested long-term effects of exposure to electromagnetic fields, since there is currently no well-established scientific evidence of a causal relationship.

Indirect effects

Undesirable effects may occur due to the presence of objects in the field resulting in a safety or health hazard. Contact with a live conductor is not within the scope of the regulations.

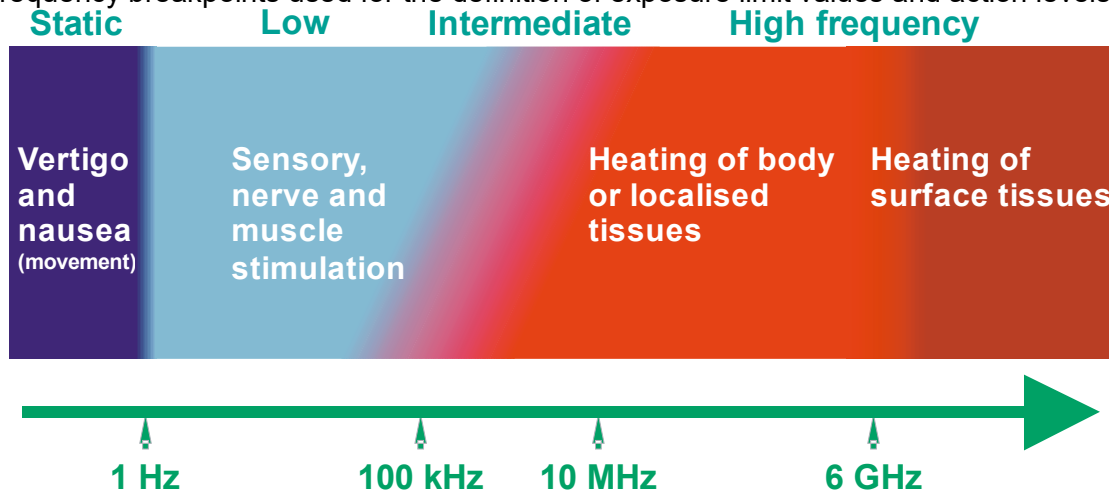
The indirect effects are:

- interference with medical electronic equipment and other devices
- interference with active implanted medical devices or equipment, such as cardiac pacemakers or defibrillators
- interference with medical devices worn on the body, such as insulin pumps
- inductive heating of passive metallic implants (artificial joints, pins, wires or plates)
- perturbation of induced internal electric fields caused by the presence of passive metallic implants
- inductive heating of shrapnel, body piercings, tattoos and body art

- unintentional initiation of detonators
- fires or explosions from ignition of flammable or explosive material
- electric shocks or burns from contact currents when a person touches a conductive object in an electromagnetic field and one of them is grounded whilst the other is not

Appendix E of the *Non-binding guide to good practice for implementing Directive 2013/35/EU Electromagnetic Fields* provides further information about indirect effects and how these risks may be managed in the workplace.

Figure 1 Schematic representation of principal direct effects of EMF showing the main frequency breakpoints used for the definition of exposure limit values and action levels



APPENDIX 2. SUMMARY OF EXPOSURE LIMIT VALUES, ACTION LEVELS AND REFERENCE LEVELS

Exposure limit values

The exposure limit values from the Schedule to the Control of Electromagnetic Fields at Work Regulations 2016 are given in tables 1 – 5. These are legal limits on exposure. However, exposure limit values are generally set in terms of quantities inside the body that are difficult to assess. Consequently, assessment will normally involve comparison of measured field strengths with the action levels reproduced later in this appendix.

Tables 1 and 2 are for non-thermal (low frequency) effects, whilst tables 3 – 5 are for thermal (high frequency) effects. For frequencies between 100 kHz and 10 MHz, it is necessary to assess compliance with the exposure limit values in **both** table 1 **and** table 3.

Throughout these tables, f is the frequency in Hz unless otherwise stated.

The exposure limit values given in table 1 are intended to prevent adverse health effects. Compliance with these limits is always mandatory.

Table 1 Health effects exposure limit values for non-thermal effects (1 Hz – 10 MHz)

Frequency range	Internal electric field strength (V/m)
1 Hz – 3 kHz	1.1
3 kHz – 10 MHz	$3.8 \times 10^{-4} f$

Notes

1. The ELVs are limits for electric fields induced in the body from exposure to time-varying external electric and external magnetic fields
2. The ELVs are spatial peak values in the entire body of an employee
3. The ELVs are peak values in time, which are equal to RMS values multiplied by $\sqrt{2}$ for sinusoidal fields. For non-sinusoidal fields the exposure assessment should be based on the weighted peak method in the time domain.

The exposure limit values given in table 2 are intended to prevent perception of the field. As this is annoying rather than hazardous, it is acceptable for exposures to temporarily exceed these values provided the conditions in the notes to the table are met.

Table 2 Sensory effects exposure limit values for non-thermal effects (1 Hz – 400 Hz)

Frequency range	Internal electric field strength (V/m)
1 Hz – 10 Hz	$0.7/f$
10 Hz – 25 Hz	0.07
25 Hz – 400 Hz	$0.0028 f$

Notes:

1. The ELVs are spatial peak values induced in the head of the exposed employee and can arise from exposure to either external electric or external magnetic fields
2. The ELVs may be exceeded during an employee's shift, providing the employer ensures that –
 - a. they are exceeded only temporarily
 - b. hazardous spark discharges and contact current in excess of those in table ?? are prevented through the provision of information and training and the use of suitable technical and personal protection measures
 - c. adequate information is provided to the employee on the possibility of sensory effects related to time-varying magnetic fields, including retinal phosphenes
 - d. where any of those sensory effects are reported to the employer, the risk assessment is updated where necessary
3. The ELVs are peak values in time, which are equal to RMS values multiplied by $\sqrt{2}$ for sinusoidal fields. The exposure assessment should be based on the weighted peak method in the time domain.

The exposure limit values given in table 3 are intended to prevent adverse health effects. Compliance with these limits is always mandatory.

Table 3 Health effects exposure limit values for thermal effects (100 kHz – 6 GHz)

Area of exposure	Specific energy absorption rate (W/kg)
Whole body	0.4 (averaged SAR in the body)
Head and trunk	10 (localised SAR in the head and trunk)
Limbs	20 (localised SAR in the limbs)

Notes:

1. The ELVs correspond to the SAR values averaged over any six minute period
2. Localised SAR in the body and limbs can be assessed by either computational dosimetry or physical measurement of 10 g of tissue. For computational dosimetry, 10 g of contiguous tissue with approximately homogeneous electrical properties must be used for the SAR average. For direct physical measurements a simple geometry, such as cubic or spherical tissue mass may be used. The maximum value obtained must be assessed against the ELVs

The exposure limit values given in table 4 are intended to prevent perception of the field. As this is annoying rather than hazardous, it is acceptable for exposures to temporarily exceed these values provided the conditions in the notes to the table are met.

Table 4 Sensory effects exposure limit values for thermal effects (300 MHz – 6 GHz)

Area of exposure	Specific energy absorption (mJ/kg)
Head	10

Notes:

1. Energy absorption must be averaged over 10 g of tissue
2. The ELV may be exceeded during an employee's shift provided the employer ensures that:
 - a. it is only exceeded temporarily
 - b. adequate information is provided to the employee on the possibility of sensory effects related to pulsed microwave radiation, including auditory sensations
 - c. where any of those sensory effects are reported to the employer, the risk assessment is updated where necessary

The exposure limit values given in table 5 are intended to prevent adverse health effects. Compliance with these limits is always mandatory.

Table 5 Health effects exposure limit values for thermal effects (6 GHz – 300 GHz)

Frequency range	Power density (W/m ²)
6 GHz – 300 GHz	50

Notes:

1. The power density is the maximum level averaged over any 20 cm² of exposed area. Spatial maximum power densities averaged over any 1 cm² must not exceed 1000 W/m².
2. From 6 GHz to 10 GHz, power density must be averaged over any six minute period. Above 10 GHz, it must be averaged over any $68/f^{1.05}$ minute period, where f is the frequency in GHz.

Action levels

The action levels from the schedule to the Control of Electromagnetic Fields at Work Regulations 2016 are given in tables 6 – 10. Action levels are **not** legal limits. Instead they are a guide either to compliance with the exposure limit values or to the avoidance of indirect effects.

Those related to the exposure limit values (tables 6 – 9) have been derived by dosimetric modelling that assumes worst case exposure conditions. Hence provided the action levels are not exceeded, compliance with the exposure limit values is assured. However, in many realistic exposure scenarios it would be possible to exceed the action levels and still comply with the exposure limit values. In general, it is simplest to work to the action levels. Nevertheless, if this is

difficult or impossible, it is always acceptable to assess compliance with the exposure limit values directly.

Tables 6 and 7 relate to non-thermal effects, whilst tables 8 and 9 relate to thermal effects. For frequencies between 100 kHz and 10 MHz it is necessary to consider compliance with **both** non-thermal **and** thermal action levels.

Unless otherwise stated, f is the frequency in Hz.

The low action levels in table 6 relate to the avoidance of spark discharges, which may be annoying. It follows that it is acceptable to temporarily exceed the low action levels provided measures have been taken to limit spark discharges (see the notes to the table). The high action levels may only be exceeded where it is possible to demonstrate compliance with the health effects exposure limit value.

Table 6 Action levels for electric fields (1 Hz – 10 MHz)

Frequency range	External electric field strength (V/m)	
	Low action level	High action level
1 Hz – 25 Hz	2.0×10^4	2.0×10^4
25 Hz – 50 Hz	$5.0 \times 10^5/f$	2.0×10^4
50 Hz – 1.64 kHz	$5.0 \times 10^5/f$	$1.0 \times 10^6/f$
1.64 kHz – 3 kHz	$5.0 \times 10^5/f$	6.1×10^2
3 kHz – 10 MHz	1.7×10^2	6.1×10^2

Notes:

1. Between the low and high action levels exposures will be compliant with the exposure limit values, but spark discharges may occur. These should be managed through suitable technical and personal protection measures and through the provision of information and training.
2. The action levels are given as root mean square (RMS) values, which are equivalent to peak values divided by $\sqrt{2}$ for sinusoidal fields. For non-sinusoidal fields exposure assessment should be based on the weighted peak method (filtering in the time domain).
3. Action levels are defined as body-absent values and this must be considered when carrying out measurements.
4. Action levels are not applicable to situations where the source is in the immediate vicinity of the exposed person. In this situation assessment of compliance with the exposure limit values is necessary.

The low action levels in table 7 relate to compliance with the non-thermal sensory effects exposure limit values, which may result in perception of the field that could be annoying or distracting. It follows that it is acceptable to temporarily exceed the low action levels provided the conditions in the notes to the relevant table are met. Low action levels are applicable to localised exposure of the head.

The high action levels and the limb action levels relate to compliance with the non-thermal health effects exposure limit values. The high action levels apply to whole body exposure, whilst the limb action levels apply in the case of localised exposure in the immediate vicinity of a limb. It is not acceptable to exceed either the high or limb action levels unless it is possible to demonstrate compliance with the health effects exposure limit value.

Table 7 Action levels for magnetic fields (1 Hz – 10 MHz)

Frequency range	External magnetic flux density (μT)		
	Low action level	High action level	Limb action level
1 Hz – 8 Hz	$2.0 \times 10^5/f^2$	$3.0 \times 10^5/f$	$9.0 \times 10^5/f$
8 Hz – 25 Hz	$2.5 \times 10^4/f$	$3.0 \times 10^5/f$	$9.0 \times 10^5/f$
25 Hz – 300 Hz	1.0×10^3	$3.0 \times 10^5/f$	$9.0 \times 10^5/f$
300 Hz – 3 kHz	$3.0 \times 10^5/f$	$3.0 \times 10^5/f$	$9.0 \times 10^5/f$
3 kHz – 10 MHz	1.0×10^2	1.0×10^2	3.0×10^2

Notes:

- Between the low and high action levels, for frequencies up to 400 Hz, exposure in the head may exceed the sensory effects exposure limit value, but will be compliant with the health effects exposure limit value
- The low action levels may be exceeded during an employee's shift, providing the employer ensures that –
 - they are exceeded only temporarily
 - adequate information is provided to the employee on the possibility of sensory effects related to time-varying magnetic fields, including retinal phosphenes
 - where any of those sensory effects are reported to the employer, the risk assessment is updated where necessary
- The action levels are given as root mean square (RMS) values, which are equivalent to peak values divided by $\sqrt{2}$ for sinusoidal fields. For non-sinusoidal fields exposure assessment should be based on the weighted peak method (filtering in the time domain).
- Action levels are defined as body-absent values and this must be considered when carrying out measurements (not normally an issue when carrying out measurements of low frequency magnetic fields).
- Action levels are not applicable to situations where the source is in the immediate vicinity of the exposed person. In this situation assessment of compliance with the exposure limit values is necessary.

The action levels in table 8 relate to compliance with the thermal health effects exposure limit values. They apply to whole body exposure. It is not acceptable to exceed the action levels unless it is possible to demonstrate compliance with the health effects exposure limit value.

Table 8 Action levels for exposure to electromagnetic fields (100 kHz – 300 GHz)

Frequency range	External electric field strength (V/m)	External magnetic flux density (μT)	Power density (W/m^2)
100 kHz – 1 MHz	6.1×10^2	$2.0 \times 10^6/f$	-
1 MHz – 10 MHz	$6.1 \times 10^8/f$	$2.0 \times 10^6/f$	-
10 MHz – 400 MHz	61	0.2	-
400 MHz – 2 GHz	$3.0 \times 10^{-3} f^{0.5}$	$1.0 \times 10^{-5} f^{0.5}$	-
2 GHz – 6 GHz	1.4×10^2	4.5×10^{-1}	-
6 GHz – 300 GHz	1.4×10^2	4.5×10^{-1}	50

Notes:

- Action levels for electric field strength and magnetic flux density are RMS values
- For pulsed sources the peak power density averaged over the pulse width must not exceed 50 kW/m^2 .
- Action levels are defined as body-absent values and this must be considered when carrying out measurements.
- Action levels are not applicable to situations where the source is in the immediate vicinity of the exposed person. In this situation assessment of compliance with the exposure limit values is necessary.
- The power density is the maximum level averaged over any 20 cm^2 of exposed area. Spatial maximum power densities averaged over any 1 cm^2 must not exceed 1000 W/m^2 .
- From 6 GHz to 10 GHz, power density must be averaged over any six minute period. Above 10 GHz, it must be averaged over any $68/f^{1.05}$ minute period, where f is the frequency in GHz.

The action level in table 9 relates to compliance with the thermal health effects exposure limit values for localised specific energy absorption rate in the limbs. It is not acceptable to exceed the action level unless it is possible to demonstrate compliance with the health effects exposure limit value.

Table 9 Action level for limb currents (10 MHz – 110 MHz)

Frequency range	Limb current (mA)
10 MHz – 110 MHz	100

Notes:

1. The action level is an RMS value

The action levels in table 10 relate to the avoidance of indirect effects such as shock and burn. Instrumentation to measure contact currents is not widely available at present.

Table 10 Action levels for contact currents (1 Hz – 110 MHz)

Frequency range	Contact current (mA)
1 Hz – 2.5 kHz	1.0
2.5 kHz – 100 kHz	$0.4 f$
100 kHz – 110 MHz	40

Notes:

1. Frequency relates to the frequency of the electromagnetic field in which a conducting object is present
2. f is the frequency in kHz
3. The action levels are RMS values
4. The action levels represent the maximum steady state current created during a continuous contact with an object in an electromagnetic field

Reference levels

Council Recommendation 1999/519/EC is intended to provide a framework for limiting public exposure to electric, magnetic and electromagnetic fields and radiations. As an internationally accepted limitation system, the reference levels specified in the Council Recommendation have also been used to define the conditions for electromagnetic compatibility testing of active implanted medical devices and more recently for medical devices (including body-worn active medical devices). Hence they provide a useful framework for the protection of employees who are reliant on active medical devices (whether implanted or body-worn).

In addition, it is currently believed that exposure up to the reference levels specified in the Council Recommendation will not present a risk to pregnant women or those fitted with passive implanted medical devices. It is possible that exposures above the reference levels may also be safe for these two latter groups of employees at particular risk, but at present it would be more difficult to demonstrate this.

Table 11 Reference levels for exposure to electric, magnetic and electromagnetic fields and radiations (1 Hz – 300 GHz)

Frequency range	Electric field strength (V/m)	Magnetic field strength (A/m)	Magnetic flux density (μT)	Power density (W/m^2)
1 Hz – 8 Hz	10 000	3.2×10^4	4.0×10^4	-
8 Hz – 25 Hz	10 000	$3.2 \times 10^4/f^2$	$4.0 \times 10^4/f^2$	-
0.025 kHz – 0.8 kHz	$250/f$	$4/f$	$5/f$	-
0.8 kHz – 3 kHz	$250/f$	5	6.25	-
3 kHz – 150 kHz	87	5	6.25	-
0.15 MHz – 1 MHz	87	$0.73/f$	$0.92/f$	-
1 MHz – 10 MHz	$87/f^{0.5}$	$0.73/f$	$0.92/f$	-
10 MHz – 400 MHz	28	0.073	0.092	2
400 MHz – 2000 MHz	$1.375f^{0.5}$	$0.0037f^{0.5}$	$0.0046f^{0.5}$	$f/200$
2 GHz – 300 GHz	61	0.16	0.20	10

Notes:

1. f is the frequency indicated in the frequency column
2. For frequencies between 100 kHz and 10 GHz, S , E^2 , H^2 and B^2 are averaged over any 6 minute period
3. For frequencies greater than 10 GHz, S , E^2 , H^2 and B^2 are averaged over any $68/f^{1.05}$ minute period
4. For pulsed sources the peak power density averaged over the pulse width should not exceed 10 kW/m^2 .
5. The reference levels are specified as RMS values.

For peak values, the following reference levels apply to electric field strength, magnetic field strength and magnetic flux density:

- for frequencies up to 100 kHz, peak reference values are obtained by multiplying the corresponding RMS values by $\sqrt{2}$
- for pulses of duration t_p the equivalent frequency to apply should be calculated as $f = 1/(2 t_p)$
- for frequencies between 100 kHz and 10 MHz, peak reference values are obtained by multiplying the corresponding RMS values by 10^α , where $\alpha = (0.665 \log(f/10^5) + 0.176)$, where f is the frequency in Hz
- for frequencies between 10 MHz and 300 GHz, peak reference values are obtained by multiplying the corresponding RMS values by 32.

APPENDIX 3. REQUIREMENTS FOR SPECIFIC EMF ASSESSMENTS IN RESPECT OF COMMON WORK ACTIVITIES AND EQUIPMENT

The table in this appendix lists many common work activities, equipment and workplaces, and provides an indication of whether assessments are likely to be required for:

- workers with active implants
- other workers at particular risk
- workers not at particular risk

The entries in this table are based on whether a situation is likely to give rise to field strengths in excess of either the reference levels in Council Recommendation 1999/519/EC or the action levels in the regulations, and if so, whether those fields are likely to be highly localised or not.

The table is based on the use of equipment conforming to recent standards that has been correctly maintained and is being used as intended by the manufacturer. Where work involves the use of very old, non-standard or poorly maintained equipment, the guidance in the table may not be applicable.

Where every activity in a workplace has a 'no' in all three columns, it should not be necessary to carry out a specific assessment as there is expected to be no risk from EMF. In these situations further actions will not normally be required. Similarly, for workplaces where there is no access for those reliant on active medical devices or other workers at particular risk, provided every activity has a 'no' in column 1, it should not be necessary to carry out a specific EMF assessment.

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk [*]	Workers at particular risk (excluding those reliant on active medical devices) [†]	Workers with active implants or body-worn active medical devices [§]
	(1)	(2)	(3)
Wireless communications			
Phones, cordless (including base stations for DECT cordless phones) – use of	No	No	Yes
Phones, cordless (including base stations for DECT cordless phones) – workplaces containing	No	No	No
Phones, mobile – use of	No	No	Yes
Phones, mobile – workplaces containing	No	No	No
Wireless Communication Devices (e.g. WiFi or Bluetooth) including access points for WLAN – use of	No	No	Yes

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk*	Workers at particular risk (excluding those reliant on active medical devices)†	Workers with active implants or body-worn active medical devices§
	(1)	(2)	(3)
Wireless Communication Devices (e.g. WiFi or Bluetooth) including access points for WLAN – workplaces containing	No	No	No
Office			
Audio-visual equipment (eg televisions, DVD players)	No	No	No
Audio-visual equipment containing radiofrequency transmitters	No	No	Yes
Communication equipment and networks, wired	No	No	No
Computer and IT equipment	No	No	No
Fan heaters, electric	No	No	No
Fans, electric	No	No	No
Office equipment (eg photocopiers, paper shredders, electrically operated staplers)	No	No	No
Phones (landline) and fax machines	No	No	No
Infrastructure (buildings and grounds)			
Alarm systems	No	No	No
Base station antennas, inside operator's designated exclusion zone	Yes	Yes	Yes
Base station antennas, outside operator's designated exclusion zone	No	No	No
Garden appliances (electric operated) – use of	No	No	Yes
Garden appliances (electric) – workplaces containing	No	No	No
Heating equipment (electrical) for room heating	No	No	No

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk*	Workers at particular risk (excluding those reliant on active medical devices)†	Workers with active implants or body-worn active medical devices§
	(1)	(2)	(3)
Household and professional appliances, e.g. refrigerator, washing machine, dryer, dishwasher, oven, toaster, microwave oven, iron, provided it does not contain transmission equipment such as WLAN, Bluetooth or mobile phones	No	No	No
Lighting equipment, e.g. area lighting and desk lamps	No	No	No
Lighting equipment, RF or microwave energised	Yes	Yes	Yes
Work places accessible to the general public which meet the reference levels specified in Council Recommendation 1999/519/EC	No	No	No
Security			
Article surveillance systems and RFID	No	No	Yes
Erasers, Tape or Hard Drive	No	No	Yes
Metal detectors	No	No	Yes
Electrical supply			
Electrical circuit where the conductors are close together and having a net current of 100 A or less – includes wiring, switchgear, transformers, etc – exposure to magnetic fields	No	No	No
Electrical circuit where the conductors are close together and having a net current of greater than 100 A – includes wiring, switchgear, transformers, etc – exposure to magnetic fields	Yes	Yes	Yes
Electrical circuits within an installation, with a phase current rating of 100 A or less for the individual circuit – includes wiring, switchgear, transformers, etc – exposure to magnetic fields	No	No	No

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk [*]	Workers at particular risk (excluding those reliant on active medical devices) [†]	Workers with active implants or body-worn active medical devices [§]
	(1)	(2)	(3)
Electrical circuits within an installation, with a phase current rating of greater than 100 A for the individual circuit – includes wiring, switchgear, transformers, etc – exposure to magnetic fields	Yes	Yes	Yes
Electrical installations with a phase current rating of greater than 100 A – includes wiring, switchgear, transformers, etc – exposure to magnetic fields	Yes	Yes	Yes
Electrical installations with a phase current rating of 100 A or less – includes wiring, switchgear, transformers, etc – exposure to magnetic fields	No	No	No
Generators and emergency generators – work on	No	No	Yes
Inverters, including those on photovoltaic systems	No	No	Yes
Overhead bare conductor rated at a voltage up to 100 kV, or overhead line up to 150 kV, above the workplace – exposure to electric fields	No	No	No
Overhead bare conductor rated at a voltage greater than 100 kV, or overhead line greater than 150 kV ¹ , above the workplace – exposure to electric fields	Yes	Yes	Yes
Overhead bare conductors of any voltage - exposure to magnetic fields	No	No	No
Underground or insulated cable circuit, rated at any voltage – exposure to electric fields	No	No	No
Wind turbines, work on	No	Yes	Yes
Light industry			

¹ For overhead lines above 150 kV the electric field strength will usually, but not always, be lower than the reference level specified in Council Recommendation 1999/519/EC.

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk*	Workers at particular risk (excluding those reliant on active medical devices)†	Workers with active implants or body-worn active medical devices‡
	(1)	(2)	(3)
Arc welding processes, manual (including MIG, MAG, TIG) when following good practice and not supporting cable on body	No	No	Yes
Battery chargers, industrial	No	No	Yes
Battery chargers, large professional	No	No	Yes
Coating and painting equipment	No	No	No
Control equipment not containing radio transmitters	No	No	No
Corona surface treatment equipment	No	No	Yes
Dielectric heating	Yes	Yes	Yes
Dielectric welding	Yes	Yes	Yes
Electrostatic painting equipment	No	Yes	Yes
Furnaces, resistively heated	No	No	Yes
Glue guns (portable) – workplaces containing	No	No	No
Glue guns – use of	No	No	Yes
Heat guns (portable) – workplaces containing	No	No	No
Heat guns – use of	No	No	Yes
Hydraulic ramps	No	No	No
Induction heating	Yes	Yes	Yes
Induction heating systems, automated, fault-finding and repair involving close proximity to the EMF source	No	Yes	Yes
Induction sealing equipment	No	No	Yes
Induction soldering	Yes	Yes	Yes
Machine tools (for example pedestal drills, grinders, lathes, milling machines, saws)	No	No	Yes
Magnetic particle inspection (crack detection)	Yes	Yes	Yes

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk*	Workers at particular risk (excluding those reliant on active medical devices)†	Workers with active implants or body-worn active medical devices§
	(1)	(2)	(3)
Magnetizer/demagnetizers, industrial (including tape erasers)	Yes	Yes	Yes
Measuring equipment and instrumentation not containing radio transmitters	No	No	No
Microwave heating and drying, in woodworking industries (wood drying, wood forming, wood gluing)	Yes	Yes	Yes
RF plasma devices including vacuum deposition and sputtering	Yes	Yes	Yes
Tools (electric handheld and transportable e.g. drills, sanders, circular saws, and angle grinders) – use of	No	No	Yes
Tools (electric handheld and transportable) – workplaces containing	No	No	No
Welding systems, automated, fault-finding, repair and teaching involving close proximity to the EMF source	No	Yes	Yes
Welding, manual resistance (spot welding, seam welding)	Yes	Yes	Yes
Heavy industry			
Electrolysis, industrial	Yes	Yes	Yes
Furnaces, arc melting	Yes	Yes	Yes
Furnaces, induction melting (smaller furnaces normally have higher accessible fields than larger furnaces)	Yes	Yes	Yes
Construction			
Construction equipment (e.g. concrete mixers, vibrators, cranes, etc) – work in close proximity	No	No	Yes
Microwave drying, in construction industry	Yes	Yes	Yes

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk*	Workers at particular risk (excluding those reliant on active medical devices) [†]	Workers with active implants or body-worn active medical devices [§]
	(1)	(2)	(3)
Medical			
Medical equipment not employing EMF for diagnosis or treatment	No	No	No
Medical equipment using EMF for diagnosis and treatment (for example, short wave diathermy, transcranial magnetic stimulation)	Yes	Yes	Yes
Transport			
Motor vehicles and plant – work in close proximity to starter, alternator, ignition systems	No	No	Yes
Radar, air traffic control, military, weather and long range	Yes	Yes	Yes
Trains and trams, electrically driven	Yes	Yes	Yes
Miscellaneous			
Battery chargers, inductive or proximity coupling	No	No	Yes
Battery chargers, non-inductive coupling designed for household use	No	No	No
Broadcasting systems and devices (radio and TV: LF, MF, HF, VHF, UHF)	Yes	Yes	Yes
Equipment generating static magnetic fields > 0.5 millitesla, whether generated electrically or from permanent magnets (for example, magnetic chucks, tables and conveyors, lifting magnets, magnetic brackets, nameplates, badges)	No	No	Yes
Equipment placed on the European market as compliant with Council Recommendation 1999/519/EC or harmonised EMF standards	No	No	No
Headphones producing strong magnetic fields	No	No	Yes
Inductive cooking equipment, professional	No	No	Yes

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk [*]	Workers at particular risk (excluding those reliant on active medical devices) [†]	Workers with active implants or body-worn active medical devices [§]
	(1)	(2)	(3)
Non-electrical equipment of all types except those containing permanent magnets	No	No	No
Portable equipment (battery powered) not containing radiofrequency transmitters	No	No	No
Radios, two-way (for example walkie-talkies, vehicle radios)	No	No	Yes
Transmitters, battery driven	No	No	Yes

Notes:

* Assessment required against applicable action levels or exposure limit values.

† Assess against Council Recommendation reference levels.

§ Localised personal exposure may exceed reference levels in Council Recommendation – this will need to be considered in the risk assessment, which should be informed by information supplied by the healthcare team responsible for implanting device and/or subsequent care.

APPENDIX 4. MATTERS TO BE CONSIDERED IN AN EMF-SPECIFIC RISK ASSESSMENT

There is a requirement under regulation 8 of the Control of EMF at Work Regulations 2016 to assess risks arising from work with electromagnetic fields and radiations at frequencies between 0 and 300 GHz. These electromagnetic fields-specific risk assessments are not necessary where:

- the most recent exposure assessment shows that exposures are compliant with the exposure limit values
- the indirect effects action levels are not exceeded
- there are no employees at particular risk

In carrying out an electromagnetic fields-specific risk assessment, the employer is required to consider both indirect effects and employees at particular risk. Indirect effects are those caused by the presence of an object or substance in the field and include:

- interference with medical electronic equipment
- initiation of electro-explosive devices
- fires and explosions resulting from ignition of flammable materials by sparks caused by induced fields, contact currents, or spark discharges
- contact currents.

Employees at particular risk are defined as:

- those employees who have declared to their employer a condition that may lead to a higher susceptibility to the potential effects of exposure to electromagnetic fields
- an employee who works in close proximity to electro-explosive devices, explosive materials, or flammable atmospheres

Both the Directive itself and the HSE guidance to the regulations identify several groups of employees who are likely to have a higher susceptibility to the potential effects of exposure to electromagnetic fields. These are:

- those fitted with active medical implants (such as cardiac pacemakers, cardiac defibrillators, and neurostimulators)
- those fitted with passive medical implants (essentially any metallic implant including a variety of artificial joints, pins, plates, screws and contraceptive implants)
- those wearing body-worn medical devices (such as insulin infusion pumps)
- pregnant women

By definition, employees at particular risk may not be adequately protected by the action levels or exposure limit values. In general, these employees will be adequately protected by the reference levels specified in Council Recommendation 1999/519/EC (see Appendix 2). In some cases it may be possible to exceed these reference levels without risk, but this would generally have to be determined on a case by case basis and may be difficult to demonstrate.

Where relevant, an electromagnetic fields-specific risk assessment must include consideration of:

- the action levels and exposure limit values
- the frequency, level, duration and type of exposure, including the distribution over the employee's body and the variations between areas in the workplace
- direct biophysical effects

- existence of replacement equipment designed to reduce the level of exposure to electromagnetic fields
- appropriate information obtained from health surveillance
- information provided by the manufacturer of relevant equipment
- other health and safety related information
- multiple sources of exposure
- simultaneous exposure to multiple frequency fields

Where an electromagnetic fields-specific risk assessment is required, the employer must keep a written record of the most recent assessment.

APPENDIX 5. PRINCIPLES OF EMF RISK CONTROL

Action plan

Where it cannot be demonstrated that exposures do not exceed an exposure limit value, it is a requirement under regulation 7 of the Control of EMF at Work Regulations 2016 to make and implement a suitable and sufficient action plan to ensure exposures do comply.

Where relevant, the action plan should include consideration of:

- alternative working methods involving lower exposure
- replacement equipment producing lower exposures
- technical measures to reduce emissions of electromagnetic fields, including interlocks, screening or similar protection measures
- demarcation and access control
- maintenance programmes for equipment, workstations and workplaces
- design and layout of workstations and workplaces
- limitations on the duration and intensity of exposure
- availability of suitable personal protective equipment

The purpose of the action plan is to achieve compliance with the exposure limit values, so whenever there is evidence that the exposure limit values have been exceeded, employers are required to identify and implement whatever changes are needed to reduce exposures below the exposure limit values.

Where an action plan is required, the employer must keep a written record of the most recent plan.

Risk management

It is a requirement to implement measures to either eliminate risks identified by an EMF-specific risk assessment or reduce them to a minimum. The approach taken should follow the principles established by the Management of Health and Safety at Work Regulations 1999. In particular, employers are required to consider:

- technical progress
- potential to restrict access to parts of the workplace
- availability of measures to control the production of electromagnetic fields at source

The practical application of these principles should lead to consideration of a number of control measures. These are presented below:

- a) It must be ensured as far as reasonably practicable that where equipment likely to generate a strong EMF radiation is purchased or borrowed, that the supplier provides details of the likely EMF output characteristics and recommended control measures. Such data should already be provided if the equipment is CE-marked and falls within scope of the Machinery Directive, but nevertheless it is recommended that the equipment is re-tested locally to confirm its EMF output.
- b) The immediate vicinity of unmanned, high-power sources of EMF radiation (e.g. radio-transmitters) shall be suitably fenced off to prevent unauthorized access.
- c) Equipment generating strong EMF radiation shall be positioned as far away as reasonably practicable from areas normally occupied by staff and others.

- d) There shall be no unnecessary metal objects near any radiating EMF device. The presence of such objects may result in high-intensity fields in certain locations. Where it is necessary for metal objects to be present near a device radiating EMF, they shall be appropriately grounded.
- e) Shielding or screening of equipment shall be carried out as necessary to reduce EMF radiation exposure.
- f) Equipment generating high-power microwaves shall not be tested without an appropriate load connected to its output. The power generated should never be allowed to radiate freely into occupied areas.
- g) Safety procedures to be followed by operators of equipment generating strong EMF radiation shall include the following requirements:
- Replacement components, in particular, waveguides, gaskets, flanges, etc., must be such that the equipment's EMF radiation characteristics remain acceptable;
 - Testing of an EMF-radiating device either before or after completion of repair work must be carried out in accordance with this SHE code work and should normally be carried out after protective shields, waveguides and other components have been put back in their designated locations as far as reasonably practicable;
 - Adjustments of voltages, replacement or dismantling of EMF-radiation-generating components or refitting waveguides should be undertaken by people trained and competent to undertake such tasks (see Appendix 4); and
 - Maintenance staff and operators of EMF radiation generating devices shall be suitably aware of the potential hazards of EMF radiation.
- h) Managers responsible for new or existing EMF-radiating-equipment subjected to modification/maintenance should ask the relevant EPA to undertake EMF surveys with appropriate test equipment.
- i) Warning signs as shown below indicating the presence of EMF radiation shall be posted as appropriate where exposure above action levels may occur. Warning signs can be obtained from SHE Group. The sign in the first panel is suitable to warn of the presence of strong low frequency magnetic fields, whilst the sign in the second panel is suitable to warn of the present of strong radiated fields.



- j) Warning signs, as shown below, prohibiting individuals with active medical devices from entering areas where EMFs exceed the reference levels shall be posted at all entrances. Warning signs can be obtained from SHE Group.



- k) EMF-generating equipment may present additional hazards such as X-ray emission and electrical dangers which will have to be evaluated separately (see SHE codes specific to these additional hazards).

APPENDIX 6. TRAINING

Role	Initial Training	Refresher	Frequency	Comments
Manager of area/activities in which EMF hazards exist	Public Health England (PHE) provide a range of non-ionising radiation training courses including, "Control of EMF at Work Regulations – a practical guide to compliance" 1 day training courses. Training in undertaking EMF strength measurements – generally provided by providers/manufacturers of measuring equipment. Detailed familiarisation with the content of this code.	(HPA) ," RF Safety Awareness "	5 yearly	
EMF Protection Advisor (EPA)				This is a specialist field in which significant prior experience of working with time varying EMFs should be considered when appointing EPAs.

Worker information and training

Staff likely to be exposed to risks identified in the risk assessment should receive information or training, which should include:

- the measures taken to eliminate or reduce risks
- the concepts and values of the action levels and exposure limit values and the possible risks associated with them
- the possible indirect effects of exposure
- the results of the most recent exposure assessment
- how to detect and report sensory and health effects
- the circumstances under which employees are entitled to medical examination and health surveillance
- safe working practices
- any additional measures required for employees at particular risk

APPENDIX 7. AUDIT CHECKLIST

Ref	Item	Rating	Comments
1	Have Directors appointed in writing EPAs for all equipment/areas generating strong EMFs?		
1.1	Appointment of EPAs		
1.2	Qualifications and experience of EPAs?		
1.3	STFC SHE Group Register of EPAs		
2	Have EPAs provided advice to management?		
2.1	Advice provided on need for exposure assessments?		
2.2	Advice provided on implementation of controls to restrict exposures?		
3	Have documented EMF surveys been undertaken for all equipment generating strong EMFs? Have these been repeated following significant change/modification or maintenance of the equipment?		
3.1	Routine surveys		
3.2	Surveys repeated following maintenance		
3.3	Surveys repeated following change/modification		
4	Is EPA EMF survey meter within calibration date and calibrated to a recognised EMF standard?		
4.1	Instrument suitable?		
4.2	Instrument calibration		
5	Responsibilities of managers for assessment of exposure and risk		
5.1	Have exposure assessments been carried out?		
5.2	Have EMF-specific risk assessments been carried out for equipment generating fields above the action levels?		
5.3	Have EMF-specific risk assessments been carried out for employees at particular risk?		

Ref	Item	Rating	Comments
6	Responsibilities of managers for equipment		
6.1	Has EMF been considered before new equipment brought on site or operated?		
6.2	Has the EPA been consulted before new equipment is brought on site or operated?		
6.3	For equipment designed and constructed on site, is there evidence that EMF has been considered?		
6.4	Has the EPA been consulted over equipment constructed on site?		
7	Responsibilities of managers to restrict exposure to fields that exceed the action levels		
7.1	Have engineering controls been implemented to restrict exposures in excess of the action levels?		
7.2	Have local operating instructions been issued for equipment generating fields in excess of the action levels?		
7.3	Have staff been made aware of hazards from strong fields?		
7.4	Have suitable warning signs been posted for fields in excess of the action levels?		
7.5	Have instructions/information been provided for visitors / contractors?		
8	Responsibilities of managers to ensure protection of employees at particular risk		
8.1	Have access restrictions been implemented for employees at particular risk where fields exceed the reference levels?		
8.2	Have identified employees at particular risk been advised to seek a consultation with Occupational Health?		
8.3	Have instructions/information regarding risks for those at particular risk been provided to visitors / contractors?		
9	Management of indirect effects		

Ref	Item	Rating	Comments
9.1	Have suitable controls been implemented for risks to safety from indirect effects?		
10	Have incidents involving EMF been reported to SHE Group?		
11	Responsibilities of staff		
11.1	Do staff comply with local instructions?		
11.2	Do staff take action to ensure visitors/users/contractors comply with local instructions?		
11.3	Do staff ensure that visitors/users/contractors are aware of access restrictions for those at particular risk?		
12	Have medical assessments been conducted for all staff exposed to EMFs above the action levels?		

APPENDIX 8. DOCUMENT RETENTION POLICY

Records Established	Minimum Retention Period	Responsible Record Keeper	Location of records	Comments/Justifications
EMF Surveys	Current + 50 Years	Line Management	Local Record Systems	Probably 50 Years from Date of last entry – health issues
Appointments:				
EMF Protection Advisor	Most Recent	Director	SHE Directory	Appointment Letter