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**

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| Last name, first name: KLAUENBERG, B Jon | Email address:  | Affiliation (if relevant): EMF Advisor to the NATO Standardization Office; Medical Force Health Protection Working Group and Electromagnetic Environmental Effects Radiation Hazards Working Group. Custodian Standardization Agreement 2345 |
| If you are providing these comments officially **on behalf** of an organization/company, please name this here: NATO Standardization Office  |
| [x]  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.** |
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| **1** | Guidelines | All: | General | Recommend including a definitions section. Highly recommend use of restricted environment and unrestricted environment versus public and occupational which are non-operational and not conducive to clarifying definition. Insert your proposed change.While terms are generally defined when introduced it would be beneficial if a definitions section was included for immediate reference while reading following sections to avoid having to search for the initial definition. |
| **2** | Guidelines | 84 | General | Healthy is not defined. Delete word “healthy Are electromagnetic engineers prohibited who have diabetes, atrical flutter, visual impairments etc? In this context thermoregulatory capability would have to be assessed and a criteria set. |
| **3** | Document ? | 85 | General | Controlled conditions should be defined. Controlled conditions: Environments where access is restricted by a safety program consisting of an organized system of policies, procedures, practices and plans designed to help ensure compliance with exposure limits associated with electric, magnetic, and electromagnetic fields, contact voltage, and contact and induced currents. Individuals exposed under controlled conditions associated with their occupational duties, shall be trained to be aware of potential radiofrequency EMF risks and to employ appropriate harm-mitigation measures, and who have the capacity for such awareness and harm-mitigation response; it is not sufficient for a person to merely be a worker.IEEE C95.1 and IEEE C95.1TM-2345 define the occupational limits as „“restricted environment: An environment in which exposure can result in exceeding the unrestricted environment (lower tier)“ Exceeding the unrestricted environment safety program initiation level requires implementation of a safety program. Safety program: An organized system of policies, procedures, practices and plans designed to help ensure compliance with exposure limits associated with electric, magnetic, and electromagnetic fields, contact voltage, and contact and induced currents. NOTE—A safety program typically includes awareness training, implementation of protective measures such as signage and the use of personal protective equipment (PPE), incident response, periodic evaluation of program effectiveness, and assigned responsibilities for implementing the program similar to the elements described in IEEE Std C95.7.  |
| **4** | Guidelines | 84 | General | The use of the term “Occupational“ is undefined and confusingIndividuals permitted access to the restricted/controlled environment have been trained on the safety program requirements to be aware of potential radiofrequency EMF risks and to employ appropriate harm-mitigationAccess to the controlled environment should not be limited to EMF occupational individuals. Anyone who meets the safety program guidelines should be allowed access, for example transient passage through controlled spaces. |
| **5** | Guidelines | 88 | General | The statement that it is not sufficient for a person to merely be a worker means only EMF trained workers will be allowed access. Delete “it is not sufficient for a person to merely be a worker“The statement that “it is not sufficient for a person to merely be a worker“ means only EMF trained workers will be allowed access. The key point should be not occupation but rather individual’s safety program status. Anyone who has been trained on the safety program applicable to the environment and systems should be allowed access regardless of occupational status. Necessary for passage through environment. Further an individual trained on safety program procedures should be able to have access for many ;erasons including work not related to electrical engineering. |
| **6** | Guidelines | 93-94 | General | It is important to state that the safety programs prevent greater risk, however, the use of occupational is problematic and limitingIndividuals allowed access to restricted environments are not deemed to be at greater risk than the general public in unrestricted environments, providing that appropriate screening and training is provided to account for all known risks. Setting dicotomy of public and occupational is too broad and is insufficiently defined. |
| **7** | Guidelines | 103-105 | Type of comment  |  Stating it is unnecessary to take additional precautionary measures is important and welcome and supported. Insert your proposed change.Explain the context of your comment. |

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

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| Continue numbering | Guidelines | Table 1:  | General | Radiant exposure in Joules per square meter is not clear Htr is not knownTransmitted energy density (also termed incident energy density J/m2 ) Radiant is inappropriate term |
| Continue numbering | Guidelines | 189 | Technical | Low-level effects refer to very low, possibly unmeasurable, thermal events. Non-thermal is incorrect as any energy deposition will result in molecular activation and thermal events even if micro. Delete non-thermal. It is anachronistic.For the purpose of determining thresholds, evidence of adverse health effects arising from all exposures is considered, including those referred to as ‘low-level’ and including those where mechanisms have not yet been elucidated.The literature review conducted for IEEE Std C95.1-2005 includes studies conducted under many different exposure conditions, some using levels of RF energy too low to produce significant heating in animal or *in vitro* test systems (herein referred to as “low-level” exposures rather than “non-thermal” exposures),  |
| Continue numbering | Guidelines | 213-215 | Editorial | Run on repetitious (too many protects)Restrictions designed to protect against smaller temperature elevations will also be protective in vivo. Editorial. No change in meaning. Note that the use of italics is not universally accepted. “Increasingly, the trend is to dispense with italics. Most publishers and style guides instruct authors not to use italics for such phrases. Both Springer and Elsevier, for example, insist on setting "in vitro," "in vivo," and "in situ" in normal, or Roman, font, and so does the Chicago Manual of Style and Scientific Style and Format. The Oxford Dictionary for Scientific Writers and Editors insists that in vivo and in vitro should be set in italics.“ Editage Insights.  |
| Continue numbering | Guidelines | 226-228 | General | Why is ICNIRP basing EMF RF exposure limits on lower non-EMF RF thermal limits that impair health?Delete “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 to base limits on“. Additionally, do not use non-EMF data when there is no EMF effect. This guideline is supposed to be EMF RF thermally based. Including other mechanisms for elevation of temperature such as fever or pharmaceutically induced temperature rise or any non-EMF agent iis inappropriate. This conflicts with lines 267-271“It is important to note that even though body core temperature increases at the operational adverse health effect threshold (+ 1°C) can result in significant physiological changes, this can be part of the body’s normal thermoregulatory response and within the normal physiological range, and thus **does not in itself represent an adverse health effect**.“ Also lines 431-436 “The present guidelines restrict radiofrequency EMF to levels that do not cause any known health effect, using relationships between exposure and tissue heating, as well as exposure and health more generally, to do so. Although the guidelines protect against significant temperature rise due to **EMF power deposition within tissue**, they do not limit other sources of heat (i.e. that are not due to radiofrequency EMF)“ |
| Continue numbering | Guidelines | 286 | Editorial | Be consistent throughout document. Heat and thermal are used interchangably.Easier for the thermal energy to transferExplain the context of your comment. |
| Continue numbering | Guidelines | 594 and 607 | Editorial | Use 6 minutes as in line 594 of Table 2 not <360 seconds as in line 607 Table 3. Consistency. See also Table 6 5Insert your proposed change. |
| Continue numbering | Guidelines | 622 | General | How do you average over an undefined unit “less than 6 minutes“?Insert your proposed change.Explain the context of your comment. |
| Continue numbering | Guidelines | 743, Table 7 | Editorial | IL2  is not defined and should not be squared. One is conjecture that the sub L refers to limb. If so it should be defined as such and included in Table 1.Use I for current not IL and in Note 1. Use I not IL2Explain the context of your comment. |
| Continue numbering | Guidelines | Table 7  | Technical | Values for grasp versus touch should be included. The values in Table 7 are induced current values not contact current valuesRefer to frequency dependent Table 14 IEEE C95.1 note this standard has passed all levels of voting and further changes will not occur**Table 14 —RMS induced and contact current ERLs****for continuous sinusoidal waveforms (100 kHz to 110 MHz)**

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|  | **Persons in Unrestricted Environments****Current (mA)** | **Persons Permitted in Restricted Environments Current (mA)** |
| **Frequency** | **100 kHz****to 3 MHz** | **3 MHz****to 30 MHz** | **30 MHz****to 110 MHz** | **100 kHz****to 3 MHz** | **3 MHz****to 30 MHz** | **30 MHz****to 110 MHz** |
| **Induced, each foot** | 45 | 45 | 45 | 100 | 100 | 100 |
| **a****Contact, grasp** | NA | NA | NA | 100 | 0.3100 (*f*/3) | 200 |
| **Contact, touch** | 16.7 | 0.316.7(*f /*3) | 33.4 | 50 | 0.350 (*f /*3) | 100 |
| NOTE 1—Tabulated values are rms values; *f* = frequency in MHz.NOTE 2—Limits apply to current flowing between the body and a grounded object that can be contacted by the person.NOTE 3—The averaging time for determination of compliance is 6 min for induced currents and grasp contact currents, Touch contact currents are determined and expressed as instantaneous values.NOTE 4—Calculated values for personnel in both environments are capped at the 30 MHz values since there is insufficient data to extrapolate above 30 MHz.NOTE 5—Light “brush” contact can result in arcs and shock and burn even at 50 mA and should be avoided especially with long objects such as cranes or cables.NOTE 6—The ceiling values (temporal peak values as measured with accepted instruments) for all currents are 220 mA for persons in unrestricted environments (for a maximum duration of 93 s) and 500 mA for persons in either environment (for a maximum exposure duration of 14.4 s). |

a T The grasping contact limit pertains to persons in restricted environments where personnel are trained to make rapid contacts with conductive objects that present the possibility of painful contact.Additional tests of human perception of RF current suggest that thresholds rise with stimulation frequency from 3 MHz to 20 MHz. Rogers, S. J. 1981 The report by Rogers lacks peer-review to qualify as a definitive reference. Responses to contact current have been reported in the peer-reviewed literature at frequencies up to 3 MHz (reviewed in Kavet et al. [2014]. Further research is needed to clarify this subject. Reductions in allowed contact current in ICNIRP 1998 and 2013/35/EU from 100 mA to 40 mA were determined to introduce major impacts on safe operations in the military setting during HF transmissions which were essential. 40 mA requirement would have forced entire deck of ships to be cleared of personeel presenting a new more significant hazard. The operational experiences showed no health or safety impacts had been reported over decades of operations. Obtained derogations from Directive 2013/35/EU. NATO and DoD adopted C95.1-2345TM2014. |
| Continue numbering | Guidelines | 759 | Technical | Contact currents are not a field per se. The RF field induces a current in a metalic object usually an elongated structure which can transfer the current to a person with contact. EMF RF exposure due to contact currents is indirect. The field induces a charge in a conducting object, typically an elongated metalic structure. Contact with the charged object conducts the current to the person.There is no field in the object. |
| Continue numbering | Guidelines | 768 | General | The position of not providing limits for contact currents is not prudent. While the literature is sparse, there are reports that support estabishing environmental safety guidance particularly for individuals who have the greatest opportunity to have contact with charged structures.Insert your proposed change.Refer to Rogers report. There is sufficient data to be analyzed to develop interim guidance. |
| Continue numbering | Guidelines | Line number | General | Insert your comment.Insert your proposed change.Explain the context of your comment. |
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| Continue numbering | Guidelines | Line number | General | Insert your comment.Insert your proposed change.Explain the context of your comment. |
| Continue numbering | Guidelines | 56-61 | General | Operational level needs to be better defined. Also while “substantiated effect” (line 52) is considered important evidence used for exposure restrictions (line 50-51) operational thresholds and levels are used extensively.Where no such threshold could be explicitly obtained from the radiofrequency health literature, or where evidence that is independent from the radiofrequency health literature has (indirectly) shown that harm can occur at levels lower than the ‘EMF-derived threshold’, ICNIRP set an ‘operational threshold’.  These are based on more-general knowledge of the relation between the primary effect of exposure (e.g. heating) and health effect (e.g. pain), to provide an operational level with which to derive restriction values in order to attain an appropriate level of protection. Insert your proposed change.Explain the context of your comment. |
| Continue numbering | Guidelines | Line number | General | The continuing practice to set an “occupational“ exposure level (reduction factor of 10) and then arbitrarily place another factor of 5 resulting in a reduction factor of 50 for the “public“ seems backwards and unscientific. If the “public“ value was first established for all individuals (everyone) and then, for the reasons given, the “occupational“ was set as a relaxed value because the safety program requirements are met it would be more rational. A reduction factor of 50 provides for mitigation of risks for the public who have not been trained on applicable safety programs. Prior to gaining access to restricted/occupational/controlled environments safety program training must be completed. Safety program implimentation Occupationally-exposed individuals are not deemed to be at greater risk than the general public, providing that appropriate screening and training is provided to account for all known risks. They must be trained to be aware of potential radiofrequency EMF risks and to employ appropriate harm-mitigation measures, and who have the capacity for such awareness and harm-mitigation responseWorkers frequently question why the exposure levels they are allowed are not as protective as the public. Additionally, the arbitrariness of the the additional factor or 5 is questioned. Note all workers become public for an average 16 hours a day. Setting a firm exposure limit for all with justifable rationale for relaxing the limit for workers is appropriate and explanatory. |