

Power-frequency EMF Exposure Standards applicable in Europe and elsewhere

Provided on www.emfs.info, an information website maintained by National Grid.

Compiled by John Swanson

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Acknowledgements

This compilation draws on:

- the original work of Dr Brian Maddock on behalf of Cigre Joint Working Group 36.01/06
- the EU Commission Implementation reports of 2002 and 2008
- the WHO Standards Harmonisation project
- the knowledge of members of Eurelectric's Environment and Society Working Group
- responses from members of ENTSO-E
- many other experts in individual countries

For record of revisions see appendix

Flags are taken from <http://www.bizforms.com/flags.htm>

Abbreviations

j	induced current density
E	electric field (external to body, unperturbed)
B	magnetic flux density

Notes

For most standards, values are given for 50 Hz only, and unless otherwise indicated, all values are for 50 Hz. For certain standards, indicated at the head of the table, 60 Hz values are also given in italics. In these tables, where only one value appears, it is the same for 50 Hz and 60 Hz.

Limits on building near lines are included where these are stated to be for exposure reasons but not where they are for other reasons such as access for maintenance. This may not always be consistent.

Countries with a standard applying to higher frequencies but not to power frequencies:

Canada
New Zealand
Peru
Spain
Turkey

Countries and organisations included

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Country:
International (ICNIRP)



last update 2/12/10
Compiled from source documents

Originating Organisation: International Commission on Non-Ionizing Radiation Protection

Document Reference: "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)." Health Physics vol 74 pp 494-522 1998. Modified in "Response to Questions and Comments on ICNIRP." Health Physics vol 75 pp438-439 1998.

Frequencies Covered: > 1 Hz – 300 GHz

Status: No legal force but recognised by UN

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational exposure	Basic Restriction	J	Central nervous system (includes spinal cord)	10 mA m ⁻²	Average over 1 cm ²
		E		10 kV m ⁻¹	
	Reference Level	B		500 µT	
		Contact current		1 mA	
General public exposure	Basic Restriction	J	Central nervous system (includes spinal cord)	2 mA m ⁻²	Average over 1 cm ²
		E		5 kV m ⁻¹	
	Reference Level	B		100 µT	
		Contact current		0.5 mA	

Originating Organisation: International Commission on Non-Ionizing Radiation Protection

Document Reference: "ICNIRP statement—guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz)" Health Physics vol 99 pp 818-836 2010.

Frequencies Covered: 1 Hz – 100 kHz

Status: No legal force but recognised by UN

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational exposure	Basic Restriction	In-situ electric field	Central nervous system (excludes spinal cord)	100 mV/m	
			Peripheral nervous system	800 mV/m	
	Reference Level	E		10 kV m ⁻¹	
		B		1 mT	
Contact current		1 mA			
General public exposure	Basic Restriction	In-situ electric field	Central nervous system (excludes spinal cord)	20 mV/m	
			Peripheral nervous system	400 mV/m	
	Reference Level	E		5 kV m ⁻¹	
		B		200 µT	
Contact current		0.5 mA			

Country:
International (IEEE)



Last update 1/2003
compiled from source document
60 Hz values (where different from 50 Hz values) given in italics

Originating Organisation: IEEE SCC 28 (now ICES)

Document Reference: IEEE C95.6-2002.

Frequencies Covered: 0 to 3 kHz


Status: No legal force.

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment	
Controlled environment	Basic Restriction	In-situ electric field	Brain	0.0443 V/m <i>60 Hz: 0.0531 V/m</i>		
			Heart	0.943 V/m		
			Hands, wrists, feet, ankles	2.10 V/m		
			Other	2.10 V/m		
		Contact current*	Each foot	3.0 mA		
			Contact	3.0 mA 1.5 mA	grasp touch	
	Maximum permissible exposure (Investigation Level)	E [*]	Whole body (average over whole body if field is non-uniform)	20 kV/m	in reach of grounded conducting object	
				"may be acceptable to exceed" 20 kV/m	not in reach of grounded conducting object	
		B [*]	Head and torso	2.71 mT		
			Arms and legs	75.8 mT <i>60 Hz: 63.2 mT</i>		
	Public	Basic Restriction	In-situ electric field	Brain	0.0147 V/m <i>60 Hz: 0.0177 V/m</i>	
				Heart	0.943 V/m	
Hands, wrists, feet, ankles				2.10 V/m		
Other				0.701 V/m		
Contact current*			Each foot	1.35 mA		
			Contact, touch	0.5 mA		
Maximum permissible exposure (Investigation level)		E [*]	Whole body (average over whole body if field is non-uniform)	5 kV/m		
				10 kV/m under normal load conditions	in power line right-of-way	
		B [*]	Head and torso	904 µT		
			Arms and legs	75.8 mT <i>60 Hz: 63.2 mT</i>		

* 1 second averaging time

Country: Europe (public)	
last update 1999 Compiled from source document	

Originating Organisation: Council of the European Union					
Document Reference: 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)					
Frequencies Covered: > 1 Hz – 300 GHz					
Status: Recommendation to member state governments to implement measures, considering both the risks and benefits in deciding whether action is required or not.					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
General public exposure, when the time of exposure is significant	Basic Restriction	J	Central nervous system	2 mA m ⁻²	Average over 1 cm ²
		E		5 kV m ⁻¹	
	Reference Level	B		100 µT	
		Contact current			0.5 mA

Country: Europe (occupational)	
Last update 1/7/2015 Compiled from source document	

NO LONGER IN FORCE					
Originating Organisation: Council of the European Union					
Document Reference: Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)					
Frequencies Covered: > 1 Hz – 300 GHz					
Status: No direct force but member state governments required to bring into force in each state by 2008					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Workers	Exposure Limit value	J	Central nervous system	10 mA m ⁻²	Average over 1 cm ²
		E		10 kV m ⁻¹	
	Action value	B		500 µT	
		Contact current			1 mA

Originating Organisation: The European Parliament and the Council						
Document Reference: Directive 2013/35/EU of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)						
Frequencies Covered: 0 Hz – 300 GHz						
Status: Member States required to enact in National law within 3 years						
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment	
Occupational exposure	Sensory Effects Exposure Limit Value	In-situ electric field	Central nervous system (excludes spinal cord)	140 mV/m peak ≈ 100 mV/m rms		
				Low Action level	10 kV m ⁻¹	
	Health Effects Exposure Limit Value	In-situ electric field	peripheral nervous system	1.1 V/m peak ≈ 800 mV/m rms		
				High Action level	20 kV m ⁻¹	
				B	6 mT	
	Action level	Contact current	limbs	18 mT		
				1 mA		

Country:
Argentina



Last update 2001
Compiled from source document

National Quantitative Limits

Originating Organisation: Energy Government Office

Document Reference: Secretariat of Energy Resolution #77/98

Frequencies Covered: Power frequencies

Status: Legally enforceable by National Power Regulatory Body (ENRE)

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Not known but assumed to be public	Limit	E		3 kV/m	edge of right of way and substation perimeter
		B		25 μ T	
		J		5 mA	

Applies to transmission lines, transformer and/or compensation stations \geq 132 kV

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Australia



Last update 2001
Compiled from source document

National Quantitative Limits

Originating Organisation: National Health and Medical Research Council, Canberra

Document Reference: Interim guidelines on limits of exposure to 50/60 Hz electric and magnetic fields (1989)

Frequencies Covered: 50/60 Hz

Status: Guideline


Note 6/2007: ARPANSA are currently producing a new Standard. Public consultation took place early 2007.

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Limit	E		10–30 kV m ⁻¹	t (hours per work day) < 80/E within this range
		B	Body	500 µT	
				5000 µT	up to 2 hours per work day
			Limbs only	25,000 µT	
Public	Limit	E		5 kV m ⁻¹	24 hours in open spaces
				10 kV m ⁻¹	few hours per day (can be exceeded for a few minutes per day)
		B		100 µT	24 hours in open spaces
				1000 µT	few hours per day (can be exceeded for a few minutes per day)

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Austria	
last update 23/3/11 original information from Austrian Association of Electricity Companies updated by Klemens Reich	

National Quantitative Limits

Originating Organisation: Austrian Standards Institute and Austrian Electrotechnical Association						
Document Reference: Electric, magnetic and electromagnetic fields in the frequency range from 0 Hz to 300 GHz - restrictions on human expose, Austrian Standard VORNORM ÖVE/ÖNORM E 8850:2006-02-01.						
Frequencies Covered: 0 Hz – 300 GHz						
Status: pre-standard						
Based on 1999/519/EG - council recommendation, ICNIRP 1998 guidelines, 2004/40/EC directive of the European parliament on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields);						
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment	
Occupational exposure	Basic Restriction	J	Head and torso	10 mA m ⁻²	Average over 1 cm ²	
	Reference Level	E		10 kV m ⁻¹		
		B			500 µT	
		Contact current			1 mA	
General public exposure	Basic Restriction	J	Head and torso	2 mA m ⁻²	Average over 1 cm ²	
	Reference Level	E		5 kV m ⁻¹		
		B			100 µT	
		Contact current			0.5 mA	

Limits based on the Swiss 1 µT limit are under discussion. They have not yet been formally introduced, but for lines requiring Environmental Impact Assessment, the panel of experts appointed by the relevant authority almost always require compliance with the Swiss limits.

Regional or Local measures

Salzburg has presumption of undergrounding for lines within 200 m of residential areas unless this is demonstrated to be unfeasible.

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Belgium



Last update 29/7/2010
information from Elia

National Quantitative Limits

Status of EU Recommendation: No action being taken at power frequencies

Originating Organisation: Federal Minister responsible for Energy

Document Reference: General Regulation for Electrical Installations (Ministerial Decree of April 07, 1987) Moniteur Belge, F.88-900 (14 Mai 1987)

Frequencies Covered: 50 Hz

Status: Legal

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public (overhead power lines only)	Limit	E		10 kV m ⁻¹	
				7 kV m ⁻¹	Road crossings
				5 kV m ⁻¹	Accessible or inhabited areas

Royal Decree implements EU Recommendation plus extra factor of 4 from 10 MHz to 6 GHz.

Regional or Local Policies

Resolution of the Flemish Government of June 11-2004 concerning the indoor pollution of buildings:
Intervention value: 10 µT, quality target: 0.2 µT.

Other Regional Decrees limits RF levels to much lower limits than EU Recommendation (e.g. 3V/m at 900 MHz)

National Non-Quantitative Measures

Industry Voluntary Measures

Because of the lack of any national limit for magnetic field exposure, local authorities will case by case, impose precautionary measures by their own interpretation, without taking into account the (financial) consequences. Elia tries to anticipate this by avoiding residential areas as much as possible and applying mitigating techniques. For that reason magnetic field calculations are elaborated for most permit applications.

Country:
Bosnia Herzegovina



Last updated 31/7/10
Information from NOS, Independent System operator

No EMF restrictions

National Quantitative Limits

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Brazil



Last updated 8 May 2014

National Quantitative Limits

Federal law 11.934 May 2009 requires exposure limits to be set that are sanctioned by WHO.

National Regulating Agency Aneel implement this as ICNIRP 1998. (2014: considering changing to ICNIRP 2010.)

Originating Organisation: Brazilian Association of Technical standards					
Document Reference: ABNT-NBR 15415					
Frequencies Covered:					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public (assumed)	limit	B	1.5 m above ground	83.3 μT	Transmission, distribution, substations and generators >1 kV, at boundary of units
		E		4.17 kV/m	

Assumed that values are specific to 60 Hz

Regional or Local Policies

Brazil, Municipality of Sao Paulo

Originating Organisation:

Document Reference: October 2005

Frequencies Covered:

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	24 hour average	B		10 μT	Existing facilities 69 kV and above
	Investigation Level			3 μT	New facilities 69 kV and above

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Bulgaria



Last update 30/4/10
Source documents obtained but in Bulgarian

National Quantitative Limits

Originating Organisation: Ministries of Health, Environment and Labour

Document References:

Occupational:

Ordinance #41

Ordinance No. 8, Gov. News No.29/1996 - for the Hygienic Requirements for the Work Places with VDU's

Ordinance No. 7, Gov. News No.88/1999 - for the Minimal Requirements for Healthy and Safety Work Conditions
Bulgarian National Standard BNS 12.1.002-78. Electric Fields near High Voltage Substations and Lines with Voltage 400 kV and more.

General population:

Ordinance No. 9 (14 March 1991) - MPEs for Electromagnetic Radiation in Residential Areas and for Determining Safety Zones Around Electromagnetic Sources, Governmental News No. 35/1991.

Ordinance No. 9, Gov. News No.46/1994 - for the Hygienic Requirements on using VDU's at School

Ordinance No. 7, Gov. News No.46/1992 - Hygienic Requirements for Health Protection of the Residential Areas.

Frequencies Covered: 0 – 300 GHz

Status:


Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational		E		25 kV m ⁻¹	ceiling limit
				20-25	up to 5 mins
				15-20	up to 10 mins
				10-15	up to 90 mins
				5-10	up to 3 hours
				5	work day (up to 8 hours)
		B		1200 μT	
Public					

EU Second Implementation Report says the ICNIRP basic restrictions have been implemented

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: China 
last update 2/12/10
information on new development supplied by delegation from State Grid Corporation of China

National Quantitative Limits

Originating Organisation: Environment Ministry						
Document Reference:						
Frequencies Covered:						
Status: Said to have been announced and to be waiting final Government approval 11/2010						
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment	
Public (previous to 2010)	Basic Restriction	j		0.5 mA m ⁻²	Status of this information unclear	
				limit	E	4 kV/m
					7 kV/m	over roads
					10 kV/m	elsewhere
Public (to be adopted 2010)				"ICNIRP" – presumed to be 5 kV/m and 100 µT	exposures in general	
				"ICES" – presumed to be 10 kV/m	power lines	

500 kV power lines: not allowed over buildings, buildings are removed within 5 m of outer conductors

Regional or Local measures

National Non-Quantitative Measures

Environmental protection law
 Environmental impact assessment
 Power line >300 kV must be assessed by EPA

Industry Voluntary Measures

Country:
Columbia



National Quantitative Limits

Originating Organisation:

Document Reference: Electrical Facilities Internal Regulation RETIE 14 Article

Frequencies Covered:

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational and public	limit	B		500 μ T	
		E		10 kV/m	

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Costa Rica



Last update 2001

National Quantitative Limits

Originating Organisation:

Document Reference: "Reglamento general para el desarrollo y operacion de las obras de transmision de electricidad, relacionado con campos electromagneticos y otros aspectos ambientales", Alcance 95-A, La Gaceta 248, 22/12/1998

Frequencies Covered: 50/60 Hz

Status: Guideline (expected to be law soon)

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public (overhead lines)	Limit	E		2 kV m ⁻¹	At border of right of way
				8 kV m ⁻¹	Centre of right of way
		B		15 µT	At border of right of way

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Croatia



Last update 15/12/2010

National Quantitative Limits

Originating Organisation: Croatian Parliament, Ministry of Health and Social Welfare

Document Reference: Non-Ionizing Radiation Law (1999, 2004); Regulations on Protections from Electromagnetic Field (2003, 2004, 2008)

Frequencies Covered: 0 - 300 GHz

Status: Law and regulation

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Reference value	B		100 μ T	
		E		5 kV/m	
Public, areas of intensified sensitivity*	Reference value	B		100 μ T	existing facilities
				40 μ T	new facilities
		E		5 kV/m	existing facilities
				2 kV/m	new facilities

* residential areas where individuals can spend up to 24 hours/day (hospitals, health resorts, tourism buildings, nurseries, schools, playgrounds)

Regional or Local measures

National Non-Quantitative Measures

Measurements of fields for all significant sources required every two years, where E or B exceed 10% of the limits, exemption if two consecutive measurements give values less than 10% of limits.

Industry Voluntary Measures

Country:
Cyprus



Last updated 30/7/10
information from Transmission System Operator Cyprus

National Quantitative Limits

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

There is no legislation in Cyprus as regards to EMF. As a common practice though, the Electricity Authority of Cyprus which is the owner of the Transmission System complies with the limits imposed by the European Union.

Country:
Czech Republic



Last update 30/7/2010
information from Elektrarenska

National Quantitative Limits

Status of EU Recommendation: Decree imposes ICNIRP values

Originating Organisation: Government of the Czech Republic and Ministry of Health care

Document Reference: Governmental Decree No. 1/2008 incl. No. 106/2010

Frequencies Covered: 0 – 300 GHz

Status: legally binding

Values in this table are for 50 Hz.

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational exposure	Basic Restriction	j	central nervous system	14 mA/m ²	
			other body	70 mA/m ²	five times higher than central nervous system
	Investigation Level	E	average from spine's or head's area	10 kV/m	
			average from spine's or head's area	500 µT	
			contact current	1 mA	
	General population	Basic Restriction	j	central nervous system	2,8 mA/m ²
other body				14 mA/m ²	
Investigation Level		E	average from spine's or head's area	5 kV/m	
			average from spine's or head's area	100 µT	
			contact current	0,5 mA	

Previous information: Governmental Decree No 480/2000 imposes ICNIRP values

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Denmark



Last update 8/2/10
information from various Eurelectric members especially Rikke Folkersen

National Quantitative Limits

Status of EU Recommendation: No known plans for legislation

No EMF Standard.

According to EU Implementation Report, "Labour Inspectorate follows the ICNIRP recommendations when evaluating exposure".

Regional or Local measures


National Non-Quantitative Measures

In 1993 the Danish health authorities introduced a precautionary approach which stated that new high voltage installations should not be built close to existing dwellings or childcare institutions/schools. Equally the building of new homes close to existing high voltage installations should be avoided. The term "close to" was not defined by a minimum distance or an exposure limit but left to a pragmatic evaluation. The precautionary approach was updated in 2007.

Industry Voluntary Measures

Autumn 2009: To ensure that the precautionary approach is applied in a uniform manner and to make it more communicable, Danish grid owners and local governments (local planning authorities) have defined an evaluation value of 0.4 μ T. This value is not an exposure limit but rather a value that indicates when various measures to reduce magnetic fields near dwellings and childcare institutions should be evaluated and analysed.

The 0.4 microtesla limit should not be considered a limit, which - when reached - dictates that measures must be initiated at any cost. If the magnetic fields are expected to be above than 0.4 microtesla (annual average), it should be examined whether measures to reduce the fields can be implemented at a reasonable cost (cost/benefit, electrical safety, security of supply, human considerations, etc.). Examples of simple measures include e.g. the optimal phasing of new overhead lines. When new dwellings and childcare institutions/schools are being built in the vicinity of power lines, an approach could be to place the rooms/areas in which children spend a considerable amount of time as far away from the power line as reasonably possible to reduce the exposure.

Country: Estonia	
Last update 30/4/10	

National Quantitative Limits

Status of EU Recommendation: Regarded					
Originating Organisation: Ministry of Social Affairs					
Document Reference: Non-ionizing radiation limits in life and recreational areas, residential buildings, sharing and training rooms and measurement of non-ionizing radiation levels (Decree, became valid 02.21.2002, redaction become valid 07.01.2007); Occupational exposure limits of physical hazards and measuring procedure of the risk parameters (Decree, became valid 07.01.2002, updated 04.30.2007).					
Frequencies Covered: 0 – 300 GHz					
Status: Valid					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Mandatory	E		5 kV/m	
		B		100 µT	

Originating Organisation:					
Document Reference: Regulation of the Government of Estonia on occupational health and safety limits (86/188/EEC) adopted 22/1/2 also Regulations and sanitary standards for the protection of occupationally exposed people from high-voltage lines, 2971-84					
Frequencies Covered:					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Details not known				

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Finland



Last update 16/2/12
information from Eurelectric and ENTSO(E) members

National Quantitative Limits

Status of EU Recommendation: Regarded as implemented through new law

Originating Organisation: Ministry of Social Affairs and Health

Document Reference: Decree on the limitation of exposure of the public to non-ionizing radiation 294/2002, based on the Law on radiation protection 592/1991, 43

Frequencies Covered: 0-300 GHz; lasers; ultraviolet

Status: Law, April 2002. ELF values are recommended not compulsory.

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Basic restriction	j		2 mA/m ²	
				10 mA/m ²	Time of exposure not significant
	Recommended limit when people exposed for significant periods of time	E		5 kV/m	
				15 kV/m	Short periods of time
		B		100 µT	
				500 µT	Short periods of time

For occupational exposure, there are no exposure limit values or official action. The intention has been to follow literally the requirements of the EU Directive. Work to write down the Finnish Act was started on the basis of the directive proposal 2004/40/EC but the work was interrupted when EUs Commission postponed the effective date of the Directive.

Finish Radiation Safety Agency recommend that new houses and day care facilities should not be built in the zone round power lines where 0.4 µT is continuously exceeded ("continuously exceeded" is not defined). This has no legal force; it may come to have effect in practice.

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

STUK recommends non-costly actions when 0.3-0.4 µT is exceeded.

Country:
France



Last update 2/7/13
Compiled from information in EU Implementation Report plus further detail from EdF/RTE

National Quantitative Limits

Status of EU Recommendation: No plans to give Recommendation any national force

Originating Organisation:

Document Reference: Order of 17 May 2001, Journal Officiel 12 June 2001 ("Technical Order")

Frequencies Covered: Applies to power systems only

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Any place accessible to the public	Limits	E		5 kV/m	New or significantly modified installations; permanent service operating conditions*
		B		100 μ T	New or significantly modified installations; permanent service operating conditions*


* "*permanent service operating conditions*" are defined as the operating conditions under which the temperature of the overhead line conductors raises up to 40 °C with standard environmental conditions (20 °C, no wind).
No legal definition for buried cables, and so the maximum permanent current is taken as reference condition.

Regional or Local measures

National Non-Quantitative Measures

"Circulaire" 2013 from Minister of Ecology, Sustainable Development and Energy (MEDDE) to Prefets of Departements. Asks them to recommend to local municipalities that they should avoid, as much as possible, giving permission for new sensitive use buildings (e.g. hospitals, primary schools, kindergartens) in a "zone de prudence" of 1 μ T exposure from high-voltage infrastructure.

Industry Voluntary Measures

Country: Germany	
Last update 2/7/13 Compiled from source document and EnBW (public) and EnBW (occupational)	

National Quantitative Limits

Status of EU Directive 2004/40/EC: Existing Ordinance is regarded as fulfilling requirements of Directive. New ordinance 1 July 2016 will replace these values with the 2013 EU Directive.					
Originating Organisation: Accident Prevention & Insurance Association					
Document Reference: BGV B11; Accident Prevention Directive for Employees about Electromagnetic Field Influence, 01 Jun 2001					
Frequencies Covered: 0 – 300 GHz; Values in this table are for 50 Hz, 16 2/3 Hz values are different.					
Status: Law. Applies to all kind of electric field source, exposing work places and areas					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Kind of Exposition Area and protective Procedure
workplaces where employees have access or have to go	Limit	E		0 to $\leq 6,7 \text{ kV m}^{-1}$	Exposition Area 2 *
				$> 6,7$ to $\leq 21,3 \text{ kV m}^{-1}$	Exposition Area 1 *
				$> 21,3$ to $\leq 30 \text{ kV m}^{-1}$	Raised Exposition Area *
		$> 30 \text{ kV m}^{-1}$		Danger Exposition Area *	
		B		0 to $\leq 424 \text{ } \mu\text{T}$	Exposition Area 2 *
				> 424 to $\leq 1358 \text{ } \mu\text{T}$	Exposition Area 1 *
> 1358 to $\leq 2546 \text{ } \mu\text{T}$	Raised Exposition Area *				
$> 2546 \text{ } \mu\text{T}$	Danger Exposition Area *				

* Each Exposition Area has its own requirements and protective procedures:
 "Exposition Area 2" is an area where employees have uncontrolled and uninformed access and where the current density of 2 mA/m^2 is not exceeded (like public exposure).
 "Exposition Area 1" is an area where employees have controlled access and have been informed as a minimum one time a year about their personal exposition situation (field values, etc.). Current density of 6 mA/m^2 is not exceeded.
 "Raised Exposition Area" is an area where employees have a strong controlled and time-limited access (e.g. transient or maximum 2 h /day at low frequency range) and have been informed as a minimum one time a year about their personal exposition situation (field values, etc.). Current density of 10 mA/m^2 is not exceeded.
 "Danger Exposition Area" is an area where no access is permitted.

Further details and explanations how to operate with the guidelines of the BGV B11 are described in an additional paper, the BGR B1, also published by the German Accident Prevention & Insurance Association.

Status of EU Recommendation: Existing Ordinance is regarded as fulfilling requirements of Recommendation					
Originating Organisation: Federal Government					
Document Reference: 26th Ordinance Implementing the Federal Immission Control Act, 16 December 1996, Federal Law Gazette (BGBl.) I p. 1966. Revised 2013.					
Frequencies Covered: 1 Hz – 9 kHz (from 2013, previously 16 2/3 Hz and 50 Hz) (separate section 10 MHz – 300 GHz). Values in this table are for 50 Hz, 16 2/3 Hz values are different.					
Status: Law. Applies to stationary installations only (power and traction lines and cables, transformers and switchgear)					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Everyone (buildings or land intended for the non-transient presence of humans)	Limit	E		5 kV m^{-1}	Brief exceedances totalling <5% of day, existing lines only
				10 kV m^{-1}	
		B		10 kV m^{-1}	Small area outside building existing lines only
				$100 \text{ } \mu\text{T}^{**}$	Brief exceedances totalling <5% of day, existing lines only
$200 \text{ } \mu\text{T}$					

* Previously: does not apply to erection or major alteration of installations in vicinity of dwellings, hospitals, schools, kindergartens, creches, playgrounds or similar facilities. Nuisance caused by contact voltage which the neighbourhood cannot reasonably be expected to tolerate not permitted.

** Values in general follow ICNIRP 2010 and would therefore be $200 \text{ } \mu\text{T}$. For 50 Hz only, not for other frequencies, precautionary factor of 2 is applied to give $100 \text{ } \mu\text{T}$.

Regional or Local measures


Lower Saxony has presumption of undergrounding for lines within 200 m of residential areas unless this is demonstrated to be unfeasible. This is stated to be for EMF reasons. It remains in place but has been superseded by the national Energy Line Extension Act.

National Non-Quantitative Measures

Energy Line Extension Act 2009 allows for undergrounding of certain specific lines within 400 m of residential areas and within 200 m of other residential properties but this is not for EMF reasons.

2013 revision of 26th Ordinance includes requirement to minimise exposures, according to provisions of separate paper still to be written.

Industry Voluntary Measures

Country: Greece	
Last update 24/8/10 Documents not seen.	
Information from DESMIE (Hellenic Transmission System Operator) and Public Power Corporation	

National Quantitative Limits

Originating Organisation: Ministers of Development, Environment and Health
Document Reference: Common Ministerial Decree 3060/238/2002 "Protection measures of the general public from operation of devices generating low frequency electromagnetic fields" KYA 3060(FOR)238/2002
Frequencies Covered: 0-150 kHz
Status: Common Ministerial Decree (KYA)

Public: basic restrictions and reference levels identical to EU Recommendation.
 Occupational: transposition of EC Directive 2004/40 to national law is still pending.

It has sometimes been reported that Greece adopted 80% of ICNIRP values. This does not apply to power frequencies. Act 1105/Vol. II/6.9.2000 "Measures to protect the general public from the operation of ground antenna installations" suggests it applies to radiofrequencies only. EU Second Implementation Report says that for "antennas" the limits are 70% of the basic restriction or 60% if less than 300m from schools, kindergartens, hospitals or eldercare facilities.

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Hungary	
Last update 2005 Information from Janos Stradl	

National Quantitative Limits

Status of EU Recommendation: Implemented by 2004 Decree					
Originating Organisation: Ministry of Health, Social Affairs and Family					
Document Reference: Decree 63/2004 ESzCsM on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)					
Frequencies Covered: 0 Hz - 300 GHz					
Status: Decree					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Limit	E		5 kV/m	
		B		100 μ T	

Status of EU Recommendation:					
Originating Organisation:					
Document Reference: MSZ 151-1:2000 "Overhead lines for power transmission. Installation prescriptions for overhead transmission lines with a nominal voltage above 1 kV"					
Frequencies Covered: power frequency only (MSZ 16260-86 covers 30 kHz - 300 GHz)					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Limit	E		5 kV m ⁻¹	1.8 m above ground
		B		100 μ T	1.5 m above ground

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

MVM Rt. (Hungarian transmission utility) follow "Environmental Protection Rules: EMF prescriptions for transmission lines and substations" for internal purposes:

Originating Organisation: MVM Rt.					
Document Reference: "Environmental Protection Rules: EMF prescriptions for transmission lines and substations"					
Frequencies Covered: 50 Hz					
Status: internal company procedure					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Limit	E		10 kV m ⁻¹	
		B		30 kV m ⁻¹	for short time
Public	Limit	E		500 μ T	
				5000 μ T	for short time
		B		5 kV m ⁻¹	
				10 kV m ⁻¹	for few hours ¹
		100 μ T			
		1000 μ T	for few hours ¹		

1 Applies in the "outpart", a land designation which does not allow dwelling homes.

Country:
Iceland



Placeholder added 3/2/10

National Quantitative Limits

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Ireland



last update 10/8/12
Aidan Corcoran, Eiregrid

National Quantitative Limits

Status of EU Recommendation: Implicitly incorporated through Government Policy Statement.

Originating Organisation: Government

Document reference: The Government Policy Statement on the Strategic Importance of Transmission and other Energy Infrastructure published July 2012


Contains a requirement 'to comply with national and international standards with respect to health, environment biodiversity, landscape and safety.' This is interpreted as compliance with EU and ICNIRP guidelines.

Regional or Local measures

National Non-Quantitative Measures

WHO web site contains reference to Planning and Development Act November 2001; details not known

Industry Voluntary Measures

Country: Israel	
last update 25/06/15 information from Shaiela Kandel, Ronen Hareuveny, and source documents	

National Quantitative Limits

NO LONGER IN FORCE					
Originating Organisation:					
Document Reference: 2001					
Frequencies Covered:					
Status: "Environmental Guideline". Applied from 2001-2004					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public		B		1 μ T 0.2 μ T	24 hour TWA Value to aim to reduce to. No need to reduce below this value.

Originating Organisation: Ministry of Environmental Protection (MOEP) and Ministry of Health					
Document Reference:					
Frequencies Covered:					
Status: used as basis for giving installation permits for new installations (lines, transformers, trains etc) For lines, railways: value defines the zone where no uncontrolled exposure (homes, offices, agricultural work) is permitted.					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Limit used in granting permits	B		200 μ T	Acute exposure
				0.4 μ T	Chronic exposure, 24 hour average over day in year with highest electricity consumption.
				0.2 μ T	Chronic exposure, annual average

transformers: value at 3 m away
chronic exposure: more than 4 hours per day, five days per week

Originating Organisation: Knesset					
Document Reference: Non-ionizing radiation law 2006 Approved by the Knesset on 19 Kislev 5766 (December 20, 2005); the bill and the explanatory notes were published in the "Bills of the Government – 184", on 15 Sivan 5765 (June 22, 2005), page 894.					
Frequencies Covered:					
Status: Law					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public				Not yet published	.

Note: The law requires regulations to be published giving values to be used in issuing permits. If regulations are not published, decisions will comply with the report of the Expert Committee on magnetic fields generated by the electricity network as published in the Environment Ministry's website. Regulations have not yet been published so in principle the Expert Committee recommendations (detailed below) apply. But in practice, the values used by the Ministries in granting permits (see above) over-ride this.


Originating Organisation: Expert Committee on magnetic fields generated by the electricity network					
Document Reference: Recommendations of the Experts Committee on Exposure to Magnetic Fields Generated by the Electricity Network					
Frequencies Covered:					
Status: When published, recommendations. Acquire legal force through 2006 law 9(see above)					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public		B		100 μ T	Existing facilities: fund of \$2M pa for reducing exposures New facilities: setback distances 400 kV, 161 kV and 11-36 kV power lines shall be 35, 20 and 3 m, Plus phase cancellation

Plus general precautionary recommendation (no limits)

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Italy	
Last update 2/12/10	

National Quantitative Limits

Status of EU Recommendation: Given force by Decree, which also sets more restrictive levels for power lines					
Originating Organisation:					
Document Reference: Decree of the Prime Minister July 8, 2003. Establishing the exposure limits, attention values and quality targets for the protection of the population from exposure to electric and magnetic fields at the network frequency (50 Hz) generated by power lines. (<i>Gazzetta Ufficiale della Repubblica Italiana n. 200 of 29-8-2003</i>)					
Frequencies Covered: 0-100 kHz					
Status: Decree, legal force under law number 36/2001, promulgated 22/2/1, Official gazette 55 of 7/3/1. Supersedes previous Decree of the Prime Minister, 23/4/92, <i>Gazzetta Ufficiale della Repubblica Italiana</i> , N.104, 6/5/1992.					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public, 50 Hz, power lines only	Exposure limit	E		5 kV m ⁻¹	
		B		100 µT	
	Attention value	B		10 µT	24 hours median value, normal operating conditions. Limit for daily exposure duration >4 hours
	Quality target	B		3 µT	maximum continuous operation current according to Italian Technical Standard CEI 11-60. New power lines and new premises.
Public, all other fields 0-100 kHz					Apply EU Recommendation of 1999

Attention values: values of electric, magnetic and electromagnetic field which shall never be exceeded in houses, schools, and places assigned to a long human presence (where people are staying for 4 hours or more per day); Quality target: values of electric, magnetic and electromagnetic field in order to gradually minimize the exposure to the electromagnetic fields in houses, schools, and places assigned to a long human presence (where people are staying for 4 hours or more per day).

The Law also introduces the concept of respect widths for power-lines as the space where the presence of any new building where people are staying for 4 hours or more per day is forbidden. The same D.P.C.M. explains that respect widths refer to quality targets and are calculated with the maximum continuous operation current (ref. § 2.6 Italian Technical Standard CEI 11-60) and that quality targets must be respected:
 by new lines towards existing buildings (areas where there's the possibility of daily exposure of population not less than four hours)
 by new buildings (areas where there's the possibility of daily exposure of population not less than four hours) towards existing lines

Regional or Local measures

Three Italian regions, Veneto, Emilia-Romagna and Toscana, have set exposure limits for power lines at 0.2 µT for new installations near nurseries, schools, hospitals, houses and places where people spend more than four hours per day. Veneto also has a similar limit of 0.5 kV/m. These have been declared illegitimate and the National Decree prevents further Regions doing likewise.

Regione Toscana – Regolamento in materia di linee elettriche ed impianti elettrici
 Regolamento relativo alla legge n.51 – 11 agosto 1999

Emilia-Romagna: legge sull-elettromog

Legge Regionale 31 Ottobre 2000 n.30

Bollettino Ufficiale della Regione del Veneto – 26-10-1999 – N.93
Legge Regionale 22 ottobre 1999, n.48

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Japan	
Last update 9/2/2012 2012 update from Nomura Research Institute	

National Quantitative Limits

Originating Organisation: Japan Society for Occupational Health					
Document Reference:					
Frequencies Covered: static - 300 GHz					
Status: No legal status					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational				"consistent with ICNIRP"	

Originating Organisation: Ministry of International Trade and Industry					
Document Reference: Technical Standards for electrical facilities, Article 112, Ministry of International Trade and Industry, Japan 1973. Also Ministerial Ordinance of Standards for Electrical Equipment 1976.					
Frequencies Covered: power lines only					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public (overhead powerlines only)	Limit	E		3 kV m ⁻¹	Does not apply where people are rarely present

Originating Organisation: Nuclear and Industrial Safety Agency of Ministry of International Trade and Industry					
Document Reference: Amendment to Ministerial Ordinance of Standards for Electrical Equipment 1976, promulgated 31 March 2011, came into force 1 October 2011.					
Frequencies Covered: power lines only					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public (electric power facilities only)	Limit	B		200 µT	

Country: Latvia	
Last update 24/8/2010 Information from AS Augstsprieguma tīkls	

National Quantitative Limits

Status of EU Recommendation: Will be implemented					
Originating Organisation:					
Document Reference: LVS (Latvian Standard) ENV 50166 1995 "Human exposure to electromagnetic fields. low frequencies (0 Hz – 10 kHz)" Rules of Minister Cabinet No. 745 "Regarding safety of employees because of risks in working environment due to exposure to EMF" Will come into force on 30 April 2012					
Frequencies Covered: ENV 50166: 0 Hz – 10 kHz. Rules No 745 0-300 kHz					
Status: recommended					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Limit	E		10 kV/m	
		B		500 µT	

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Lithuania	
Last update 2002	

National Quantitative Limits

Originating Organisation: The Ministry of Health of the Republic of Lithuania, The Ministry of Social Security and Labor of the Republic of Lithuania 21/12/901					
Document Reference: Lithuanian Hygiene Norm (HN) 110: 2001 Electromagnetic field of 50 Hz frequency in work places. Permissible digital levels and measurement requirements, approved by joint Order of the Minister of Health and the Minister of Social Security and Labour 21/12/00					
The Ministry of Energy of the Republic of Lithuania "Safety rules for the maintenance of power installations" 26/11/2004 establish that occupational exposures are regulated by Hygiene Norm 110.					
The Ministry of Social Security and Labor of the Republic of Lithuania "Regulations on staff protection against the risks of electromagnetic fields" 25/4/2006 implements EU Directive 2004/40/EC					
Frequencies Covered: 50 Hz					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Order	E		5 kV/m	Minimum*
				25 kV/m	Maximum [#]
		B		720 µT	Minimum*
				4080 µT	Maximum [#]

* Limit where protection measures not applied

[#] Limit where screening measures are applied. Working time is limited.

Status of EU Recommendation:					
Originating Organisation: The Ministry of Health of the Republic of Lithuania 04/01/01					
Document Reference: Lithuanian Hygiene Norm (HN) 104: 2000 Protecting the public against electromagnetic fields emitted by overhead power lines approved by Order of the Minister of Public Health 4/1/2					
Frequencies Covered: specific to power lines					
Status: legally binding					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Order	E		5 kV/m	Protection zone 30 m. Sanitary protection zone 300 m.
		B		no limit	

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Luxembourg



Last update 31/7/10
information from Eurelectric and ENTSO(E) members

National Quantitative Limits

Status of EU Recommendation: No plans up to now to give Recommendation any national force.

Originating Organisation: ITM division for Security and Health

Document Reference: "loi du 10 juin 1999 relative aux établissements classes"; ITM-CL 10.2 (12.11.1997)
This national act of 10 June 1999 on classified establishments where the HV lines belong to, does not tackle EMF issues and no limits are in it.
Security prescriptions released by the "Inspection du Travail et des Mines, ITM division for Security and Health" refer to the term of the German 26th BlmschV and apply the following limitations: E= 5kV/m; B = 100 μ T for permanent exposure and to DIN/VDE 0848 for short term exposure. These limits are applied by ITM in their construction permit for the lines.

Frequencies Covered: This ITM prescription applies to power systems (50Hz) only

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Everyone, permanent exposure	Limits	E		5 kV/m	New or modified installations;
		B		100 μ T	New or modified installations;

A recently received permitting paper for a new OH line delivered by the Department of Environment of the Government requested a limitation of 1 μ T for sensitive places like

- space where people stay regularly during a certain amount of time (this is very imprecise definition);
- public or private playgrounds
- not yet built places where the activities mentioned before are allowed based on a general approved future development plan

The legal status of this is being challenged.

Regional or Local measures

National Non-Quantitative Measures

The government released a circular 1644 (ref 26/94) of 11 March 1994 to local authorities recommending that land in the immediate proximity of high voltage power lines should no longer be approved as building land. This circular is not based on a legal act.

Industry Voluntary Measures

Country:
Macedonia



Placeholder added 3/2/10

National Quantitative Limits

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Malta



Last update 9/7/2

National Quantitative Limits

Status of EU Recommendation:

Originating Organisation: Ministries of Health, Transport and Communications, and Social Policy

Document Reference: Report on Recommendations for limiting human exposure to time-varying electric, magnetic and electromagnetic fields in the frequency range from 0 Hz to 300 GHz, August 25 2000

Frequencies Covered: 0 – 300 GHz

Status: Recommendation

Values identical to ICNIRP

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Montenegro




Placeholder added 3/2/10

National Quantitative Limits

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Netherlands	
Last update 1/4/11	
Compiled from various informants including Anco Veldhuizen, Tennet TSO, and Tennet workshop 1/4/11	

National Quantitative Limits

Status of EU Recommendation: No plans to create legislation					
Originating Organisation: Ministry of Housing, Spatial Planning and the Environment					
Document Reference: Letter of October 3 2005 of the Ministry of Housing, Spatial Planning and the Environment on overhead powerlines, reiterated in letter of 4 November 2008					
Frequencies Covered:					
Status: Advice to local and regional authorities and power companies					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	Values as ICNIRP				
Children where exposure from power line of long duration*	Advice	Annual average** field calculated from power line		0.4 μ T	Applies to new power lines / new dwellings only, where reasonably possible***

* dwellings, schools and crèches. Letter of 4 November 2008 specified "long stay" is at least 14-18 hours a day during one year and specifies that gardens are included with houses.

** "Calculation Guide" specifies how to calculate this. Use clearance for 15 °C. Use load as 90 °C rating (for aluminium/steel conductors, 70 °C for copper), multiplied by 30% (220/380 kV, derived from average of two years' load data) or 50% (110/150 kV, derived from N-1 criterion) to get estimate of annual average.

*** If value is exceeded, TSO policy is to offer to buy homes or pay compensation if owner prefers to remain, but it is not yet a requirement to remove such homes. Recent court action could force government to clarify this.

Last update 9/7/2					
Compiled from source document					
Originating Organisation: Health Council of the Netherlands, ELF Electromagnetics Fields Committee					
Document Reference: The Hague, Health Council of the Netherlands 2000, Publication Number 2000/6					
Frequencies Covered: 0 – 10 MHz					
Status: Advisory Report, effectively superseded by more recent advice					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational exposure	Basic Restriction	j	Body, head included	25 mA m ⁻²	
			Body, head excluded	100 mA m ⁻²	
	Investigation Level	E	Body, head included	62.5 kV m ⁻¹	Indirect effects not possible
			Body, head excluded	250 kV m ⁻¹	
				40 kV m ⁻¹	Indirect effects possible
	B		600 μ T		
General population	Basic Restriction	j	Body, head included	5 mA m ⁻²	
			Body, head excluded	20 mA m ⁻²	
	Investigation Level	E		8 kV m ⁻¹	
			B		120 μ T

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
New Zealand



last update 19/8/16
information supplied by Martin Gledhill, formerly Ministry of Health

National Quantitative Limits

Originating Organisation: Ministry of Health

Document Reference: Ministry of Health. 2015. Interagency Committee on the Health Effects of Non-ionising Fields: Report to Ministers 2015. Wellington: Ministry of Health. Published in April 2015 by the Ministry of Health.

Status: Report from Ministry of Health technical advisory committee

“The Ministry of Health recommends the use of guidelines published by the International Commission on Non-Ionising Radiation Protection (ICNIRP)* to manage public exposures to ELF fields. (Worksafe recommends their use for occupational exposures.)

.....

The Ministry of Health recommends that the occupational limits should only be applied to people such as electricians or others who are aware of their exposures and trained in any precautions that might be necessary. In homes, offices and most other work sites, the public limits should apply.”

* The text makes clear that this refers to the most recent ICNIRP guidelines, i.e. for power frequencies, ICNIRP 2010.

Document Reference: 2008 National Policy Statement on Electricity Transmission (the Transmission NPS)**

Status: Instrument under the Resource Management Act 1991

Policy 9:

Provisions dealing with electric and magnetic fields associated with the electricity transmission network must be based on the International Commission on Non-Ionising Radiation Protection Guidelines for Limiting Exposure to Time Varying Electric Magnetic Fields (up to 300 GHz) (Health Physics, 1998, 74(4): 494-522) and recommendations from the World Health Organisation monograph Environment Health Criteria (No 238, June 2007) or revisions thereof and any applicable New Zealand standards or national environmental standards.

Document Reference: The Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009**

Status: Instrument under the Resource Management Act 1991

Require that following certain types of upgrade or maintenance work to pre-2010 transmission lines, the electric and magnetic fields should comply with the (now superseded) 1998 ICNIRP guidelines. An evaluation of these regulations may take place in 2015, and this may provide an opportunity to consider referencing the ICNIRP 2010 guidelines, whose use is recommended by the Ministry of Health.

** Both instruments only apply to transmission lines (and, in the case of the Transmission NPS, associated infrastructure such as substations), but not, say, to local electricity distribution infrastructure.

Regional or Local measures

Some district plans have guidance based on the Transmission NPS, and also cover other activities that produce ELF fields.

National Non-Quantitative Measures

“In addition to compliance with the numerical limits in the ICNIRP guidelines, the Ministry also encourages the use of low or no-cost measures to reduce or avoid exposures, and supports this approach for the siting of new electrical facilities.”

(Interagency Committee Report 2015 cited above)

Industry Voluntary Measures

Country:
Norway



last update 17/9/15
information from various Eurelectric and ENTSO(E) members

National Quantitative Limits

Reported that Norway uses "ICNIRP", and therefore now uses ICNIRP 2010.

Regional or Local measures

National Non-Quantitative Measures

Status of EU Recommendation:

Originating Organisation: Norwegian Radiation Authority, resulting from Parliamentary debate following High Court decision in 2007

Document Reference: Lov om strålevern og bruk av stråling (strålevernloven) av 12. mai 2000. Forskrift om strålevern og bruk av stråling (strålevernforskriften).
<http://www.regjeringen.no/nb/dep/fin/dok/regpubl/stprp/20052006/stprp-nr-66-2005-2006-.html?id=139085> (s 61-65, in Norwegian only)


Frequencies Covered:

Status:

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
General population	Investigation level. If exceeded, must evaluate possible methods for reducing exposure, but only required to take those measures if they evaluated as "reasonable"	B		0.4 μ T (annual average)	Applies to new homes, kindergartens and schools, and new power lines

"to prevent disease, to reduce concern and fear, for better visual aspect, for increased operational reliability"

Industry Voluntary Measures

Country: Paraguay	
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National Quantitative Limits

Originating Organisation:					
Document Reference: Federal Law 716/96					
Frequencies Covered:					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Framework law establishing penalties for exceeding limits but no limits fixed yet					

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Philippines



last changed 31/1/11

National Quantitative Limits

Newspaper report January 2011 refers to "the 833 mG [83.3 μ T] exposure limit set by the International Commission on Non-Ionizing Radiation Protection that has been adopted by the Department of Health (DoH)"

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Poland	Last update 30/7/10 Information from Polish System operator
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National Quantitative Limits

Originating Organisation: Polish Ministry of Labor and Social Policy					
Document Reference: Ordinance of the Polish Ministry of Labor and Social Policy, November 29, 2002, Journal of Law No 217/2002 para 1833 with further amendments					
Frequencies Covered: 0 - 300 GHz					
Status: Law, effective from June 2003					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Limit	E		10 kV m ⁻¹	
		B		200 A m ⁻¹ = 160 μT	Not applied in high voltage lines

Limits shown are between "intermediate zone" (exposure allowed for <8 hours per day) and "risk zone". Limits between "safe zone" (exposure allowed indefinitely) and "intermediate zone" are 3 times lower. Limits between "risk zone" and "dangerous zone" are 10 times higher.

Originating Organisation: Ministry of Environment					
Document Reference: Ordinance of Ministry of Environment from October 30, 2003; Official Journal No 192/2003, pos.1883					
Frequencies Covered: 0 – 300 GHz					
Status: Law					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	limit	E		10 kV m ⁻¹	Residential areas
				1 kV m ⁻¹	
		B		60 A m ⁻¹ = 48 μT	

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Portugal



Last update 20/3/11
Information from Sara Carvalho Fernandes, Energias de Portugal
and Jose Peralta, REN

National Quantitative Limits

Originating Organization: Portuguese Government.

Status of EU Recommendation: Implemented as national Law.

Frequencies Covered: 0 Hz – 300 GHz

Status: National Law

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
General public exposure, when the time of exposure is significant*	Basic Restriction	J	Central nervous system	2 mA m^{-2}	Average over 1 cm^2
		E		5 kV m^{-1}	
	Reference Level*	B		$100 \text{ }\mu\text{T}$	
		Contact current		0.5 mA	

* Implied that compliance is required with reference levels and for all power lines at all times

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Romania



Last updated 30/4/10

National Quantitative Limits

Originating Organization: Ministry of Labour and Social Solidarity

Document reference: No 655/10.09.97: "Specific occupational health and safety standards for the transportation and distribution of electrical energy"

Status of EU Recommendation: Voluntary compliance

Frequencies Covered: 50 Hz


Status: Mandatory standard

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
		Implies it has E field values only			

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Russian Federation	
Last update 30/4/10 Source documents available but in Russian	

National Quantitative Limits

Originating Organisations: Russian Parliament, signed by the President; State Committee of Standardization; Ministry of Public Health					
Document References:					
Occupational: Standard: GOST 12.1.002–84 Occupational safety standards system. Power frequency electric fields. Permissible levels of field strength and requirements for control at work-places Sanitary Regulation: SanPiN 5802–91 Sanitary norms and regulations of work in power frequency (50 Hz) electric fields exposure conditions Sanitary Regulation: SanPiN 2.2.4.723–98 Power frequency magnetic field (50 Hz) in occupational environment					
General Public: Federal law "The sanitary-epidemiological welfare of the population" from March 30th, 1999 no. 52–FZ Sanitary Regulation: MSanPiN 001–96 Sanitary norms of permissible levels for physical factors during use of domestic articles Sanitary Regulation: SanPiN 2.1.2.1002–00 Sanitary-epidemiological requirements for living buildings and locations					
Frequencies Covered: 50 Hz					
Status:					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational		E		$50/(T+2) \text{ kV m}^{-1}$	T is duration of exposure in hours
				25 kV m^{-1}	ceiling limit
				25 V m^{-1}	VDU use
		B		0.1 mT	work day limit (8 hours)
				2 mT	ceiling limit
				$0.25 \text{ }\mu\text{T}$	VDU use
Public		E		500 V m^{-1}	assumed to be residential buildings
				1000 V m^{-1}	living areas outside buildings
				$10 \text{ }\mu\text{T}$	assumed to be residential buildings
		B		$50 \text{ }\mu\text{T}$	living areas outside buildings

Reported that from Nov 2007 public limits will be:
5 μT in residential buildings
10 μT outdoors in residential areas

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Serbia



Placeholder added 3/2/10

National Quantitative Limits

National law introduced 2009; values unknown. Previously transmission company followed "WHO recommendations".

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Singapore



last update 12/5/5
information from WHO

National Quantitative Limits

Originating Organisation: Health Sciences Authority

Document Reference: Health and safety Guideline on EMF Exposure 2001

Frequencies Covered:

Status: Voluntary

Applies ICNIRP values

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Slovak Republic



Last update 30/7/10
information from Slovenská elektrizačná prenosová sústava a.s.

National Quantitative Limits

Originating Organisation: Slovak Government, Ministry of Health

Document Reference: Announcement 534/2007 issued 16. 8. 2007, and decree 329/2006 issued 10.5.2006, restrictions on human bodies

Frequencies Covered: 0 Hz – 2.5 kHz

Status: National Law

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment	
Occupational exposure	Basic Restriction	J	Head and torso	10 mA m^{-2}	4Hz-1000Hz	
	Reference Level	E		10 kV m^{-1}	50Hz	
		B			$500 \text{ }\mu\text{T}$	50 Hz
		Contact current			1 mA	0 - 2,5 kHz
General public exposure	Basic Restriction	J	Head and torso	2 mA m^{-2}	4Hz-1000Hz	
	Reference Level	E		5 kV m^{-1}	50 Hz	
		B			$100 \text{ }\mu\text{T}$	50 Hz
		Contact current			0.5 mA	0 - 2,5 kHz

Previous information from WHO web site: Decree No 123/1993 (Coll.) on the protection of health from the harmful effects of electromagnetic fields, based on ICNIRP values.

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Slovenia



last update 30/4/10

National Quantitative Limits

Status of EU Recommendation:

Originating Organisation: Ministry of Environment

Document Reference: Decree on Electromagnetic radiation in the natural and Living Environment 1996, revised 2004

Frequencies Covered:

Status: Decree

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public (electric power facilities >1 kV)	Limit	E		10 kV m ⁻¹	
		B		100 µT	
	Limit, new facilities, first protected areas*	E		500 V m ⁻¹	
		B		10 µT	

* hospitals, health resorts, residential areas, tourism buildings, nurseries, schools, playground, public parks and recreational areas, public centres which include services and restaurants

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
South Africa



last update 9/7/2
compiled from source document

National Quantitative Limits

Originating Organisation: National Department of Health

Document Reference: Hazardous Substances Act, 1973 (Act 15 of 1973) - Limits for Human Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields in the Frequency Range up to 300 GHz

Frequencies Covered: 0 – 300 GHz

Status: Mandatory

Values as ICNIRP

WHO website suggests the Act does not give values and compliance with ICNIRP is voluntary, recommended by Department of Health

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
South Korea (Republic of Korea)



Last update 19/8/16
information supplied by Professor Kim, Hoseo University

National Quantitative Limits

Originating Organisation: Ministry of Information & Communication

Document Reference: Guidelines for Human Protection from EMF Exposure 2001

Frequencies Covered:

Status: Ordinance but voluntary compliance (details of status not clear)

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	"Reference Level"	E		10 kV m ⁻¹	
		B		500 μT	
Public	"Reference Level"	E		5 kV m ⁻¹	
		B		100 μT	

Compiled from WHO web site. May be superseded.

Originating Organisation: Ministry of Trade, Industry and Energy

Document Reference: Korean Electrical Code, article 17

Frequencies Covered: 0 ~300Hz

Status: Mandatory standard

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Public	limit	E		3.5 kV/m	
		B		83.3 μT	

Regional or Local measures

National Non-Quantitative Measures

No precautionary policy is formally established. However, no residential house has been exposed to 0.4 μT by recently built power lines after experiencing long/persistent consulting with concerned residents. This implies that the precautionary policy already came to be implemented in substance.

In 2015 "Act of compensation and support for areas adjacent to transmission and substation facilities" was enacted and this includes the followings. "Residents within a 180/60m radius from recently built 765/345kV power lines can claim for the purchase of the corresponding house, and land within a 33/13m radius is partly compensated."

Industry Voluntary Measures

Country:
Spain



last update 12/7/2

Compiled from WHO web site, corrected with information from Juan Bernar Solano

National Quantitative Limits

Status of EU Recommendation: Royal Decree 2001 establishes values for 9 kHz – 300 GHz based on EU Recommendation. No action taken for power frequencies.

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Red Electrica voluntarily follow EU Recommendation

Country:
Sweden



last update 1/10/2009

National Quantitative Limits

Status of EU Recommendation: No plans to incorporate in law, but continue to apply the precautionary principle

Regional or Local measures

Stockholm has limit of 2 μ T
Old lines should comply with 4 μ T annual average
These are old provisions which are now superseded by the national approach

National Non-Quantitative Measures

Originating Organisation: Swedish National Board of Occupational Safety and Health, National Board of Housing, Building and Planning, National Electrical Safety Board, National Board of Health and Welfare, Radiation Protection Institute.

Document Reference: Low-frequency electrical and magnetic fields: the precautionary principle for national authorities. Guidance for decision makers. September 1996.

includes statement:

“If measures to reduce exposure can be taken at reasonable expense and with reasonable consequences in all other aspects, an effort should be made to reduce fields radically deviating from what could be deemed normal in the environment. Where new electrical installations and buildings are concerned, efforts should be made already at the planning stage to design and position them in such way that exposure will be limited. “

The following section considers “what is meant by a normal magnetic field level?” and states that the median value for homes and day nurseries in major towns or cities is approximately 0.1 μ T, with 10% of homes having at least one room with a magnetic field exceeding 0.2 μ T. It therefore suggests, without being explicit, that “radically deviating from normal” should be understood in relation to these figures.

Industry Voluntary Measures

Swedish Transmission utility has voluntary policy of 0.4 μ T annual average for new lines.

Country:
Switzerland



Last update 1/4/11

Compiled from source document. Information on exemptions from conversations at meetings.

National Quantitative Limits

Status of EU Recommendation:

Originating Organisation: Bundesrat (Upper House)

Document Reference: Ordinance concerning protection from non-ionising radiation (NISV). 23 December 1999

Frequencies Covered: 0 – 300 GHz

Status: Legal requirement from 1 Feb 2000. Existing constructions have three years in which to meet requirements.

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment	
Everyone (exposure from fixed facilities only) (does not apply to staff operating the plant which produces the field)	Limit	E		5 kV m ⁻¹	In operational premises, excludes in-house sources	
		B		100 µT		
	Limit, any one installation, "sensitive use locations"	B, overhead line or underground cable >1 kV			1 µT	New installations: exemptions possible if all reasonable [#] measures taken. Old installations: does not apply provided phases optimised
		B, transformer station, substation or switching station			1 µT	New and old installations: Exemptions possible if all reasonable [#] measures taken.
		B, Railways and trams			1 µT (mean over 24 hours)	New installations: exemptions possible if all reasonable [#] measures taken. Old installations: does not apply provided return conductor fitted
	Interior electrical installations				New installations to be in accordance with best available technology (so as to reduce field)	

^{*} includes rooms in buildings regularly occupied for significant periods of time; children's playgrounds designated as such under planning law (but not private gardens); and undeveloped land where the above forms of utilisation are permitted

[#]Exemptions may be granted if all technically and operationally feasible and financially viable measures have been taken. Indications from Swiss utility are that around 10 exemptions have been issued for fields up to 3 µT and one for 5 µT.

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
Taiwan



last update 12/5/5

National Quantitative Limits

Originating Organisation:

Document Reference: Limits for environmental exposure to non-ionising radiation 2001

Frequencies Covered:

Status:

Public only

Values as ICNIRP

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country: Ukraine	
last update 30/11/12 reference in paper by Okun et al 2012	

National Quantitative Limits

Originating Organisation:
Document Reference:
Frequencies Covered:
Status:
Occupational limit 1750 μ T

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Country:
United Kingdom



last update 19/8/16
Compiled from source documents

National Quantitative Limits

Status of EU Recommendation: Applied as part of new NRPB advice 2004

Originating Organisation: National Radiological Protection Board (subsequently became Health Protection Agency)

Document Reference: "Advice on Limiting Exposure to Electromagnetic Fields (0-300 GHz)" Documents of the NRPB vol 15 no 2 2004. Adopted "in the terms of the EU Recommendation" by letter from Government to NRPB 22 July 2004. Further details in Code of Practice February 2011.

Frequencies Covered: 0 – 300 GHz

Status: Government policy with no direct legal force. But the general legal duty to act safely (Health and Safety at Work Act 1974) is interpreted in terms of compliance with this guidance. Compliance is written in to the procedures for obtaining consent for new high-voltage power lines.

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
General public exposure, where time of exposure is significant ²	Basic Restriction	J	Central nervous system	2 mA m ⁻²	Average over 1 cm ²
	Reference Level	E		5 kV m ⁻¹	
		B		100 µT	
		Contact current		0.5 mA	
		Stress resulting from surface charge		Should be avoided	

² Government policy in form of Written Ministerial Statement 16 October 2009 states: "...the UK Government considers that exposure for potentially significant periods of time might reasonably be regarded as referring to residential properties, and to properties where members of the public spend an appreciable proportion of their time." (para 42).

Health Protection Agency advise that the basic restrictions should be taken as corresponding to the following values for uniform whole-body exposure:

	Magnetic	Electric
Public	360 µT	9 kV/m

Originating Organisation: Health and Safety Executive

Document Reference: Control of Electromagnetic Fields at Work Regulations 2016*

Frequencies Covered: 0 Hz – 300 GHz

Status: Legally binding


Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment		
Occupational exposure	Sensory Effects Exposure Limit Value	In-situ electric field	Central nervous system (excludes spinal cord)	140 mV/m peak [≈ 100 mV/m rms]			
				Low Action level	E	10 kV m ⁻¹	
	Health Effects Exposure Limit Value	In-situ electric field	peripheral nervous system	1.1 V/m peak [≈ 800 mV/m rms]			
				High Action level	E	20 kV m ⁻¹	
				B	6 mT		
	Action level	Contact current	limbs	18 mT			
				1 mA			

* In Northern Ireland, the same limits are enacted by the Control of Electromagnetic Fields at Work Regulations (Northern Ireland) 2016 (S.R. 2016 No. 266)

Regional or Local measures

National Non-Quantitative Measures

Government policy introduced 16 October 2009 also involves optimal phasing of power lines as a precautionary measure to reduce fields: "The Government ... urges industry to optimal phase overhead lines wherever possible and reasonable. We will proactively work with industry to consider how best to take this forward. This might include developing a voluntary code of practice on phasing for voltages of 132kV and above." "Optimum Phasing of high voltage double-circuit Power Lines A voluntary Code of Practice" was published 2011.

Country: USA	
Compiled from source document 60 Hz values (where different from 50 Hz values) given in italics	

National Quantitative Limits

Originating Organisation: ACGIH					
Document Reference: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices 2000					
Frequencies Covered: 0 – 30 kHz (radiofrequencies in separate section)					
Status: Advisory (non-governmental organisation)					
Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational	Threshold Limit Value	E		25 kV m ⁻¹	Applies away from surfaces of conductors
		B	whole or partial body	1200 µT <i>60 Hz: 1000 µT</i>	
			arms and legs	6 mT <i>60 Hz: 5 mT</i>	
			hands and feet	12 mT <i>60 Hz: 10 mT</i>	

Regional or Local measures

USA (specific States)				
These limits apply specifically to power lines				
				last update 21/10/2002
<i>these values are assumed to be specific to power lines and are therefore 60 Hz</i>				
State	Area where limit applies	Quantity	Limit	Comment
Florida	Edge of right-of-way	E	2 kV/m	
		B	15 µT <i>20 µT</i>	230 kV lines 500 kV lines
	Everywhere	E	8 kV/m <i>10 kV/m</i>	69-230 kV lines 500 kV lines
Minnesota	Everywhere	E	8 kV/m	
Montana	Edge of right-of-way	E	1 kV/m	May be waved by landowner
	Road crossings	E	7 kV/m	
New Jersey	Edge of right-of-way	E	3 kV/m	
New York	Edge of right-of-way	E	1.6 kV/m	
		B	20 µT	
	Public road crossings	E	7 kV/m	
	Private road crossings	E	11 kV/m	
	Everywhere	E	11.8 kV/m	
Oregon	Accessible or inhabited areas	E	9 kV/m	

In addition, the following States have versions of “prudent avoidance” applied to new power lines:

- Colorado, Maryland: prudent avoidance decided through a specific siting case which set precedent and was subsequently applied to all new siting applications
- New Jersey: more of a practice than a policy
- Connecticut, Hawaii: formal policy
- Ohio: requires utilities to “prudently address” EMF issues
- Pennsylvania: staff handling siting applications expect evidence of prudent avoidance but has never been set down as formal policy

National Non-Quantitative Measures

Country:
Venezuela



Last update 4 May 2007

National Quantitative Limits

Originating Organisation:

Document Reference: COVENIN 2238:2000

Frequencies Covered:

Status: Technical Standard

Applies to:	Type of Restriction	Quantity	Part of Body	Value	Comment
Occupational		H		333 mA/m	
		E		8.33 kV/m	
Public		H		83.3 mA/m	
		E		4.17 kV/m	

Assumed specific to 60 Hz

Values as quoted in mA/m but are probably actually A/m

Regional or Local measures

National Non-Quantitative Measures

Industry Voluntary Measures

Record of revisions

Revision 1a November 2000: updated Italy
Revision 1b March 2001: added Argentina and Italy
Revision 2 April 2001: added IEEE draft and USA states
Revision 2a April 2001: revised draft Italian decree
Revision 2b May 2001: updated Hungary
Revision 2c June 2001: added new Poland occupational
Revision 2d July 2001: added note on Italy
Revision 2e August 2001: added more detail on Argentina
Revision 2f September 2001: updated Hungary
Revision 2g September 2001: minor change to Ireland
Revision 2h December 2001: revised Italy and France
Revision 3 April 2002: brought in line with EU Implementation Report
Revision 3a May 2002: updated through Eurelectric
Revision 3b July 2002: added data from WHO web site
Revision 3c July/August 2002: revised with input from Eurelectric members
Revision 3d August 2002 further Eurelectric data
Revision 3e October 2002 checked USA data against NIEHS Blue Book
Revision 3f January 2003: typographical changes, IEEE C95.6 final version
Revision 3g February 2003: updated Finland
Revision 3h March 2003: removed lapsed Italian details
Revision 3i May 2003: new information on Austria
Revision 3j September 2003: new Italian decree
Revision 3k May 2004: extra detail on France, new advice in UK
Revision 3l March 2005: Italian regions, UK new limits, text of Swedish precautionary advice
Revision 3m May 2005: add China, Singapore, Taiwan, Israel, update Poland
Revision 4 December 2005: revised Hungary, Greece, Portugal, Netherlands, Europe occupational, added flags and hyperlinks
Revision 4a May 2007: added Brazil, Columbia, Paraguay, Venezuela
Revision 4b October 2007: added placeholder for new Russian standard, added deferment of Europe occupational
Revision 4c September 2008: updated from EU Second Implementation report
Revision 4d October 2009: update Nordic countries from Eurelectric information, new UK precautionary policy
Revision 4e February 2010: further updates from Eurelectric (Nordic, Greece); changed format; added placeholders for missing ENTSO(E) member countries; updated Bulgaria, Estonia, Romania, Russia, Slovenia from WHO website
Revision 5 August 2010: results from ENTSO(E) members
Revision 5a December 2010: new ICNIRP, update to China, correction to Italy
Revision 5b December 2010: update to Croatia
Revision 5c January 2011: added Philippines, updated Portugal, Austria
Revision 5d April 2011: add details for Netherlands 0.4 μ T, info on exemptions in Switzerland
Revision 5e May 2011: added info on Brazil
Revision 5f January 2012: updated Japan
Revision 5g February 2012: updated Finland, Germany
Revision 5h August 2012: updated Ireland
Revision 5i November 2012: added Ukraine
Revision 5j February 2013: updated Israel
Revision 5k July 2013: update France, Germany
Revision 5l May 2014: update Brazil
Revision 5m June 2015: updates to Israel (not yet definitive)
Revision 6 July 2015: further update Israel; 2013 EU Directive added; formatted with emfs.info branding
Revision 6a September 2015: new information on Norway
Revision 6b August 2016: new information South Korea and New Zealand, new occupational Regulations UK