

Comments to be uploaded until 9.10.2018

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.

How to complete the comments table:

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

This response document asks you to provide your 'comment', your 'proposed change', and the 'context' to this comment and proposed change. What is meant by these is the following:

Comment: A brief statement describing the issue that you have identified (and that you would like ICNIRP to take into account in the final version of the guidelines).

Proposed Change: A brief statement describing how you would like the document changed to account for this issue.

Context: A brief statement identifying relevant documents in support of your comment and proposed change.

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

Last name, first name: Chou, C-K.	Email address:	Affiliation (if relevant): IEEE ICES TC95						
If you are providing these comments officially on behalf	If you are providing these comments officially on behalf of an organization/company, please name this here: IEEE ICES							
 ☑ I hereby agree that, for the purpose of transparency, my identity (last and first names, affiliation and organization where relevant) will be displayed on the ICNIRP website after the consultation phase along with my comments. ☐ I want my comments to be displayed anonymously. 								



	Document (Guidelines, App A, App B)	Line Number #	Type of comment (General/ Technical/ Editorial)	Comment. Proposed change. Context.	
1	Guidelines	71	Editorial	Insertion of the word "and" is unnecessary.	
				Delete the word "and".	
				"These quantities cannot be easily measured so quantities that"	
2	Guidelines	84	General	ICNIRP states that the upper tier exposure limits apply ONLY to occupationally- exposed individuals who are healthy adults exposed under controlled conditions associated with their occupational duties, trained to be aware of potential RF EMF risks, etc. This contrasts substantially with recommendations in the IEEE standard C95.1 where the differentiating criterion (lower tier vs upper tier limits) is simply being subject to an RF safety program which will, among other things, ensure awareness of exposures and instructions on how to reduce exposures to less than the upper tier limit. IEEE refers to such individuals as "persons permitted in restricted environments". Occupational exposures that comply with the ICNIRP "occupational reference levels" are presumed to be safe. If exposures greater than the general public limits but less than the occupational limits are not safe for some, the document should spell out the health status criteria that would eliminate workers from being allowed access to occupational levels of exposure. Further, ICNIRP should clarify the issue of exposure environments wherein individuals can be exposed above the public limits but can't be exposed above the occupational limits. If one cannot be exposed above the occupational limits because of the nature of the site and not dependent on a safety program, what is the reason for being aware of one's exposure and how to reduce one's exposure? This one factor sharply distinguishes the ICNIRP limits from the IEEE limits and imposes an unwarranted impact on access to many transmitter sites and use of some personal wireless communications devices (such as higher powered walkie-talkies used for personal purposes such as amateur radio and other use).	
				ICNIRP should explain the hazard for exposure to RF fields above the public limit but that are below the occupational limit and why such exposure would be hazardous for the general public.	
				Some workers who are trained in RF safety and, therefore, allowed to be exposed up to the occupational limit, are not in good health. Hence, ICNIRP should explain the health/medical criteria to be used to exclude certain workers from entering environments in which exposure can exceed the general public limits. At the same time, ICNIRP should clearly explain why occupation should be a controlling factor in whether one may be allowed to be exposed above the public limits.	



Guidelines	156 Table	Technical	Transmitted energy density Htr radiant exposure (J m-2), not consistent with other items in this Table. Also, since H is the symbol for magnetic field strength, H _{tr} is a poor symbol for transmitted energy density. Perhaps, U _{tr} would be better for the symbol.
			Change "radiant exposure" to "joule per square meter" Change to another symbol, such as U _{tr} , for transmitted energy density.
			For consitency with other definitions, and not to confuse with magnetic field strength.
Guidelines	215	Editorial	It is strange to end a sentence with "this" in "elevations will also protect against this."
			Change to "elevations will also safeguard against this effect."
			Protect against is used two times already in this sentence. Avoid the same three times.
Guidelines	228	Editorial	Sentence should not end with a preposition.
			Reword sentence so as not to use "on" at the end.
			"Where there is good reason to expect health impairment at temperatures lower than those shown to impair health via radiofrequency EMF exposure, ICNIRP uses those lower temperatures as a basis for its limits."
Guidelines	287	Editorial	"because it is easier for the heat energy to transfer to the environment" Heat is thermal energy. So "heat energy" is an odd expression.
			Change "heat energy" to "thermal energy".
			More proper word.
Guidelines	339-340	Technical	"the 'Limbs', comprising the upper arm, forearm, hand, thigh, leg and foot". IEEE C95.1 set the same limits for pinnae and limbs. The pinna issue was extensively discussed during IEEE 1528-2003 development. C95.1-2005 was revised accordingly to apply extremity limits to pinnae. FCC has adopted to apply extrmety limits to pinnae. This change makes the measurements in the pinnae unnecessary as stated in the IEEE 1528 standard. Pinna is included in the Type-1 tissues as indicated in line 327, and it should follow Type-1 tissue limits.
	Guidelines Guidelines	Guidelines 215 Guidelines 228 Guidelines 287	Guidelines 215 Editorial Guidelines 228 Editorial Guidelines 287 Editorial



		Adopt the same limits for pinnae as in limbs.
		IEEE 1528-2013 section 1.4.1 Specific Anthropomorphic Mannequin (SAM) has extensive discussion on the pinnae issue for compliance purpose. C95.1-2005 has explantion in C.2.2.2.3 Rationale for applying the peak spatial-average SAR values for the extremities to the pinna. IEC 62209-1-2016 does not have measurement of SAR in the pinnae.

Add further rows if needed. For this copy the above row.

8	Guidelines	430, 681	Technical	Splitting up the exposure limit guidance on the basis of health effect AND frequency range is very confusing. For the development of compliance procedures and regulations it is important to have the traceability as to what effect is being covered but ultimately it is more important to have a clear expression of the limiting EMF parameter rather than the limiting effect. By not including nerve stimulation in the 2018 guidance, there is a challenge to establish what should actually be complied with. Where there is a scope overlap (100 kHz to 10 MHz) the 2018 guidance should give the critical limit for all (proven) effects.
				For example: At 100 kHz the 2018 guidance reference level covering all risks is 1220/f or 12200 V/m unperturbed rms occupational, at 10 MHz this is 122 V/m. For 3 kHz to 10 MHz the corresponding ICNIRP 2010 guidance reference level (table 3) covering low frequency risks is 170 V/m unperturbed rms occupational. Further, there is a discontinuity at 10 MHz 122 V/m or 170 V/m?
				Both the ICNIRP 2010 and ICNIRP 2018 tables have the same title:
				"Reference levels for whole body exposure to time-varying far-field electric, magnetic and electromagnetic fields, from 100 kHz to 300 GHz (unperturbed rms values)" except that the 2018 Table 4 includes both occupational and GP guidance.
				ICNIRP 2018 to include the most restrictive limit from 2010/2018 for a given exposure metric/frequency/applicability(Occ-GP) and perhaps clarify in notes where this has been done according to referenced 2010 guidance. Discontinuities at given frequencie should be reviewed.
9	Guidelines	437	Technical	The guidelines include science/engineering based concepts and also precaution. In explaining the rationale for two thresholds unambiguously, additional clarification of the ICNIRP understanding should be provided to distinguish between:-
				Case A: There is no known adverse health effect for any human irrespective of health, age, gender, racial background or pregnancy from EMF exposures at up to the occupational limit which is subject to a reduction factor below known adverse effect exposure level as a precaution to accommodate scientific uncertainty and potential outliers for susceptible people. A further precautionary reduction factor has been applied to establish the general public limits to assist the practical management of EMF exposure.
				Case B: For healthy people there is no known adverse health effect for any human irrespective of gender, racial background from EMF exposures at up to the occupational limit which is subject to reduction factor below known adverse effect exposure level to accommodate scientific uncertainty.



				There have been studies [reference] suggesting that some people [age, pregnant, ill] may have adverse health effects at levels [close to occupational limit]/[between occupational limit and general public limit] and so for general public exposure, a further reduction factor is applied to establish the general public limits.
				ICNIRP should clarify their position and include text for case A or Case B as ICNIRP consider appropriate. Clearly distinguishing what ICNIRP conclude science has demonstrated and what ICNIRP has included on the basis of precaution helps policy makers and compliance standards developers in their application of the guidelines and also public understanding.
10	Guidelines	481-482	Editorial	Since the whole sentence is about head and torso limit, the (5 °C in Type-1 tissue and 2 °C in Type-2 tissue) causes confusion. Also consistent with the Limbs limit descriptions in the next paragraph.
				Change (5 °C in Type-1 tissue and 2 °C in Type-2 tissue) to (2 °C in Type-2 tissue).
				Head and torso are type-2 tissues.
11	Guidelines	597	Editorial	The exposure scenario for BASIC RESTRICTIONS does not include plane wave power density – only Str. Part 5 of Note a is therefore not applicable to Table 2.
				Delete part 5 of Note a. Else include clarification why it is relevant.
				Guidelines and standards should be clear and extraneous text removed to reduce confusion.
12	Guidelines	3, and	Technical	The criteria for determining whether exposure time < 6 minutes in those two tables are not sufficiently well defined. It will create all sorts of questions about how to apply it.
		718 Table 6		Replace exposures "<6 min" with "exposures during any 6 min period". At least that makes the applicability of the 6-minute rule clearer.
				What does exposure "< 6 minutes" mean? What waveforms would fit that description? For example, consider an exposure consisting of a train of pulses repeated at 1 pulse per 10 sec with a duty cycle of 0.1 (i.e. 1 sec pulses), that lasts for > 6 minutes. Does this exposure last for > 6 min or for 1 second? What about the case of a worker who climbs a transmission tower, and is exposed to RF at highly varying levels for hours at a time. Would the limits for "<6 min" apply at all in that case? Even if the worker has to expose him/herself to comparatively high levels of RF for brief times?



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13	Guidelines	601 Table 3, and 718 Table 6	Technical	that is suitable fo the guideline will and the answer w guidelines are a b	r practition be: how will be very will be very wing step be the means that we have the contraction of the co	oners to use. long can wor y difficult to ackwards fro	They are even difficuker x be exposed to Rapply even for experts massimple "averaging deline that includes n	uations. The limits for exposures "< 6 min" are not expressed in a form alt for specialists to understand. The important question that users of F at level y? The limits in the draft are not framed in a way to answer it, is to discern from the tables. From a practical perspective, the revised g time". maximum exposure times at varying levels above the MPE to remain the the arcane "6-min" rule in the present draft.
14	Guidelines	601 Table 3, and 718 Table 6	Technical	at high levels. But down to and ever frequencies. For example, usin	this is and below 6	n issue only fo GHz. Moreo ndard therm	or high fluence mm-w ver such extension int al model for surface h	es 3 and 6 is to restrict excessive transient heating from brief exposures rave pulses. There is no justification to extend this time dependence troduces major discrepancies in level of protection at different eating (Foster et al., 2016, 2017) one can calculate for pulses at various mitted plane wave power density)
				1 sec pulse	Freq,	Transient	Steady State]
				fluence 2.5	GHz	temperat	Temperature Rise	
				kJ/m ² (2500		ure rise,	at MPE for CW	
				W/m ²)		°C	exposure (BR = 100 W/m ²) °C	
					100	1.1	1.9	
					30	1.0	1.8	
					10	0.3	1.5	
					6	0.15	1.2	
				30 sec pulse fluence 12 kJ/m² (400 W/m²)	100	1.9	1.9	
					30	1.7	1.8	
					10	1.0	1.5	
					6	0.6	1.2	



				(a) Restrict the applicability of Tables 3 and 6 to mm waves (30-300 GHz). The old 6 min averaging time is adequate and simplifies compliance assessment; (b) State that the limits apply to pulses. Suggest refer to IEEE definition: pulse is a waveform whose level departs from one state, attains another state, and ultimately returns to the original state. Suggest a clarifying remark that the intention is for these tables to apply to intense high-fluence pulses and waveforms with high crest factor (ratio of peak to average exposure).
15	Guidelines	646	Editorial	The term diameter seems incorrect here for sources below 30 MHz. E.g. a half-wave dipole for 3.5 MHz will have a LENGTH of something like 38m but be constructed of a wire of DIAMETER 4mm. Further, the field source may not actually be an antenna.
				refer to the maximum dimension (e.g. length) of the radiating source and wavelength respectively.
16	Guidelines	651-656	Technical	The guidelines state that ICNIRP is unaware of the uncertainity that can be associated with how the reference levels are applied, depending on the exposure environment. This reduces confidence in the recommended exposure limits.
				Change it to: "However, due to a range of factors that impact on the degree to which these definitions are appropriate for application to the reference levels, it is unclear what the uncertainity may be in assessing actual exposure under some conditions. Nonetheless, the very large reduction factors used in deriving the reference levels are deemed sufficient to avoid any understatement of biologically important energy absorption within the body."
				The recommended revised statement, while acknowledging a degree of uncertainty, provides greater assurance that regardless of how the reference levels are applied to a compliance assessment, the guidelines are still protective.
17	Guidelines	667	Editorial	The sentence beginning "The resultant SAR elevation…" is an incomplete sentence.
				Suggested change: "The resultant SAR elevation is small relative to the basic restriction (circa 40%, which is similar to the <i>in vivo</i> whole body average SAR measurement uncertainty; Flintoft et al., 2014). There are many levels of conservativeness built into the basic restriction derivation itself, and importantly, this small elevation will not impact on health."
18	Guidelines	675	Editorial	Туро
				Change ((Hirata et al., 2013) to (Hirata et al., 2013).
19	Guidelines	683,701	Technical	The REFERENCE LEVELS include plane wave power density considering near- and far- field cases so the part 5 note from line 597 may apply to Tables 4 and 5.



			Consider if part 5 of Note a in line 597 is technically applicable to Table 4 and Table 5 and if so include it there.
Guidelines	697	Technical	Below 400 MHz, ICNIRP recommends NO permissible increase of incident fields for local exposure (see NOTE 2). In practice, this means that in a vast number of environmental exposure assessments, measurements will revert to simply measuring the spatial peak field, not the spatial average which is what the WBA reference levels are based on. There are data from Findlay (2009) from which relaxation of the local field from the WBA average value can be determined that will ensure compliance with the local BR. The presently proposed approach provides no latitude for assessing exposure to nonuniform fields which are dominant in this frequency range and make it unnecessarily conservative. Further, no scientific support for this level of conservatism is provided.
			Revise this section of the text to allow for some field nonuniformity in conducting exposure assessments. The present approach is entirely too restrictive.
			Findlay, RP and PJ Dimbylow (2009). Spatial averaging of fields from half-wave dipole antennas and corresponding SAR calculations in the NORMAN human voxel mode between 65 MHz and 2 GHz. Phys. Med. Biol. 54m 2437-2447.
Guidelines	709	Editorial	Typo 66-30 GHz
			Change to 6-30 GHz.
Guidelines	720	Technical	When defining formulas, it is good practice to ensure that all terms are uniquely and consistently identified.
			Having the time interval expressed in line 719 in units of minutes and then in line 730 stating that t is measured in seconds is really confusing.
			Decide whether to express time intervals in seconds OR minutes and be consistent.
			Where t is a rolling averaging period in seconds.
Guidelines	728	Editorial	6-30 GHz, >30 – 300 GHz should be expressed more clearly as per line 732
			6 GHz to 30 GHz, >30 GHz to 300 GHz
Guidelines	747	Technical	RF contact currents and associated RF burns represent the <u>most likely hazardous aspect of RF exposure</u> . Yet, section 5.3.1 does not point this out to the reader.
	Guidelines Guidelines	Guidelines 709 Guidelines 720 Guidelines 728	Guidelines 709 Editorial Guidelines 720 Technical Guidelines 728 Editorial



				Insert statement to the effect that RF burns represent the most likely hazarous aspect of RF exposure where there are documented reports of the dangers of such but that documented dangers associated with RF field exposure has yet to be found.
				The recommended insertion of text helps provide perspective about RF exposures and declares what the real hazard is.
25	Guidelines	757	Editorial	The words "and E-field" are unncessary.
				"This is due to the larger current density (A m-2), and consequently the higher localized SAR in the body."
26	Guidelines	759	Editorial	The sentence "Exposure due to contact currents is indirect, in that it requires an intermediate conducting object to conduct the field." Is an odd statement. Conducting the field is inappropriate terminology. Conducting current is correct.
				Replace "field" with "current".
				Contact current comes about from conduction of current from an ungrounded object or from the body (induced current)—to a grounded object.
27	Guidelines	788	Technical	The sentence "Thus it is not clear that contact current will remain a health hazard across the entire 100 kHz to 110 MHz range." implies that ICNIRP is pretty confident that RF burns can't happen above 110 MHz. This is false as anyone who has worked inside high power UHF amplifers at broadcast stations knows.
				Revise text: "Thus it appears that the threshold for heating from RF contact currents varies with frequency. While the recommendations here only extent to 110 MHz, high values of contact currents at much higher frequencies would be expected to have dire consequences if conducted through points on the body and appropriate caution should always be used when working around high power circuits."
				It is inappropriate to imply that RF burns brought about through contact currents cannot happen above 110 MHz. Users of the guidelines should be informed to always be alert for the potential of high contact currents regardless of frequency.
28	Guidelines	792	Editorial	The term "EMF region" is an undefined term. Redraft sentance appropriately. Change to "within the frequency range 100 kHz to 110 MHz."
29	Guidelines	800	Technical	The sentence "Thus it is not clear that contact current will remain a health hazard across the entire 100 kHz to 110 MHz range." implies that ICNIRP is pretty confident that RF burns can't happen above 110 MHz. This is false as anyone who has worked inside high power UHF amplifers at broadcast stations knows.



				Revise text: "While peer reviewed evidence of hazards associated with high contact currents above 110 MHz is sparse, caution should always be used when working in environments in which high values of contact current may be possible, regardless of the frequency."
				It is inappropriate to imply that RF burns brought about through contact currents cannot happen above 110 MHz. Users of the guidelines should be informed to always be alert for the potential of high contact currents regardless of frequency.
30	Guidelines	869-873	Editorial	References of ACGIH. Here the two references on ACGIH, are 2018b and 2018a. The sequence should be reversed to be 2018a and 2018b. In the text, ACGIH 2017 appeared three times and 2018b mentioned once. Where is the reference for 2017?
				Fix the mentioned problems.
31	Guidelines	991-1004	Editorial	Refrences Teunissen et al. And United Nation are not in alphbetical order. They should be before W. The three W references also are not in alphabetical order.
				Correct the order.
32	Guidelines	All	Editorial	The font used for these documents makes it challenging to distinguish between number 1 and letter capital I.
				Choose a clearer font.
33	Appendix A	17, 24	Editorial	In this sentence "As described in the main document, the operational adverse health effects (OAHETs) resulting from the lowest radiofrequency exposure levels are due to temperature rise (nerve stimulation is discussed and protected against within the low frequency guidelines; ICNIRP 2010). ", OAHETs are thresholds and not effects, the abbreviation should not have inserted here.
				Modify the sentence in line 17 to: As described in the main document, the operational adverse health effects resulting from radiofrequency exposures are due to temperature rise (nerve stimulation is discussed and protected against within the low frequency guidelines; ICNIRP 2010). Modify line 24 to: The operational adverse health effect thresholds (OAHETs) considered are 1 °C
			- 1	
34	Appendix A	50	Editorial	"SAR is strongly correlated with tissue temperature elevation.". Tissue temperature rises because of SAR. Although correlation does not necessarily causation, it is better to keep it consistent with Line 60 "temperature elevation is simply related to the SA".
				Change the sentence to "Temperature elevation is strongly correlated with SAR."



35	Appendix A	63-65	Editorial	This sentence is confusing: "The whole body average SAR is not the average value over the whole body, but the total power absorbed in the whole body divided by the whole body weight:" Better change it to "The whole body average SAR is not the average value over the whole body, but the total power absorbed in the whole body divided by the whole body weight:"	
				Change to "The whole body average SAR is the total power absorbed in the whole body divided by the body weight:"	
36	Appendix A	376	Editorial	This sentence is confusing: "At frequencies over 6 GHz, a focused beam can be radiated." Better changed to: "At frequencies over 6 GHz, exposure can be from focused beams."	
				Change sentence to: " At frequencies over 6 GHz, exposure can be from focused beams."	
37	Appendix A	381-391	Technical	IEEE C95.1 specifies limit X for 4 cm ² averaging for 6 to 300 GHz, and limit 2X for 1 cm ² for 30 GHz to 300 GHz. This modification takes care of the discontinuity problem and is still protective for the skin in terms of temperature rise.	
				Allow the both 4 cm ² and 1 cm ² averaging area for above 30 GHz, but change limit to 2X.	
				Harmonize with IEEE C95.1. Removes the averaging area discontinuity at 30 GHz.	
38	Appendix A	412-413	Editorial	As previously used, the heating factor was related to SAR. Here the heating factor is normalized to incident power density. It is better to add "incident power density" before heating factor to avoid confusion.	
				Change to "Monte-Carlo statistical estimation of the incident power density heating factor was conducted, where it was shown that the maximum heating factor is 2.5x10-2 °C m ² W ⁻¹ .	
				Minimize confusion.	
39	Appendix A	449-450	Technical	The two equations are from an unpublished paper by Kodera et al. The limits for less than 6 minutes are based on this unpublished paper. It is not possible for ICES to evalute the approach without seeing the paper. IEEE C95.1 does not specify different limits for less than 6 minutes, but does have fluence and peak power density exposure limits.	
				See responses in items 12. 13, and 14.	
40	Appendix A	462, 279	Editorial	"Head and Trunk" is not consitent with the main text which uses "Head and Torso".	
				Change both places to "Head and Torso".	



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41	Appendix A	633	Editorial	"specified by ICRP", what is this "ICRP"? International Commission on Radiological Protection?	
				Please clarify this.	
42	Appendix A	641-642	Editorial	Divided by the body weight is adequate. No need for whole body weight.	
				Change "whole body weight" to "body weight".	
43	Appendix A	677	Editorial	Why it is called "the de-fact database"?	
				Please clarify.	
44	Appendix B	17	Editorial	Isn't this "Technical Document" called "environmental health criteria"?	
				Change "Technical Document" to "Environmental Health Criteria".	
				Use the correct terminology.	
45	Appendix B	122-123	Editorial	"and as Green and Akirav (2010) has not been replicated" Since two authors, has not been replicates should be have not replicated, or change to "and as it has been replicated by Green and Akirav (2010)".	
				Change to "and as Green and Akirav (2010) have not replicated" or "and as it has not been replicated by Green and Akirav (2010)"	
				Grammatic issue.	
46	Appendix B	175	Editorial	500 W m ⁻² ; remove the extra "." after -2	
				Remove the extra "." after -2.	
47	Appendix B	260-261	Editorial	"Adair, Mylacraine and Cobb, 2001b." Since there are three coauthors, it should be referenced as Adair et al. 2001b.	
				Change the reference to Adair et al. 2001b.	
				Reference style.	



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48	Guidelines	129	Editorial	Typo in "to cause dialectric breakdown".
				Change to "to cause dielectric breakdown".