

Dear Contributor,

Thank you for participating in the public consultation of the ICNIRP draft guidelines.

Please note that it is important that ICNIRP understands exactly the points that you are making. To facilitate our task and avoid misunderstandings, please:

- be concise
- be precise
- provide supporting evidence (reference to publication, etc.) if available and helpful.

Please provide your details below as per the online form and the provision of the privacy policy

Last name, first name: WOOD, Andrew	Email address:	Affiliation (if relevant): Swinburne University of Technology
If you are providing these comments officially on behalf of an organization/company, please name this here: Australian Centre for Electromagnetic Bioeffects Research, (Swinburne node)		

Please complete the comments table: Please use 1 row per comment. If required, please add extra rows to the table.

	Document (Guidelines, App A, App B)	Line Number #	Type of comment (General/ Technical/ Editorial)	Comment	Proposed change	Context
1	Guidelines	36-38	Editorial	Sentence construction awkward. Suggest split.	'...guidelines. Any decisions on potential exemptions should be the role of national.....'	Better clarity
2	Guidelines	40	General	spell out the issue	'... by causing equipment, such as indwelling pacemakers, to malfunction.' Alternatively 'indwelling therapeutic devices'.	,Equipment' too generic a term
3	Guidelines	56	Technical	,strongly' may be too strong. Lines 97 – 105 may be taken as over-kill in ICNIRP's mission to dissuade ,precautionary' extra margins. Safety margins are variously 10; 5; 2 with little rationale behind the choice of these numbers.	Delete ,strongly'.	Numerous examples of occupational exposures exceeding standards, albeit occasionally (esp walkie-talkie e.g. R Hareuveny, R Kavet, A Shachar, M Margaliot and L Kheifets, 2015, Journal of Radiological Protection, Volume 35, Number 2)
4	Guidelines	87	Editorial	Not clear what ,capacity' refers to	,...the capacity to make such awareness and harm-mitigation responses.'	Capacity based on physical, mental and environmental abilities?
5	Guidelines	120	Technical	Magnetic fields are also induced, surely?	...volts per metre; $V\ m^{-1}$) and magnetic fields (H, measured in amps per metre; $A\ m^{-1}$), and they can....	Although the E field is the main measure of SAR and temperature rise, Poynting vector (upon which SAR is based) has both
6	Guidelines	146 ff	Technical	Very confusing to have H for magnetic field and for radiant exposure. Also, why are vector symbols not italic when the scalar symbols are?	Use some other letter of the alphabet for radiant exposure, R_{tr} , say	Clarity

7 Contin ue numbe ring	Guidelines	156	Technical	Need to explain why some symbols are bold	,symbols in bold are vector quantities, that is, they have both magnitude and direction'	Clarity
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Add further rows if needed. For this copy the above row.

And paste it here.

8 Contin ue numbe ring	Guidelines	128	Technical	Not sure why ,brief enough' since strength-duration curves show that a step (rheobase) has the lowest threshold	Delete ,brief enough'	Accuracy
Contin ue numbe ring	Guidelines	129	Editorial	Dielectric is misspelt. Also not sure why DC phenomena are invoked in an RF guideline. Breakdown also occurs with pulses and A See e.g. Chang, Biophys J 56:641 (1984).	Correct spelling and add ,and with RF and pulsed fields.' to the end of the sentence.	Accuracy
Contin ue numbe ring	Guidelines	163	Editorial	Remember to update the WHO reference to 2018 or 2019	Delete ,in the near future', or insert ,for preliminary document see...'	Explain the context of your comment.
Contin ue numbe ring	Guidelines	157 - 190	General	Duplicates some of the material from page 2. Consider re-writing	Eliminate duplication	Explain the context of your comment.
Contin ue numbe ring	Guidelines	210	Technical		Permeabilization rather than ,permeability'	All membranes are permeable to a degree
Contin ue	Guidelines	234	Editorial	Awkward sentence construction	,this could improve health, rather than impair it, depending on prevailing conditions.	Not exactly clear what is meant.

numbering						
Continue numbering	Guidelines	241-242	Technical	,brief temperature elevations..cause larger temperature elevations. Reference to ,temperature' dissipation	?Not certain, but maybe distinction needs to be drawn between external and internal temperature elevations	Not clear what is meant here – seems to mix heat flow with temperature rise
Continue numbering	Guidelines	265	Editorial	,with no clear evidence of the adverse health threshold'	?no clear evidence of what the adverse health threshold is?	Unclear how the end of the sentence relates to the beginning.
Continue numbering	Guidelines	290-295	General	IR will cause core temperature elevation in the ,Near IR' part of the spectrum i.e. above 100 THz, where tissue becomes progressively less absorptant (decreases by 4 orders of magnitude: see Lajevardipour, Bioelectromagnetics 2016).	,frequencies well beyond 300 GHz (> 100 THz)....': ,this is because near infrared, as well as lower frequencies....	Need to distinguish between Near and Far-Infrared.
Continue numbering	Document ?	300-308	Technical	Need to be aware that the exposure discussed in Brockow is Near IR, so probably 1 micron wavelength (300 THz)	Needs further work	As above: seems to be comparing apples with oranges
Continue numbering	Guidelines	Line number	Technical	Comment deleted.	Insert your proposed change.	Explain the context of your comment.
Continue numbering	Guidelines	369	Editorial	Unclear what ,This time interval' refers to, since the averaging time relates to the thermal time constant and the time ,sufficient to produce steady state' are two different things.	Maybe start the sentence ,For the purpose of demonstrating compliance, a 6-minute average is proposed, as it closely matches....'	Need clarity
Continue	Guidelines	371	Editorial	Use of >6 – 300 nomenclature in several places needs to be explained	Add ,where >6 GHz indicates that the lower end of the range does not include 6 GHz itself'.	Clarity

numbering						
Continue numbering	Guidelines	381	Technical	Justification of 6GHz transition difficult to follow: although cutaneous tissue would be within the upper half of a 10g cube (i.e. within the first 1.08 cm) in some places it would only be 0.1 cm (the eyelid, for example). This would mean that the underlying tissue (Type-2, in the case of the eye) could be absorbing significant proportions (with only a 2°C margin).	Revisit	Note Foster is suggesting transition at 30 GHz (from averaging time considerations). This may further cut into margins
Continue numbering	Guidelines	430	General	Mention is made here of the need to comply with low frequency guidelines. Since there is a large difference in E field RL (12.2 cf 0.17 kV/m) and for H-field (49 vs 80 A/m) some mention of this needs to be made in section 5.2.	At line 680 or somewhere a note: ,since these guidelines do not incorporate nerve stimulation effects, exposures involving frequencies below 10 MHz should also comply with the ICNIRP low frequency guidelines (2010)‘	Note that E & H field limits in the low frequency guidelines are supplied up to 10 MHz, even though the range is only meant to extend to 0.1 MHz.
Continue numbering	Guidelines	507	General	Repeat of much that was stated in lines 409 - 413	Maybe at lines 409 – 413 don’t refer to actual numbers, but just state that SA needs BRs	Reduce repetition
Continue numbering	Guidelines	540	General	As above: see lines 420, 421	As above	Reduce repetition
Continue numbering	Guidelines	555-588	Editorial	The material in lines 555- 563 and 570 - 581 is a little different to that previously presented in 4.3.3.1.1 and 4.3.1.2, so should perhaps be incorporated into these sections. There could then be a reference back to these sections, with the remaining part concentrating on what measures would constitute risk mitigation.	For this section, insert‘ The extent of thermal stress experienced by an occupational worker will depend on the tasks being performed (e.g. strenuous working conditions such as climbing radio towers), the heat load from other sources (e.g. high ambient temperature, high humidity) and the	Section needs to provide clear guidance for risk mitigation. Avoids repetition: N.B. ,increased cardiovascular load‘ (line 556) is not a health effect, it is a biological effect.

					<p>wearing of non-permeable thermally insulating protective clothing (e.g. boots, jackets, helmets). Both whole body and local basic restrictions have been developed to ensure that the heat load due to radiofrequency exposure will have minimal additional impact on a worker's thermal stress in many occupational settings. Care must be exercised when a worker encounters an environment where there are significant impediments to normal thermoregulation. For superficial exposure scenarios, local thermal discomfort or pain are important indicators of potential thermal tissue damage. It is thus important, particularly in situations where other thermal stressors are present, that the worker understands about the effect that radiofrequency exposure can contribute to their thermal load. Where significant heat is expected from other sources, it is advised that workers have a suitable means of verifying their body core temperature (see ACGIH 2018b for further guidance).'</p>	
Continue numbering	Guidelines	646	Editorial	,antenna diameter' could be misinterpreted for monopole and dipoles (OK for dishes)	,longest dimension' for ,diameter'	Reduce possibility of misinterpretation

Contin ue numbe ring	Guidelines	652	Editorial	Repeat of 625	Maybe ,Further to the comments above....‘	At 625 grounding was given as the reason for allowing BRs to be exceeded, but here magnitude of difference, the desirability for continuity with ICNIRP 1998 and the area/mass ratio in small persons are given as reasons: maybe these should be ,in addition to the reason stated earlier‘
Contin ue numbe ring	Guidelines	Somewh ere in 611 - 649	General	In other places the rationale of ratio between occupational and general public is mentioned and a brief justification given. For RLs it is $\sqrt{5}$,Since the ratio of occupational to general public SAR limits is 5, the ratio of electric or magnetic field amplitudes is the square root of 5‘	Clarity
	Guidelines	687	Editorial	The note at # is an important qualifier on the condition for compliance stated at Note 3 but the reader may not notice the exception to Note 3 even though it is marked in the table	Add at the end of Note 3: ..“ except for the conditions outlined at # below” – or simply put the # here too.	Clarity
	Guidelines	741-745	Editorial	Superscript for note 1 on I_L^2	Clarify that the 2 here refers to squaring then averaging before taking a square root.	Clarity
Contin ue numbe ring	Guidelines	746	Editorial	Heading ,5.3. Guidance‘ seems odd, since 5.3.1 is the only section	Rename ,5.3 Guidance on Contact Currents‘	An alternative would be to introduce the concept of ,Guidance‘ in 5, rather than here. Note that the rationale relates to nerve stimulation, which is not reflected in the BRs, in addition to burns (hence the much lower ICNIRP 2010 E-field limits.
Contin ue numbe ring	Guidelines	795	Technical	Values conflict with ICNIRP 2010, which allows 40 and 20 mA in the range 0.1 – 10 MHz	Refer to ICNIRP 2010 values, up to 10 MHz at least	Remove conflicting information
Contin ue numbe ring	Guidelines	836	Technical	Since E_L for the range 0.1 – 10 MHz is so much less than in ICNIRP 2010 than here, some guidance on what to use is required.	Make reference to ICNIRP 2010, and alert to the much lower limits for E_L and lower limits for H_L .	Resolve conflicting information

Continue numbering	Guidelines	856 & 861	General	Same symbol H used for both magnetic field and incident power density. This comment also applies for H_{tr} line 856	Use a different symbol for the latter	Resolve potential confusion
Continue numbering	Guidelines	846	Technical	It should be clear that none of the summations in eq 3 – 5 should be greater than 1. So for $f < 2$ GHz evaluations should be done for both E and H if in the near field (or in media other than air)	Insert ,For near field exposures, neither eqn 3 or 4 summations should be > 1 . For exposures with frequency components below 10 MHz, the limits in ICNIRP (2010) will also apply.	Clarity
Continue numbering	Guidelines	699	Editorial	The minus sign in front of 0.177 is easy to miss	Insert a space between the f and the minus sign	Clarity
Continue numbering	Appendix A	17	General	Unclear what ,operational‘ refers to in this context (and in main document).	Define ,operational‘	Clarity
Continue numbering	Appendix B	116	Technical	There are more studies on microwave thresholds than the one given here, some quite old – see for example Cook, J.Physiol. (1952), 118: 1 – 11. This gives threshold at 3 GHz of 10 kW/m ² for 2 min exposures (converted units). It is also possible to derive rate of temperature rise from this work.	Refer to this ref and to others (there must be lots).	,has not been replicated‘ may not be the case
Continue numbering	Appendix B	406	General	Microwave and RF hyperthermia and ablation have been used in cancer therapy for decades. Thus RF does have an effect on cancer, with some established thermal mechanisms	Modify conclusion to read something like ,apart from the use of radiofrequency EMF hyperthermic treatments for cancer, there are no other substantiated effects‘	Explain the context of your comment.
Continue	Appendix A	87	Technical	Define H^*	,and H^* denotes the complex conjugate of the vector H .	Clarity. Also, see comment above about italicising vector quantities (line 146 in main doc)

numbering						
Continue numbering	Appendix A	53	Technical	The formula $SAR = C \, dT/dt$ can lead to large errors if used inappropriately	Add guidance to the reader that the equation should only be applied to measured or calculated temperature readings for no more than the first few seconds after RF energy is applied, for typical cases such as examining SAR in human or animal tissue. Failure to do so will result in significant underestimation of SAR.	Prevention of misinterpretation.
Continue numbering	Guidelines	602	Technical	In the cross-over at 6GHz, there is an implied assumption that the mass per unit surface area is $10 \, \text{kg/m}^2$, or alternatively that the absorption occurs in a 1 cm layer (assuming tissue density to be $10^3 \, \text{kg/m}^3$).	Some words of explanation would be helpful, maybe in App A	Transparency of assumptions made
Continue numbering	Document ?	Line number	Type of comment	Insert your comment.	Insert your proposed change.	Explain the context of your comment.
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