

Update: ICNIRP limits / Australian Centre for Electromagnetic Bioeffects Research (ACEBR)

Rodney Croft

Chair, International Commission on
Non-Ionizing Radiation Protection (ICNIRP);
Director, ACEBR, University of Wollongong, Australia
r.croft@icnirp.org

ICNIRP RF Guidelines (100 kHz – 300 GHz)

- Published March 2020 (1st revision since 1998)
 - Health Physics, 118(5):483-524
- Followed public consultation
 - Various presentations during development process
 - Formal Public Consultation Document
 - >1500 comments/suggestions from 93 respondents
 - Impressed (& grateful) for the many constructive comments
 - Resulted in substantial improvements to the guidelines
 - Resulted in a strong collaborative project and outcome

2020 Basic Restrictions; ≥ 6 minutes

Exposure Scenario	Frequency Range	Whole body average SAR (W kg ⁻¹)	Local Head/Torso SA (W kg ⁻¹)	Local Limb SAR (W kg ⁻¹)	Local S _{ab} (W m ⁻²)
Occupational	100 kHz to 6 GHz	0.4	10	20	NA
	>6 to 300 GHz	0.4	NA	NA	100
General Public	100 kHz to 6 GHz	0.08	2	4	NA
	>6 to 300 GHz	0.08	NA	NA	20

Notes:

1. Whole body average SAR is to be averaged over 30 minutes.
2. Local SAR and S_{ab} exposures are to be averaged over 6 minutes.
3. Local SAR is to be averaged over a 10-g cubic mass.
4. Local S_{ab} is to be averaged over a square **4-cm²** surface area of the body. Above 30 GHz, an additional constraint is imposed, such that exposure averaged over a square 1-cm² surface area of the body is restricted to two times that of the 4-cm² restriction.

5x reduction relative to 1998

2020 Basic Restrictions; >0 to <6 minutes

Exposure Scenario	Frequency Range	Local Head/Torso SA (kJ kg ⁻¹)	Local Limb SA (kJ kg ⁻¹)	Local U _{ab} (kJ m ⁻²)
OCC	>400 MHz to 6 GHz	$3.6(0.05 + 0.95[t/360]^{0.5})$	$7.2(0.025 + 0.975[t/360]^{0.5})$	NA
	>6 to 300 GHz	NA	NA	$36(0.05 + 0.95[t/360]^{0.5})$
GP	100 kHz to 400 MHz	$0.72(0.05 + 0.95[t/360]^{0.5})$	$1.44(0.025 + 0.975[t/360]^{0.5})$	NA
	>400 MHz to 6 GHz	NA	NA	$7.2(0.05 + 0.95[t/360]^{0.5})$

Notes:

1. t is time in seconds, and restrictions must be satisfied for all values of t >0 to <360 s.
2. Local SA averaged over a 10-g cubic mass.
3. Local U_{ab} averaged over square 4-cm² surface area of body. >30 GHz, exposure over 1-cm² restricted to $72(0.025 + 0.975(t/360)^{0.5})$ for occupational and $14.4(0.025 + 0.975(t/360)^{0.5})$ for general public exposure.
4. Exposure from any pulse, group of pulses, or subgroup of pulses in a train, as well as from the summation of exposures, delivered in t seconds, must not exceed these levels.

ICNIRP RF Guidelines (100 kHz – 300 GHz)

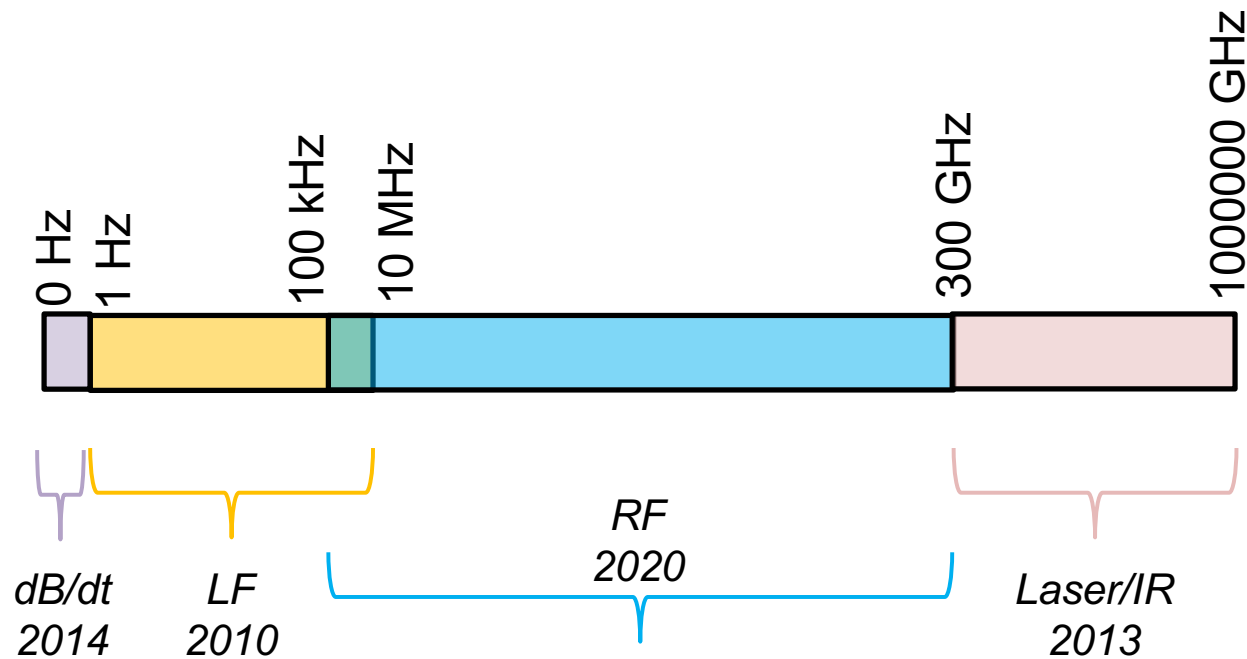
- Document explaining the differences available at [icnirp.org/en/differences.html](https://www.icnirp.org/en/differences.html)

Some important features

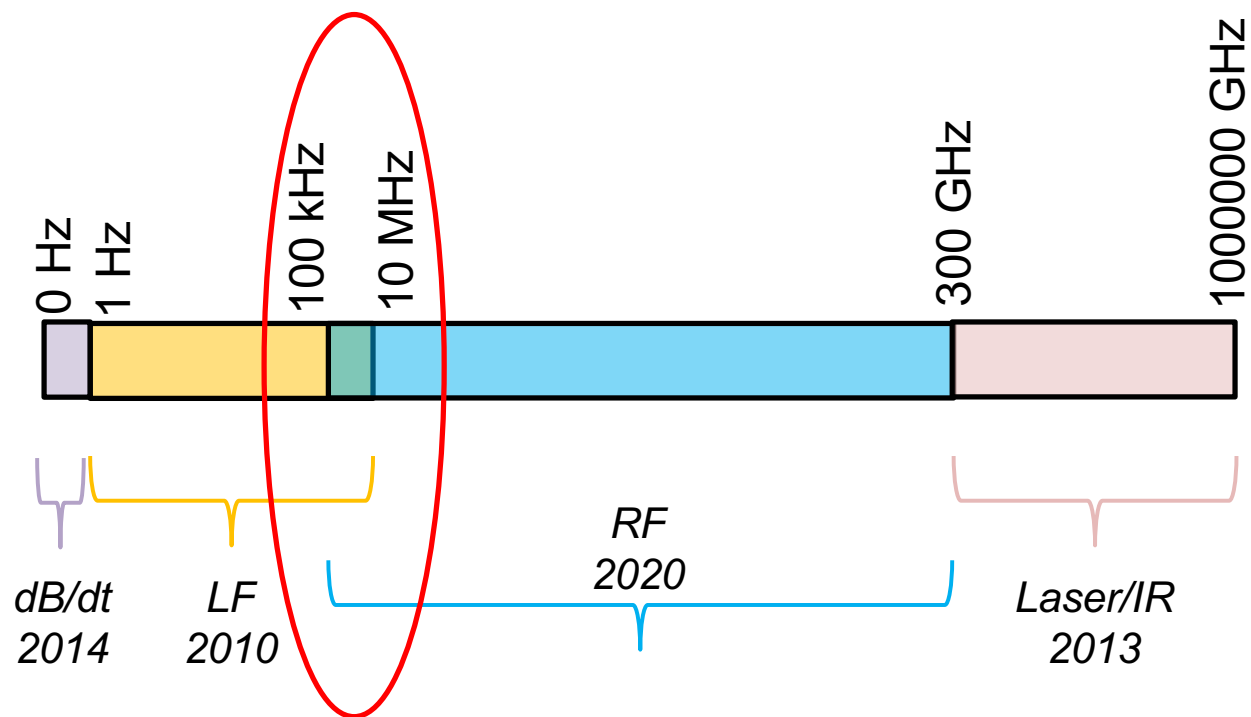
- Based on all adverse health effects, not only heating
- Based on both acute and chronic exposure studies
- Accounts for people of all ages and infirmity status
- There is many conservative steps built into the restriction derivations
- *Where restrictions are not specified separately for different sub-populations or disease processes, this is because such differentiation was not supported by the science*

What's next?

Current ICNIRP Guideline landscape

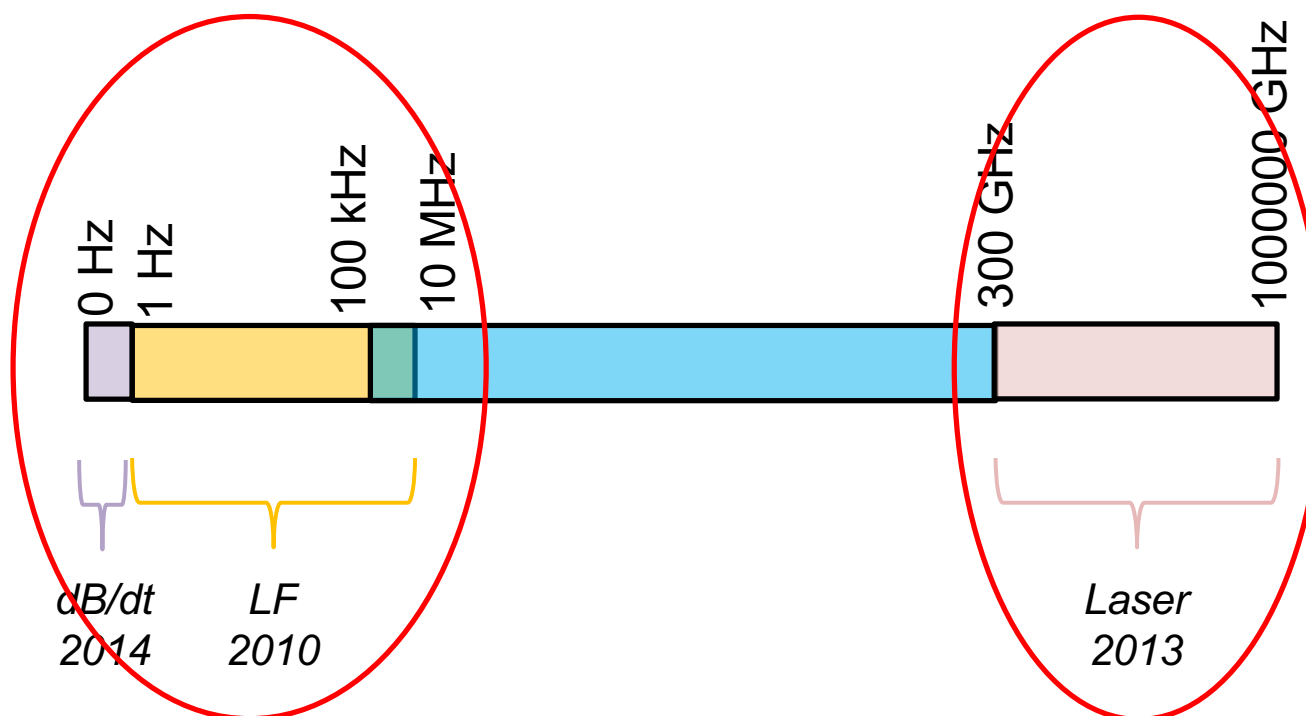


What ICNIRP is working on



Need to deal thoroughly with the crossover frequency range

What ICNIRP is working on



Need to reconsider restrictions in terms of the more systematic approach of the RF GDLs

Currently working on

- Updating low frequency guidelines
 - Low frequency (2010) and dB/dt, ICNIRP 2013, ICNIRP 2013
 - Potentially dB/dt (2014) and static magnetic fields (2009)
- Updating laser guidelines (2013)
- Looking more closely at some specific issues
 - NIR and the environment
 - UV (validity of relative spectral effectiveness factor; role of UVA in cataractogenesis; long term exposure effects)
 - Ultrasound scoping exercise (potential statement or GDL)
 - Various statements (laser pointers; short wave; MRI)

ACEBR Update

- Australian Centre for Electromagnetic Bioeffects Research (ACEBR)
 - Government-funded research Centre of Excellence
 - Swinburne, RMIT, Uni Adelaide, Uni NSW, Uni Wollongong
 - Croft, Wood, Finnie, Martinac, Wiedemann, Yarovsky, Ivanova, Loughran, Pirogova, Taylor
 - 2018 to 2023

Research Update

- Not much activity since COVID
- Current research projects
 - A role of melatonin and heat in RF/Sleep EEG changes?
 - Psychosocial determinants of EHS symptoms
 - Does RF ameliorate Alzheimer's disease pathology in mice?
 - Determining the RF exposure threshold for CW-electroporation
 - Validation of RF thermal models in humans
 - Improving RF-health literacy within General Practitioners
 - Modelling of GHz RF absorption in the eyes and skin
 - Effect of clothing on GHz RF absorption

Thanks!