Open Letter to the Ethic's Committe of Crumlin Childrens' Hospital

Dear Members of the Ethics Committee,

I am writing to you not only as a Fellow of the Irish Computer Society, who actively promoted the Irish Wireless Industry, but also as a father, and someone deeply committed to the welfare of children, our environment and community. I wish to bring to your attention a matter of urgent ethical concern regarding the possible installation of multiple mobile masts at Crumlin Childrens' Hospital.

- **Concern introduction:** It has come to my attention that there are plans to allow installation of multiple mobile telecommunication masts, at Crumlin Children's hospital. While I understand the potential necessity for enhanced communication capabilities, I am deeply concerned about known health risks and implications from microwave signal exposures that may exceed workplace sensory, and public auditory effect limits contained in S.I. 337 of 2016, (Safety, Health and Welfare at Work Act, Electromagnetic Fields), and EU Recommendation, 1999/519/EC.
- **Impact on Health and Safety:** Extract from the legislation[i]:-

'*non-thermal effects... might have a detrimental effect on the mental and physical health of exposed workers. Moreover, the stimulation of sensory organs may lead to transient symptoms, such as vertigo or phosphenes. These effects might create temporary annoyance or affect cognition or other brain or muscle functions, and may thereby affect the ability of a worker to work safely*'

- The possibility that levels of mobile microwave signals (non-ionising) may exceed pubic auditory, and sensory effect limits poses a health risk not only to patients, hospital staff, and the nearby neo-natal unit, but also to the surrounding community. Furthermore, it is concerning that hospital staff may not be informed about known health risks associated with non-thermal exposure to intense pulsed microwave signals. Are all management and hospital staff aware of *'at particular risk',* worker groups? Do staff members with pacemakers, and pregnant women know they are recognised as *'at particular risk'*?
- **Staff and Senior Management Awareness:** Are all workers aware of their legal responsibilities and entitlements, with regards to S.I. 337 of 2016? Have staff been informed, and familiar with EU Commission publications[ii] created to protect *'at particular risk'* worker groups, and assist workplaces implement and comply with their legal obligations re:mitigating wireless health risks, and monitoring same? Are there wireless monitoring systems in place to ensure areas frequented by the public, do not exceed public auditory effect limits?

- **Ethical Considerations:** This situation raises critical ethical questions regarding the Precautionary Principle, Children's Safety First Act, Right to a Safe Environment, and the Duty of Care Crumlin Childrens Hospital has towards its patients, staff, and the wider community.
- Potential health risks associated with exceeding public auditory effect limits, and non-compliance with Irish/EU legislation (1999/519/EC, & 2013/35/EU) necessitate a thorough, and transparent review of regulations, guidelines, and EU Commissin publications.
- Regarding Children's welfare and well-being, Resolution 1815 sent by the Council of Europe is of particular significance as Irish authorities have been informed children are considered 'high-risk', when it comes to pulsed microwave signal exposure[iii].
- **Resolution Request:** I urge the Ethics Committee to:

1. Ensure Crumlin Children's Hospital complies with it's legal obligations to inform and train hospital staff/management about known health risks, and related sensory effects, from non-thermal pulsed microwave signal exposure.
2. Implement measures in the hospital and nearby neo-natal unit, to monitor and mitigate potential health risks arising from any possible mast installation, including public disclosure of non-ionsing radiation levels, staff health risk assessments, and ground shielding of rooftop spaces should the mast installation proceed.
3. Consider alternative options that do not compromise children's health, public health, and occupational health standards e.g. Can mobile operaters implement site & mast-sharing arrangements using the nearby mast infrastructures at Swan Leisure Centre – Comreg Map in Appendix 3.
4. If Crumlin Hospital proceeds in allowing the mobile mast installation, please ensure detailed pre- and post-wireless site-surveys, are conducted within the Childrens hospital and neo-natal unit to ensure there is no increase in pulsed microwave signals compromising public auditory effect limits.
5. Ensure site-survey measurements account for combined exposures of all pulsed microwave signals in spectrum range 0.3 to 10Ghz, ensuring public auditory effect limits are not breached.
6. For workplace compliance and sensory effect limits, wireless site-surveys must measure the combined energy from all pulsed microwave signals in the range 0.3Hhz to 6Ghz (Annex III – Table A2)[iv].
7. Ensure mast installers and any mobile operator intending on using the

mast are fully informed and aware of their legal obligations vis-a-vis S.I. 337 of 2016. It might be an idea to obtain this in writing from senior management from the mast installation company, and any/all mobile operators who intend using the mast.

8. From a Public liability perspective, you may want to ensure that Crumlin Childrens Hospital are not liable for any public health issues. You could request mobile operators to provide public liability insurance covering potential health risks to staff and the general public, regarding any breaches in Public Auditory & Sensory effect limits.
9. From a wireless site-survey perspective, it is worth noting official site-surveys are measured using 6 minutes duration. Mobile phone mast exposure is continuous, and subject to considerable fluctuations throughout any given 24 hour period. Considering the best interests of children and staff, conducting a continuous, longer-term survey ideally spanning a number of days (minimum 24 hrs) to accurately estimate, combined pulsed microwave signal exposure might be a good option.
10. International Comparison. In 2017, the WHO published a list of countries where more enhanced, reduced, and protective microwave signal exposure levels were introduced to protect children and other vulnerable groups of people in hospitals, schools etc. Appendix 2 contains more details.

Appendix 1 – EMF Safety Directive Guidelines

Contains extracts from EU Commission guidelines to assist workplaces implement the EMF Safety Directive. Details about *'at particular risk'* worker groups, and examples of environments where *'at particular risk'* groups are entitled to specific risk assessments.

Appendix 2 – 2017 World Health Organisation & Council of Europe

Contains listing of countries with more enhanced, and robust protection limits for Children, Hospitals, Schools and areas considered 'sensitive use'. It also contains information about the Public Auditory Effect limit, included in 1998 guidelines promoted by the WHO, and advice from the Council of Europe regarding Children being susceptible to brain tumours, and reducing microwave exposure.

Appendix 3 – Comreg Site-surveys, EU Directive & Irish Legislation

Contains an example list of official site-surveys published by Comreg, showing areas in Ireland where the public auditory limit has been breached. From a public liability perspective, Crumlin Childrens' Hospital might want to ensure they are not liable for breaches in public auditory effect limits caused from mast/antenna emmissions located on the premises.

Thank you for giving your attention to this matter, and trust you will take necessary steps to ensure all workplace regulatory obligations are adhered to, and that you will demonstrate a priority ensuring Children's Wellbeing, and Welfare is of paramount importance in all considerations and discussions on how best to proceed.

If interested, I am available to discuss this matter further, and can provide additional information upon request.

Sincerely,

Allan Brennan

Appendix 1

Extracts from EMF Safety Directive Implementation Guidelines

Table 3.1 Workers at particular risk as identified in the EMF Directive

Workers at particular risk	Examples
Workers wearing active implanted medical devices (AIMD)	Cardiac pacemakers, cardiac defibrillators, cochlear implants, brainstem implants, inner ear prostheses, neurostimulators, retinal encoders, implanted drug infusion pumps
Workers wearing passive implanted medical devices containing metal	Artificial joints, pins, plates, screws, surgical clips, aneurism clips, stents, heart valve prostheses, annuloplasty rings, metallic contraceptive implants, and cases of AIMD
Workers wearing body-worn medical devices	External hormone infusion pumps
Pregnant workers	

NB: in considering whether workers may be at particular risk, employers should give consideration to the frequency, level and duration of exposure

Key message: effects of EMF

EMF in the workplace may cause direct or indirect effects. Direct effects are those arising from an interaction of the fields with the body and may be either non-thermal or thermal in nature. Indirect effects result from the presence of an object in the field resulting in a safety or health hazard.

Key message: action levels and exposure limit values

For most employers it will be simpler to demonstrate compliance with action levels than exposure limit values, although compliance distances may well be larger for the former than the latter. Action levels are also provided for some, but not all, indirect effects. Action levels and exposure limit values will not normally provide sufficient protection for workers at particular risk.

Table 3.2 — Requirements for specific EMF assessments in respect of common work activities equipment and workplaces

Type of equipment or workplace	Assessment required for		
	Workers not at particular risk* (1)	Workers at particular risk (excluding those with active implants)** (2)	Workers with active implants*** (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. Wi-Fi or Bluetooth) including access points for WLAN — use of	No	No	Yes
Wireless Communication Devices (e.g. Wi-Fi or Bluetooth) including access points for WLAN — workplaces containing	No	No	No

Key message: EMF assessments

Where the workplace contains only situations listed in Table 3.2 that have a 'No' in all relevant columns it will not normally be necessary to make a specific EMF assessment. A general risk assessment meeting the requirements of the Framework Directive will still be required and employers should remain alert to changing circumstances.

Table B1 — Summary of relevant health and sensory effects used to limit exposures in different frequency regions

Field and frequency	Sensory effects	Health effects
Static magnetic field 0 — 1 Hz	Vertigo, nausea, metallic taste	Altered blood flow in limbs, altered brain function; Altered heart function
Low frequency fields 1 Hz -10 MHz	Phosphenes (perceived as light flashes); (Minor change in brain function 1 — 400 Hz)	Tingling sensation or pain (nerve stimulation) Muscle twitches Disturbed heart rhythm
High frequency fields 100 kHz — 6 GHz	Microwave hearing effect (200MHz — 6.5 GHz)	Excessive whole-body or localised heating or burns
High frequency fields 6 — 300 GHz		Localised heat damage to eyes or skin

Note: Sensory effect limit is approximately 9.7 V/m, which equates to a power/density of 250,000uW/m^2 – continuous-wave (CW) unit conversion. Depending on use-case, pulsed signals may use more energy, therefore exposure levels would need to be reduced.

Appendix 2

2017 World Health Organisation & Council of Europe

Countries with enhanced, and reduced protection limits for Hospitals, Schools, Kindergartens, Eldercare facilities, or areas where people may stay for more than 4 hours.[v]

- Belgium max exposure levels reduced to approx 2% of WHO Guidelines
- Bulgaria max exposure levels reduced to less than 1.5% of WHO Guidelines
- Chile max exposure levels reduced to less than 1.5% of WHO Guidelines
- Italy max exposure levels reduced to less than 1.5% of WHO Guidelines
- Switzerland max exposure reduced to less than 1.5% of WHO Guidelines
- Israel maximum exposure levels cannot exceed 10% of WHO Guidelines
- Greece, when within 300m of Hospitals, Schools, Kindergartens, or Eldercare facilities, maximum non-ionising radiation exposure, $\leq$ 60% ICNIRP limits

Note 1:

Comparisons above use Power/Density exposure limits listed on the Global Health Observatory webpage.

Note 2:

2017 WHO Global Health Observatary is not an exhasutive list of countries with enhanced, and reduced non-ionising radiation protection levels for Children, Hospitals, Schools etc.

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Italy, 2017, Radiofrequency, Power density (W/m^2), 1800 MHz

Comment: The exposure limit is 1 W/m^2. Moreover, in homes, schools, playgrounds and places where people may stay for longer than 4 hours, an 'attention value' of 0.1 W/m^2 is applied and averaged over any 24 hour period. A 'quality goal' for new installations is identical to the attention value.
Value: 0.1/1.0
Details: WHO region: Europe, Exposed: Public
Effective date: 2017-05-31

Close

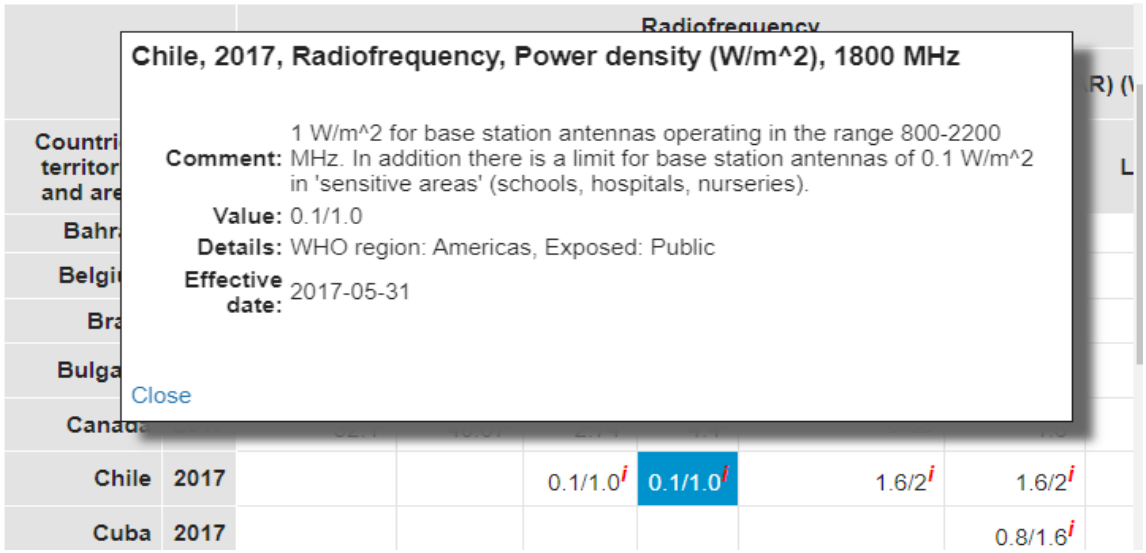
Countries, territories and areas	Year	Radiofrequency						
		Electric field (V/m)		Power density (W/m^2)		Specific absorption rate (SAR)		
		900 MHz	1800 MHz	900 MHz	1800 MHz	Whole body	Head and trunk	
Israel	2017	[13.0]	[18.0]	[0.45]i	[0.9]i	[0.08]	[2]	
Italy	2017	6/20i	6/20i	0.1/1.0i	0.1/1.0i	0.08	2	
Japan	2017	47.55	61.4	6	10	0.08	2	

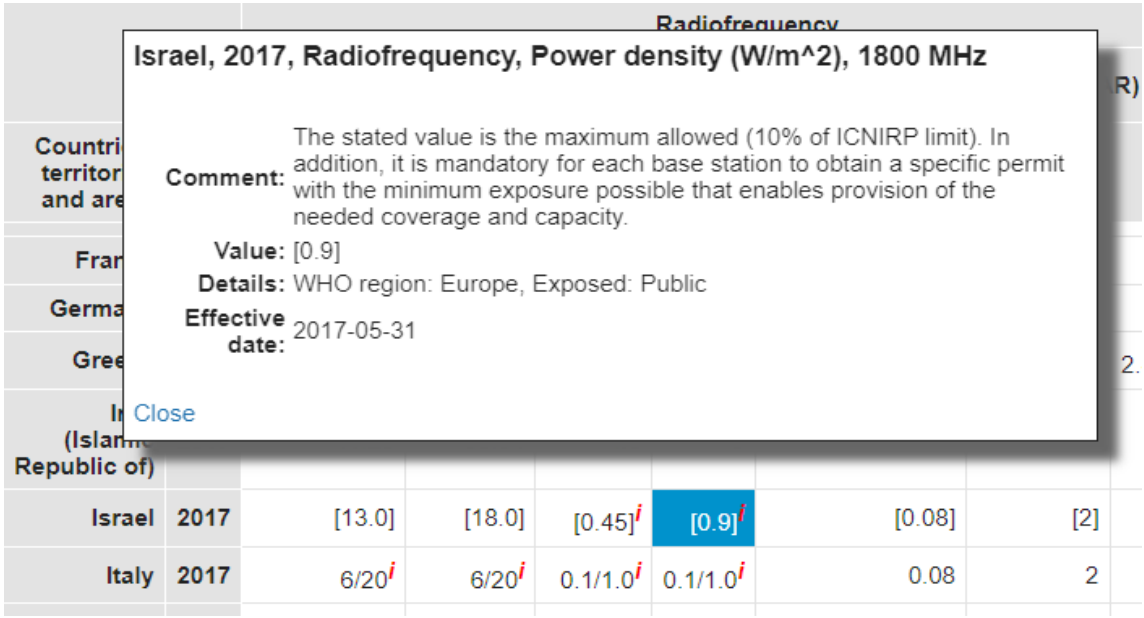
Countries, territories and areas	Year	Radiofrequency						
		Electric field (V/m)		Power density (W/m^2)		Specific absorption rate (SAR)		
		900 MHz	1800 MHz	900 MHz	1800 MHz	Whole body	Head and trunk	
Argentina	2017	41.25	58.36	4.5	9	0.08	2	
Australia	2017	41.1i	58.1i	4.5i	9i	0.08	2	
Austria	2017	41.25	58.34	4.5	9	0.08	2	
Bahrain	2017	41	58	4.5	9	0.08	2	
Belgium	2017	i	i	i	i			

Belgium, 2017, Radiofrequency, Power density (W/m^2), 1800 MHz

Comment: Brussels: 0.192 W/m^2 (maximum total field, each operator gets 33% of the total)
Details: WHO region: Europe, Exposed: Public
Effective date: 2017-05-31

Close


Radiofrequency
Chile, 2017, Radiofrequency, Power density (W/m^2), 1800 MHz
Comment: 1 W/m^2 for base station antennas operating in the range 800-2200 MHz. In addition there is a limit for base station antennas of 0.1 W/m^2 in 'sensitive areas' (schools, hospitals, nurseries).
Value: 0.1/1.0
Details: WHO region: Americas, Exposed: Public
Effective date: 2017-05-31
Close
Chile 2017 0.1/1.0 0.1/1.0 1.6/2 1.6/2
Cuba 2017 0.8/1.6


Radiofrequency
Israel, 2017, Radiofrequency, Power density (W/m^2), 1800 MHz
Comment: The stated value is the maximum allowed (10% of ICNIRP limit). In addition, it is mandatory for each base station to obtain a specific permit with the minimum exposure possible that enables provision of the needed coverage and capacity.
Value: [0.9]
Details: WHO region: Europe, Exposed: Public
Effective date: 2017-05-31
Close
Israel 2017 [13.0] [18.0] [0.45] [0.9] [0.08] [2]
Italy 2017 6/20 6/20 0.1/1.0 0.1/1.0 0.08 2

Auditory Effect Limit – WHO Guidelines (1998 – ICNIRP, p509)

Table 4. Basic restrictions for time varying electric and magnetic fields for frequencies up to 10 GHz.[a]

Exposure characteristics	Frequency range	Current density for head and trunk (mA m^{-2}) (rms)	Whole-body average SAR (W kg^{-1})	Localized SAR (head and trunk) (W kg^{-1})	Localized SAR (limbs) (W kg^{-1})
Occupational exposure	up to 1 Hz	40	—	—	—
	1–4 Hz	40/*f*	—	—	—
	4 Hz–1 kHz	10	—	—	—
	1–100 kHz	*f*/100	—	—	—
	100 kHz–10 MHz	*f*/100	0.4	10	20
	10 MHz–10 GHz	—	0.4	10	20
General public exposure	up to 1 Hz	8	—	—	—
	1–4 Hz	8/*f*	—	—	—
	4 Hz–1 kHz	2	—	—	—
	1–100 kHz	*f*/500	—	—	—
	100 kHz–10 MHz	*f*/500	0.08	2	4
	10 MHz–10 GHz	—	0.08	2	4

[a] Note:

1. *f* is the frequency in hertz.
2. Because of electrical inhomogeneity of the body, current densities should be averaged over a cross-section of 1 cm^2 perpendicular to the current direction.
3. For frequencies up to 100 kHz, peak current density values can be obtained by multiplying the rms value by $\sqrt{2}$ (~1.414). For pulses of duration t_p the equivalent frequency to apply in the basic restrictions should be calculated as $f = 1/(2t_p)$.
4. For frequencies up to 100 kHz and for pulsed magnetic fields, the maximum current density associated with the pulses can be calculated from the rise/fall times and the maximum rate of change of magnetic flux density. The induced current density can then be compared with the appropriate basic restriction.
5. All SAR values are to be averaged over any 6-min period.
6. Localized SAR averaging mass is any 10 g of contiguous tissue; the maximum SAR so obtained should be the value used for the estimation of exposure.
7. **For pulses of duration t_p the equivalent frequency to apply in the basic restrictions should be calculated as $f = 1/(2t_p)$. Additionally, for pulsed exposures in the frequency range 0.3 to 10 GHz and for localized exposure of the head, in order to limit or avoid auditory effects caused by thermoelastic expansion, an additional basic restriction is recommended. This is that the SA should not exceed 10 mJ kg^{-1} for workers and 2mJ kg^{-1} for the general public, averaged over 10 g tissue.**

Note: Auditory effect limit, promoted by the WHO to protect people from microwave hearing, is also contained in EU Recommendation 1999/519/EC, EU Directive 2004/40/EC and was renamed to *'sensory effect'* limit for workers in EMF Safety Directive 2013/35/EU (S.I. 337 of 2016)

Council of Europe – Resolution 1815

Below are some extracts from of Resolution 1815, sent by the Council of Europe (CoE) regarding dangers, and risks of microwave signals to Children.

8.1.1. take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours;

8.1.2. reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

8.1.3. put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age;

8.1.4. pay particular attention to "electrosensitive" people who suffer from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;

8.2 concerning the private use of mobile phones, DECT wireless phones, WiFi, WLAN and WIMAX for computers and other wireless devices such as baby monitors:

8.2.1. set preventive thresholds for levels of long-term exposure to microwaves in all indoor areas, in accordance with the precautionary principle, not exceeding 0.6 volts per metre, and in the medium term to reduce it to 0.2 volts per metre;

8.3 concerning the protection of children:

8.3.1. develop within different ministries (education, environment and health) targeted information campaigns aimed at teachers, parents and children to alert them to the specific risks of early, ill-considered and prolonged use of mobiles and other devices emitting microwaves;

8.3.2. for children in general, and particularly in schools and classrooms, give preference to wired Internet connections, and strictly regulate the use of mobile phones by schoolchildren on school premises;

8.4 concerning the planning of electric power lines and relay antenna base stations:

8.4.4. determine the sites of any new GSM, UMTS, WiFi or WIMAX antennae not solely according to the operators' interests but in consultation with local and regional government authorities, local residents and associations of concerned citizens;

Note 1: Resolution 1815 recommends indoor exposure limits of 0.6 V/m and 0.2 V/m, these equate to power/density exposures of approximately 1,000 and 100 uW/m^2

Note 2: EU Directive's Workplace Sensory Effect limit based on 6 minutes, is approx 250 times greater than the preventative threshold limit advised in 2011, and 2500 times above the medium-term preventative threshold limit.

Note 3: Research 'The Effects of RF-EMF on the Child Brain' (Touro College, 2019) in its conclusion section states - *'Both biologically and socially, the early years of development are extremely sensitive to environmental factors of a child. The SAR guidelines have still not been changed to accommodate the developing brain of a child'*[vi].

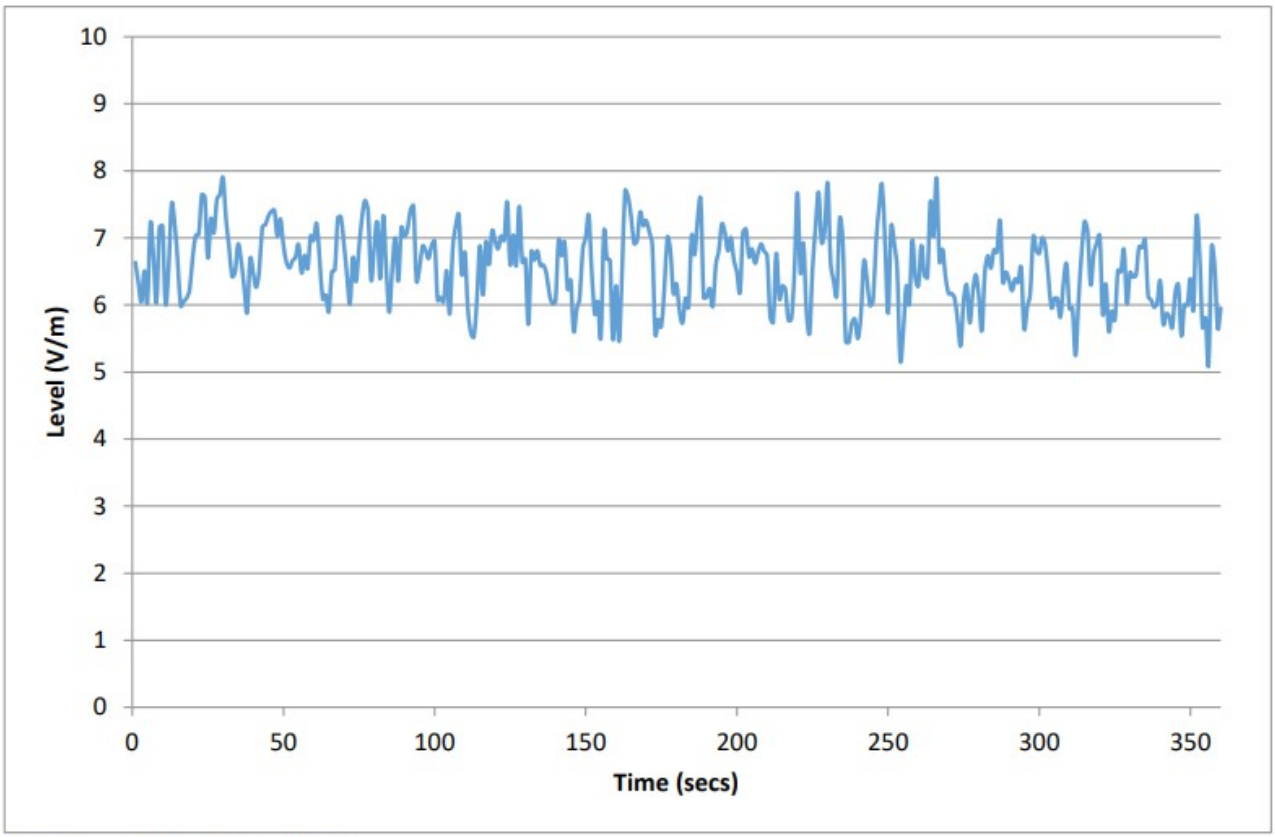
Appendix 3

Comreg Site-surveys, EU Directive & Irish Legislation

Below are extracts from site-surveys published on the Communication Regulators (Comreg) website[vii]. Each wireless survey shows areas in Ireland where public auditory effect limits have been exceeded.

It should be noted these surveys do not include the full measurement range up to 10Ghz and therefore are likely to underestimte total public exposure limits via-a-vis the public auditory effect contained in 1998 WHO EMF Guidelines, and EU Recommendation 1999/519/EC.

Electric field strengths recorded over 6 minute period using 3 GHz probe at point of maximum NIR



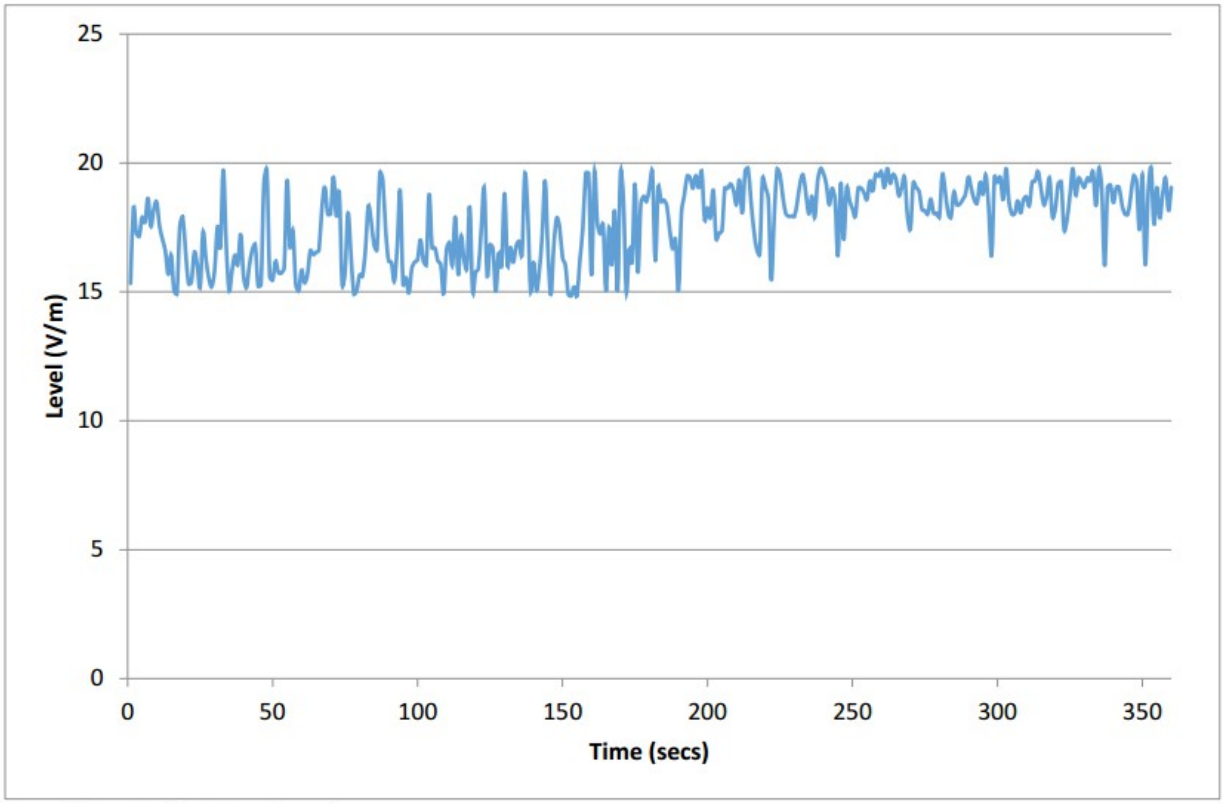
Acquisition Mode: 1 Sec. Sampling

Mean Measurement V/m:	6.55 V/m	**Peak Measurement V/m:**	7.90 V/m
Date:	05/12/2022	**Start Time:**	15:48
Meter:	NBM-550	**Probe:**	EF3091
Frequency Range:	100 kHz – 3 GHz		

Ireland – Dublin, Rathmines Garda Station (2022)

- Public Auditory Effect Limit, approx 50,000 uW/m^2
- Peak exposure 7.90 V/m = 165, 544 uW/m^2, over 3 times public auditory effect limit
- Mean exposure 6.55 V/m = 113,800 uW/m2, over 2 times public auditory effect limit

Electric field strengths recorded over 6 minute period using 3 GHz probe at point of maximum NIR



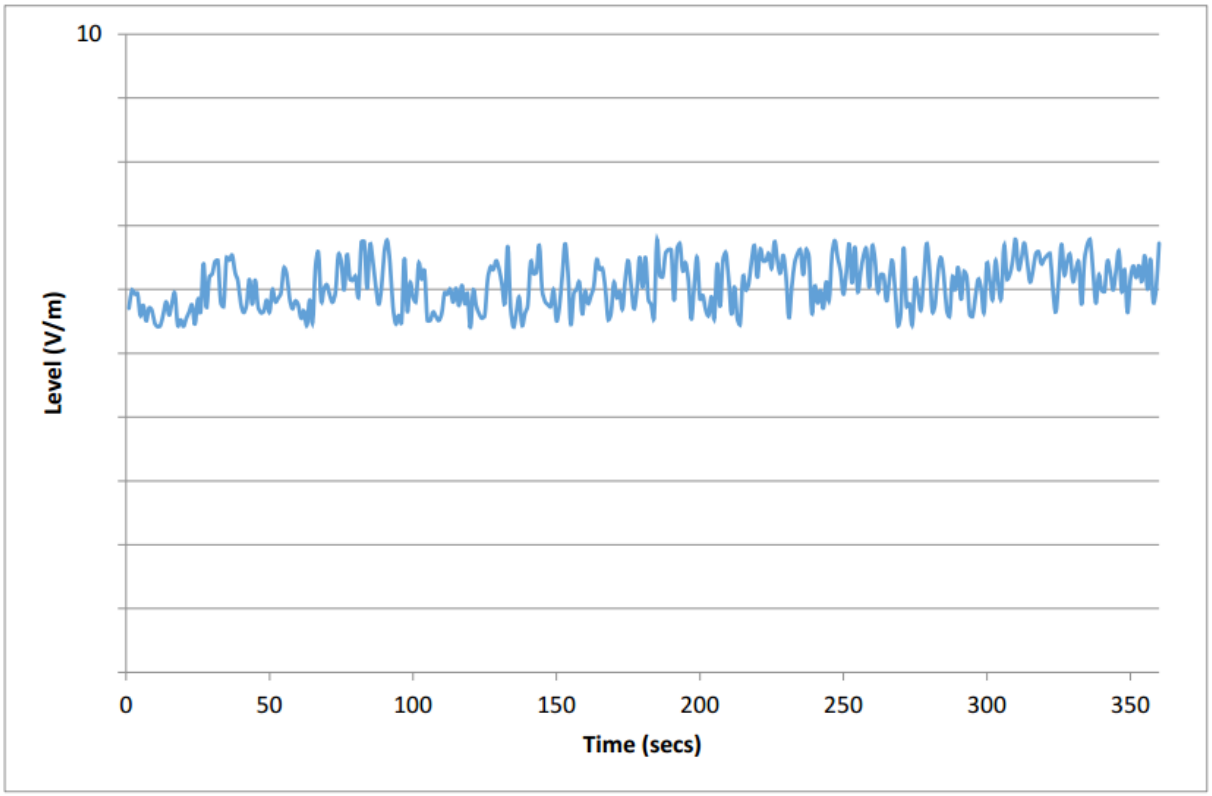
Acquisition Mode: 1 Sec. Sampling

Mean Measurement V/m:	17.68 V/m	**Peak Measurement V/m:**	19.81 V/m
Date:	22/06/2021	**Start Time:**	10:52
Meter:	NBM-550	**Probe:**	EF3091
Frequency Range:	100 kHz – 3 GHz		

Ireland – Cork, Grafton Mall (2021)

- Public Auditory Effect Limit, approx 50,000 uW/m^2
- Peak exposure 19.81V/m = 1,041,000 uW/m^2, nearly 21 times above public auditory effect limit
- Mean exposure 17.68V/m = 829,000 uW/$m^{2,}$, over 16 times above public auditory effect limit

Electric field strengths recorded over 6 minute period using 3 GHz probe at point of maximum NIR



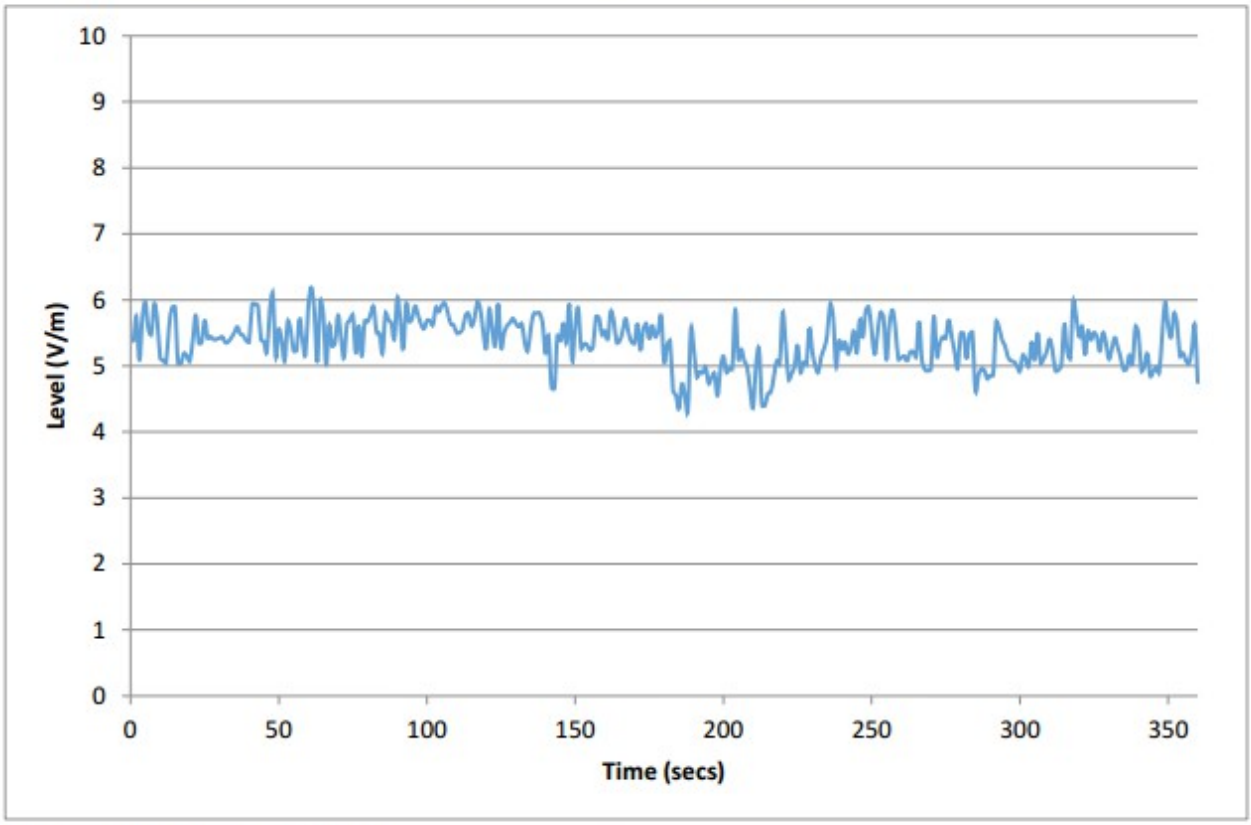
Acquisition Mode: 1 Sec. Sampling

Mean Measurement V/m:	6.07 V/m	**Peak Measurement V/m:**	6.79 V/m
Date:	25/11/2020	**Start Time:**	09:44
Meter:	NBM-550	**Probe:**	EF3091
Frequency Range:	100 kHz – 3 GHz		

Ireland – Dublin, Clondalkin 9th Lock Road (2020)

- Public Auditory Effect Limit, approx 50,000uW/m^2
- Peak exposure 6.79V/m = 122,292 uW/m^2, approx 2.5 times above public auditory effect limit
- Mean exposure 6.07 V/m = 97,731 uW/m^2, approx 2 times above public auditory effect limit

Electric field strengths recorded over 6 min period using 3 GHz probe at point of max NIR:



Acquisition Mode: 1 Sec. Sampling

Mean Measurement V/m:	5.36 V/m	**Peak Measurement V/m:**	6.19 V/m
Date:	27/06/2018	**Start Time:**	11:10
Meter:	NBM-550	**Probe:**	EF3091
Frequency Range:	100 kHz – 3 GHz		

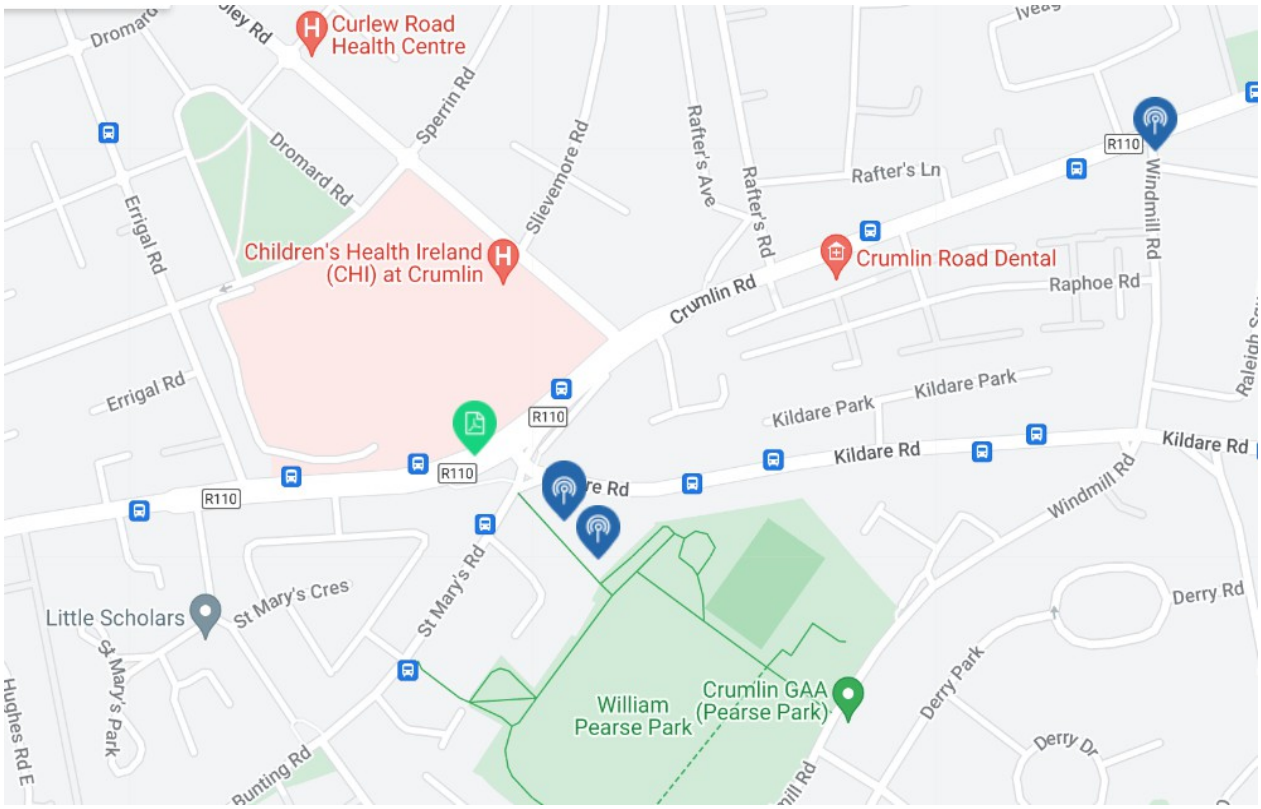
Waterford City (2018)

- Public Auditory Effect Limit, approx 50,000uW/m^2
- Peak exposure 6.19V/m = 101,634uW/m^2, over twice public auditory effect limit
- Mean exposure 5.36V/m = 76,206uW/m^2, over 50% public auditory effect limit

Wireless signals – operational note:
To obtain maximum data capacity, wireless signals such as GSM, UMTS, LTE, Wi-Fi etc require power/density exposure levels significantly lower than 1uW/m^2.

Wireless signals – energy consumption technical note:
Due to 21st Century technical developments, pulsed microwave signals (OFDM & OFDMA) have increased Channel bandwidth, MIMO/MU-MIMO, use beacon frames (ms), inter-frames (µs), transmission control frames, guard interval frames (ns) etc etc. This combination of microwave pulsing, means energy usage from today's pulsed wireless signals can be far greater than those referenced in 1998 WHO Guidelines (ICNIRP). Ergo when operating close to full-cycle/capacity, a 50mW/m^2 OFDMA signal will generate more than 50mJ of energy, when compared with a 1998 pulsed signal, or a continuous wave (CW) signal . This is significant when measuring microwave energy emissions, auditory/sensory effect limits, and workplace/public regulatory compliance.

Comreg site-viewer map



Above map taken from ComReg website https://siteviewer.comreg.ie/#explore

The map above, taken from Comreg's website shows existing mobile infrastructure, in close proximity to the Childrens' Hospital which present site & mast sharing opportunities for mobile operators, rather than installing new masts at the Children's Hospital.

Appendix 4

Comparison – EU Directive and Irish Legislation

(1) Under the Treaty, the European Parliament and the Council may, by means of directives, adopt minimum requirements for the encouragement of improvements, in particular of the working environment, to guarantee a better level of protection of the health and safety of workers. Such directives are to avoid imposing administrative, financial and legal constraints in a way which would hold back the creation and development of small and medium-sized undertakings.

(2) Article 31(1) of the *Charter of Fundamental Rights of the European Union provides that every worker has the right to working conditions which respect his or her health, safety and dignity.*

(3) Following the entry into force of 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)(3), serious concerns were expressed by stakeholders, in particular those from the medical community, as to the potential impact of the implementation of that Directive on the use of medical procedures based on medical imaging. Concerns were also expressed as to the impact of the Directive on certain industrial activities.

(4) The Commission examined attentively the arguments put forward by stakeholders and, after several consultations, decided to thoroughly reconsider some provisions of Directive 2004/40/EC on the basis of new scientific information produced by internationally recognised experts.

(5) Directive 2004/40/EC was amended by Directive 2008/46/EC of the European Parliament and of the Council(4), with the effect of postponing, by four years, the deadline for the transposition of Directive 2004/40/EC, and subsequently by Directive 2012/11/EU of the European Parliament and of the Council(5), with the effect of postponing that deadline for transposition until 31 October 2013. This was to allow the Commission to present a new proposal, and the co-legislators to adopt a new directive, based on fresher and sounder evidence.

(6) *Directive 2004/40/EC should be repealed and more appropriate and proportionate measures to protect workers from the risks associated with electromagnetic fields should be introduced. That Directive did not address the long-term effects, including the possible carcinogenic effects, of exposure to time-varying electric, magnetic and electromagnetic fields,* for which there is currently no conclusive scientific evidence establishing a causal relationship. This Directive is intended to address all known direct biophysical effects and indirect effects caused by electromagnetic fields, in order not only to ensure the health and safety of each worker on an individual basis, but also to create a minimum basis of protection for all workers in the Union, while reducing possible distortions of competition.

(7) *This Directive does not address suggested long-term effects of exposure* to electromagnetic fields, since there is currently no well-established scientific evidence of a causal relationship. However, if such well-established scientific evidence emerges, the Commission should consider the most appropriate means for addressing such effects, and should, through its report on the practical implementation of this Directive, keep the European Parliament and Council informed in this regard. In doing so, the Commission should, in addition to the appropriate information that it receives from Member States, take into account the latest available research and new scientific knowledge arising from the data in this area.

(8) *Minimum requirements should be laid down, thereby giving Member States the option of maintaining or adopting more favourable provisions for the protection of workers,* in particular by fixing lower values for the action levels (ALs) or the exposure limit values (ELVs) for electromagnetic fields. However, the implementation of this Directive should not serve to justify any regression in relation to the situation already prevailing in each Member State.

(9) The system of protection against electromagnetic fields should be limited to a definition, which should be free of excessive detail, of the objectives to be attained, the principles to be observed and the fundamental values to be applied, in order to enable Member States to apply the minimum requirements in an equivalent manner.

(10) In order t*o protect workers exposed to electromagnetic fields it is necessary to carry out an effective and efficient risk assessment*. However, this obligation should be proportional to the situation encountered at the workplace. Therefore, it is appropriate to design a protection system that groups different risks in a simple, graduated and easily understandable way. Consequently, the reference to a number of indicators and standard situations, to be provided by practical guides, can usefully assist employers in fulfilling their obligations.

(11) *The undesired effects on the human body depend on the frequency of the electromagnetic field or radiation to which it is exposed. Therefore, exposure limitation systems need to be exposure-pattern and frequency dependent in order to adequately protect workers* exposed to electromagnetic fields.

(12) The level of *exposure to electromagnetic fields can be more effectively reduced by incorporating preventive measures into the design of workstations and by giving priority, when selecting work equipment, procedures and methods, to reducing risks at source.* Provisions relating to work equipment and methods thereby contribute to the protection of the workers involved. There is, however, a need to avoid duplication of assessments where work equipment meets the requirements of relevant Union law on products that establishes stricter safety levels than those provided for by this Directive. This allows for simplified assessment in a large number of cases.

(13) Employers should make adjustments in the light of technical progress and scientific knowledge regarding the risks related to exposure to electromagnetic fields, with a view to improving the safety and health protection of workers.

(14) Since this Directive is an individual Directive within the meaning of Article 16(1) of Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (6), *it follows that Directive 89/391/EEC applies to the exposure of workers to electromagnetic fields, without prejudice to more stringent and/or specific provisions* contained in this Directive.

(15) The *physical quantities, ELVs and ALs, laid down in this Directive are based on the recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP)* and should be considered in accordance with ICNIRP concepts, save where this Directive specifies otherwise.

(16) In order to ensure that this Directive remains up-to-date, the power to adopt acts in accordance with Article 290 of the Treaty on the Functioning of the European Union should be delegated to the Commission in respect of purely technical amendments of the Annexes, to reflect the adoption of regulations and directives in the field of technical harmonisation and standardisation, technical progress, changes in the most relevant standards or specifications and new scientific findings concerning hazards presented by electromagnetic fields, as well as to adjust ALs. It is of particular importance that the Commission carry out appropriate consultations during its preparatory work, including at expert level. The Commission, when preparing and drawing-up delegated acts, should ensure a simultaneous, timely and appropriate transmission of relevant documents to the European Parliament and to the Council.

(17) If amendments of a purely technical nature to the Annexes become necessary, the Commission should work in close cooperation with the Advisory Committee for Safety and Health at Work set up by Council Decision of 22 July 2003(7).

(18) In exceptional cases, *where imperative grounds of urgency so require, such as possible imminent risks to workers' health and safety arising from their exposure to electromagnetic fields, the possibility should be given to apply the urgency procedure to delegated acts adopted by the Commission.*

(19) In accordance with the Joint Political Declaration of 28 September 2011 of Member States and the Commission on explanatory documents(8), Member States have undertaken to accompany, in justified cases, the notification of their transposition measures with one or more documents explaining the relationship between the components of a directive and the corresponding parts of national transposition instruments. With regard to this Directive, the legislator considers the transmission of such documents to be justified.

(20) A system including ELVs and ALs, where applicable, should be seen as a means to facilitate the provision of a high level of protection against the adverse health effects and safety risks that may result from exposure to electromagnetic fields. However, such a system may conflict with specific conditions in certain activities, such as the use of the magnetic resonance technique in the medical sector. It is therefore necessary to take those particular conditions into account.

(21) Given the specificities of the armed forces and in order to allow them to operate and interoperate effectively, including in joint international military exercises, Member States should be able to implement equivalent or more specific protection systems, such as internationally agreed standards, for example NATO standards, provided that adverse health effects and safety risks are prevented.

(22) *Employers should be required to ensure that risks arising from electromagnetic fields at work are eliminated or reduced to a minimum.* It is nevertheless possible that in specific cases and in duly justified circumstances, the ELVs set out in this Directive are only temporarily exceeded. In such a case, employers should be required to take the necessary actions in order to return to compliance with the ELVs as soon as possible.

(23) *A system ensuring a high level of protection as regards the adverse health effects and safety risks that may result from exposure to electromagnetic fields should take due account of specific groups of workers at particular risk* and avoid interference problems with, or effects on the functioning of, medical devices such as metallic prostheses, cardiac pacemakers and defibrillators, cochlear implants and other implants or medical devices worn on the body. Interference problems, especially with pacemakers, may occur at levels below the ALs and should therefore be the object of appropriate precautions and protective measures,

Regulatory Note 1: S.I. 337 of 2016, signed into law by Minister Mary Mitchell O'Connor, on 29th June 2016, contains significant ommissions when compared to the original EU Directive (signed, 26th June 2013). For example, the above 23 points are missing from the Irish version of the Directive.

Regulatory Note 2: There are also many EU Directive Articles, missing from the Irish version of the EMF Safety Directive. Including, but not limited to:-

- **Article on Penalties**, *Member States shall provide for adequate penalties applicable in the event of infringements of national legislation adopted pursuant to this Directive. These penalties must be effective, proportionate and dissuasive.*
- **Article 15, Review and reporting**, *Taking into account Article 1(4), the report on the practical implementation of this Directive shall be established in accordance with Article 17a of Directive 89/391/EEC*
- **Article 16 Transposition**, *Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 1 July 2016.*

Regulatory Note 3: It is interesting to note, the same 'Sensory *and Auditory effect'* limits (SA values), are refered to as non-thermal in the 2004 Workplace Directive, and yet are listed under the Thermal effects section in 2013/35/EU (Annex III). Furthermore, although limits remained the same in both Directives, wording changed from *'auditory effect'* (2004), to the more health encompassing *'sensory effects'* (2013). It is also worth mentioning, at the WHO Symposium (*Biologic Effects and Health Hazards of Microwave Radiation, 1973)*, it was known then, pulsed microwave signal exposure could cause 3 types of microwave cataracts (acute, sub-acute and delayed), microwave hearing, headaches, and a range of other conditions.

Sensory effects ELVs from 0,3 GHz to 6 GHz

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

Table A2

Sensory effects ELVs for exposure to electromagnetic fields from 0,3 to 6 GHz

Frequency range	Localised specific energy absorption (SA)
$0,3 \leq f \leq 6$ GHz	10 $mJkg^{-1}$

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

Professional Background

Promoted, and deployed a wide range wireless technologies throughout the 21st Century. Held Technical/Management roles in Corporate environments(IBM, SAP, Telecoms etc.), and was involved in a number of start-up ventures (App Development, Data Analytics etc). Previous positions include:-

- Senior Wireless Fellow, Childrens' Health Defence (US Non-profit)
- Founder of Ireland's 1st Certified Wireless Network Provider
- 1st EU License re:Introduction of Commercial millimetre-Wave E-Band spectrum (71/76 & 81/86Ghz)
- Co-Founder DublinWAN
- Technical Manager ESAT/BT
- Director, Irish Internet Society

i https://www.irishstatutebook.ie/eli/2016/si/337/made/en/print
ii https://op.europa.eu/en/publication-detail/-/publication/c6440d35-8775-11e5-b8b7-01aa75ed71a1
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https://op.europa.eu/en/publication-detail/-/publication/c5fb1d53-8775-11e5-b8b7-01aa75ed71a1
iii https://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=17994
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