

# EBU

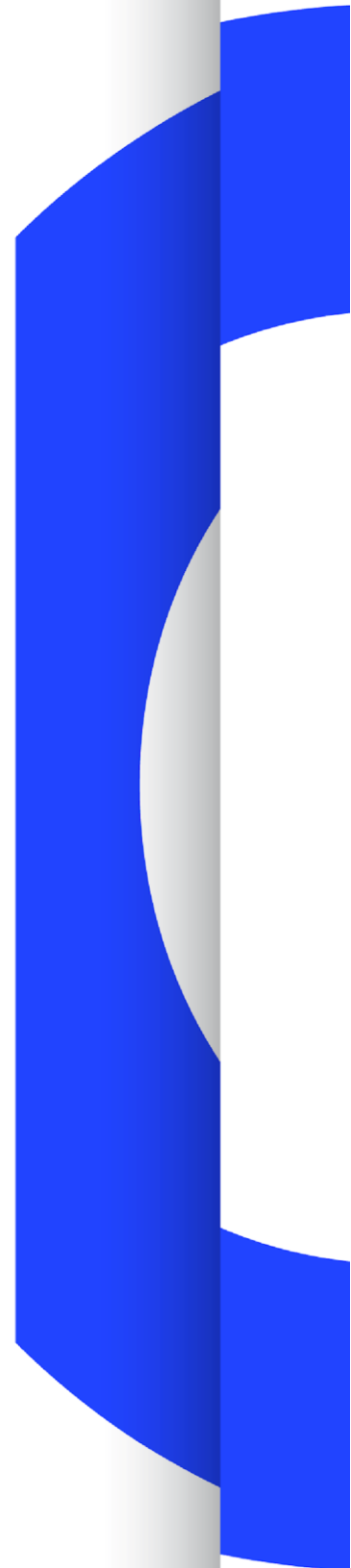
OPERATING EUROVISION AND EURORADIO

## TR 066

### REVIEW OF THE 2020 GUIDELINES OF THE INTERNATIONAL COMMISSION ON NON-IONIZING RADIATION

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## Abstract

In 2020, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued updated guidance, “ICNIRP Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz)”, (referred to as ICNIRP 2020, hereafter). This report provides a review of the revised guidance.

The previous guidance was published in 1998 and covered frequencies in the range 0 - 300 GHz. The ICNIRP has previously published updates covering frequencies in the lower ranges but that led to confusion and inconsistencies in the guidance for frequencies in the range 100 kHz - 10 MHz. One of the objectives of ICNIRP 2020 was to clarify the guidance in that range.

This report concludes that in general, the ICNIRP has aimed for ‘stability’ in its guidance and therefore, there are no major changes to the basic restrictions.

The new guidance provides more detail and, overall, *Demonstration of Compliance* could be considered a simpler process. The main area where this is not the case is in the reactive Near-Field.

Clarification regarding the assessment of cumulative effects in the frequency range 100 kHz - 10 MHz is still required.

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## Review of the ICNIRP 2020 Guidelines for Limiting Exposure to Non-Ionizing Radiation

<i>EBU Committee</i>	<i>First Issued</i>	<i>Revised</i>	<i>Re-issued</i>
TC	2021		

**Keywords:** ICNIRP, Non-Ionizing Radiation, Exposure, Safety Guidelines.

### 1. Introduction

In 1998 the ICNIRP issued guidance for frequencies from 0 - 300 GHz. ICNIRP 2020 is the third instalment of the updates to that guidance, and it covers frequencies from 100 kHz to 300 GHz. Previous updates in 2009 and 2010 provided guidance for static magnetic fields and for frequencies from 1 Hz-100 kHz, respectively. However, it should be noted that the 2010 guidance included basic restrictions and reference levels for frequencies up to 10 MHz. Therefore, in the last decade, prior to the publication of ICNIRP 2020, it has been necessary to comply with both the 1998 and 2010 guidance for frequencies between 100 kHz-10 MHz.

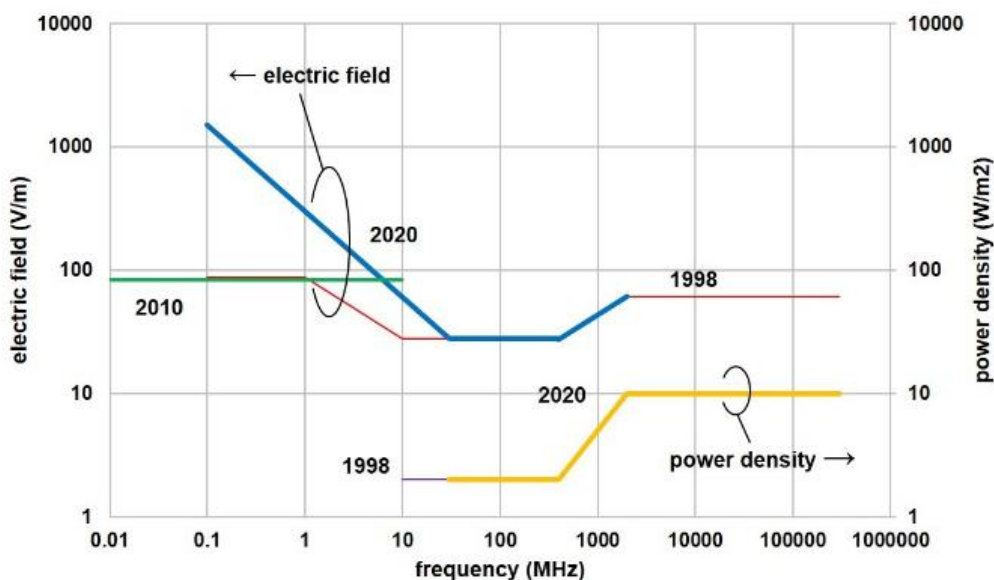
The full ICNIRP 2020 can be downloaded from the ICNIRP website:

<https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf>.

### 2. Detailed comparison of changes

#### 2.1 Overview

This ICNIRP-sourced figure compares the old and new (whole body average) reference levels.



N.B. The units for the Electric Field and Power Density axes are independent.

## 2.2 100 kHz-10 MHz

This frequency range is of particular interest because, prior to the publication of ICNIRP 2020, both the 1998 guidance and the 2010 guidance applied. This introduced some anomalies into the assessments.

Previously	Now
Basic restrictions (2010) for direct effects on the nervous system	No change
Basic restrictions (1998) for heating effects - SAR limits	No change in value

For whole body average, the E-Field reference levels are significantly higher at the lower end of the frequency range. However, the 2010 reference levels still apply for localised values. This means that, when relying on reference levels alone, even where the whole-body average reference level is significantly higher, individual levels cannot exceed those from the 2010 guidance (equivalent to the localised reference levels in ICNIRP 2020). However, the higher whole-body average reference levels are useful when a cumulative assessment needs to be carried out, taking account of higher frequencies (above 10 MHz). This is because the lower frequency components will be a small fraction of the permitted whole-body average.

One point of clarification that is still needed is the determination of the cumulative effect of the lower frequencies regarding nerve stimulation.

ICNIRP 2020 states, “*This publication replaces .... the 100 kHz to 10 MHz part of the ICNIRP (2010) low-frequency guidelines*”. Therefore, there is now, apparently, no requirement to carry out a summation to consider the cumulative effect of direct nerve effects for frequencies above 100 kHz. This has been raised with the ICNIRP; its response was that this would be addressed.

The ICNIRP 2020 H-Field reference levels are lower than those in the 2010 guidance for most of the range 100 kHz-10 MHz.

Additionally, ICNIRP 2020 now includes much more detail regarding the consideration of the Far and Near Fields. Specifically, for the range 100 kHz-30 MHz, ICNIRP 2020 states that it considers all exposures to be in the Near Field and hence requires compliance with both the E-Field and H-Field reference levels.

Therefore, broadcasters may wish to carry out some further assessments on LF/MF/HF sites to investigate whether E-Field measurements alone are sufficient for determining exposure around such sites.

## 2.3 30 MHz-2 GHz

This frequency range includes VHF/FM radio, DAB and TV; also, the following cellular bands: 800, 900, 1400 and 1800 MHz.

The main change at these frequencies is an increase in the permitted averaging time from 6 minutes to 30 minutes for the whole body averaged values. Therefore, while the levels themselves are the same, the increase in averaging time equates to a relaxation.

Additionally, there are now reference levels for shorter time intervals specifically aimed at localised heating; this is helpful and provides additional information. These levels are higher than those for the whole body averaging over 30 minutes; thus, these values enable use of spatial averaging. Previously, spatial averaging was problematic; without any knowledge of appropriate localised maxima, it was difficult to ensure that the localised SAR limits were not being exceeded.

## 2.4 2 GHz-6 GHz

This includes the following cellular bands: 2100, 2300, 2600, 3400, 3600, 3900 MHz.

The main change in this range is that there are now no longer reference levels given in terms of E-Field and H-Field; only power density.

As for the lower frequencies, there are also levels given for localised heating in terms of shorter averaging time.

## 2.5 6 GHz-300 GHz

Previously, there was a change in the way the basic restrictions were expressed at 10 GHz. This threshold frequency has changed to 6 GHz and so is now in line with the threshold in the EMF Directive<sup>1</sup>. However previously, for frequencies above the threshold, SAR was not included as a basic restriction, only power density; in ICNIRP 2020, both apply.

The power density reference levels remain at 50 and 10 W/m<sup>2</sup> (occupational and public respectively); however, the basic restriction is specified in terms of the absorbed power density and so this is lower than the 1998 power density basic restriction as it takes account of the fact that not all incident power is absorbed. Additionally, the averaging area has reduced.

## 2.6 Field Zones

As mentioned in § 2.2, there is also now a distinction between the various field zones, and these are detailed in the following table.

Freq.	Averaging time (min)	Field region	Compliance required
100 kHz-30 MHz	30 or 6	Guidance assumes always Near Field	Both E- and H-Fields
30 MHz-2 GHz	30 or 6	Far Field	Either E-Field, H-Field or power density
		Radiative Near Field	Either power density or both E-Field and H-Field
		Reactive Near Field	Both E and H-Fields; power density cannot be used
2 - 300 GHz	30 or 6	Far Field and radiative Near Field	Power density only
		Reactive Near Field	Reference levels cannot be used, and so basic restrictions must be assessed

As can be seen, the values that need to be considered vary depending on the field region. This has most impact when defining occupational exclusion zones; generally public exclusion zones will be in the Far Field where the compliance requirements are simpler.

For areas where compliance with the H-Field is required, this may be problematic; generally, for RF meters, H-Field probes cover a much lower frequency range. Hence carrying out surveys to demonstrate compliance will not necessarily be practical. For example, Narda™ probes have an upper frequency of 1 GHz.

<sup>1</sup> [Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents \(electromagnetic fields\)](#)

## **2.7 ICNIRP and the EMF Directive**

Currently, no changes have been made to the EMF Directive. Hence, the Exposure Limit Values still apply. This means that for workers in countries where the EMF Directive applies, the averaging time remains at 6 minutes where occupational compliance is being assessed.

## **2.8 Additional Information**

Additional information on the changes can be found on the ICNIRP website:

<https://www.icnirp.org/en/differences.html>.

## **3. Conclusions**

In general, the ICNIRP has aimed for ‘stability’ in its guidance and, therefore, there are no major changes to the basic restrictions.

The new guidance provides more detail and, overall, *Demonstration of Compliance* could be considered a simpler process. The main area where this is not the case is in the reactive Near-Field.

Clarification regarding the assessment of cumulative effects in the frequency range 100 kHz - 10 MHz is still required.