

ITU Regional Forum for Europe 5G Strategies, policies and implementation

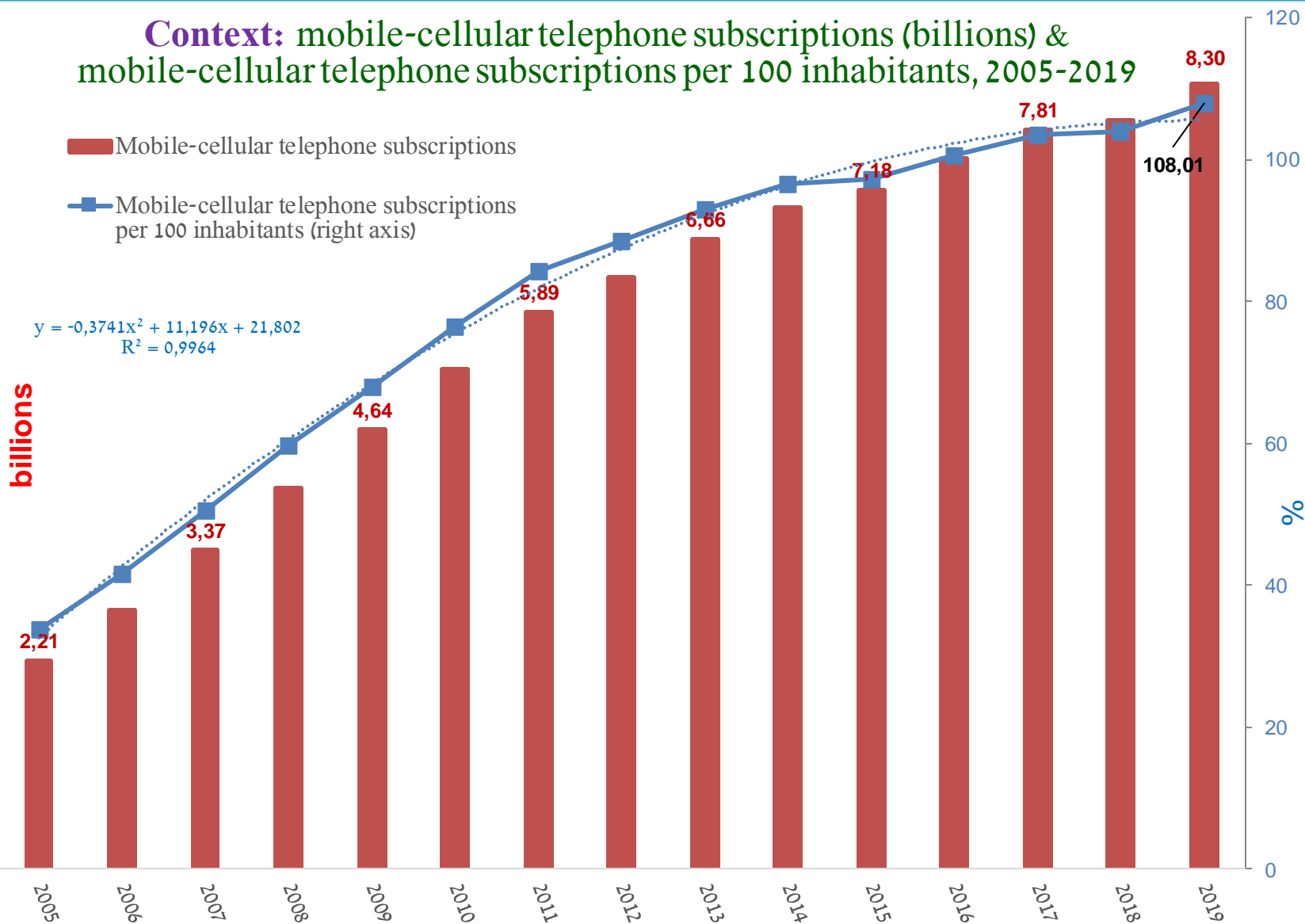
EMF and other challenges
Setting the context

RF Human Hazards;
Implementing 5G for Good: Does EMF Matter?

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Context: mobile-cellular telephone subscriptions (billions) & mobile-cellular telephone subscriptions per 100 inhabitants, 2005-2019



Does EMF Matter? White background-paper: ITU provisions related to 5G and EMF

1. Review of ITU Recommendations, Reports, Conferences and events divided by sectors
2. ITU-R/D/T resources relating to EMF and 5G
3. Identification of IMT frequency bands in ITU Radio Regulations ([2020 edition](#))
4. Report ITU-R [SM.2452](#) on EMF measurements
5. ITU-T [K.series](#) Recommendations and [Supplements](#) ; ITU-T detailing the characteristics of 5G emissions: [K Suppl. 9](#) and [K Suppl. 16](#)
6. ITU Workshops and Initiatives on EMF
7. ITU, Human Capacity Building Opportunities

International organisations/ standardisation bodies related to 5G and EMF

1. WHO, ICNIRP and IEEE
2. Thorough analysis of Tables and Figures of [ICNIRP](#) (2020) Guidelines and [IEEE 95.1](#) (2019) standard in force for the IMT frequencies 450 MHz–71 GHz
3. Exposure limits from base stations, cellulars and handsets applicable to 5G
4. Compare/Contrast ICNIRP (1998), IEEE 95-1 (2019) and ICNIRP (2020)

Open issues directly and indirectly related to 5G & EMF

1. Misinformation
2. Delays in installing base-stations
3. Economic cost for society
4. Environment, including EMF hazards to animals and plants

ITU Radio Regulations ([2020 edition](#)), Footnotes identifying the band for IMT

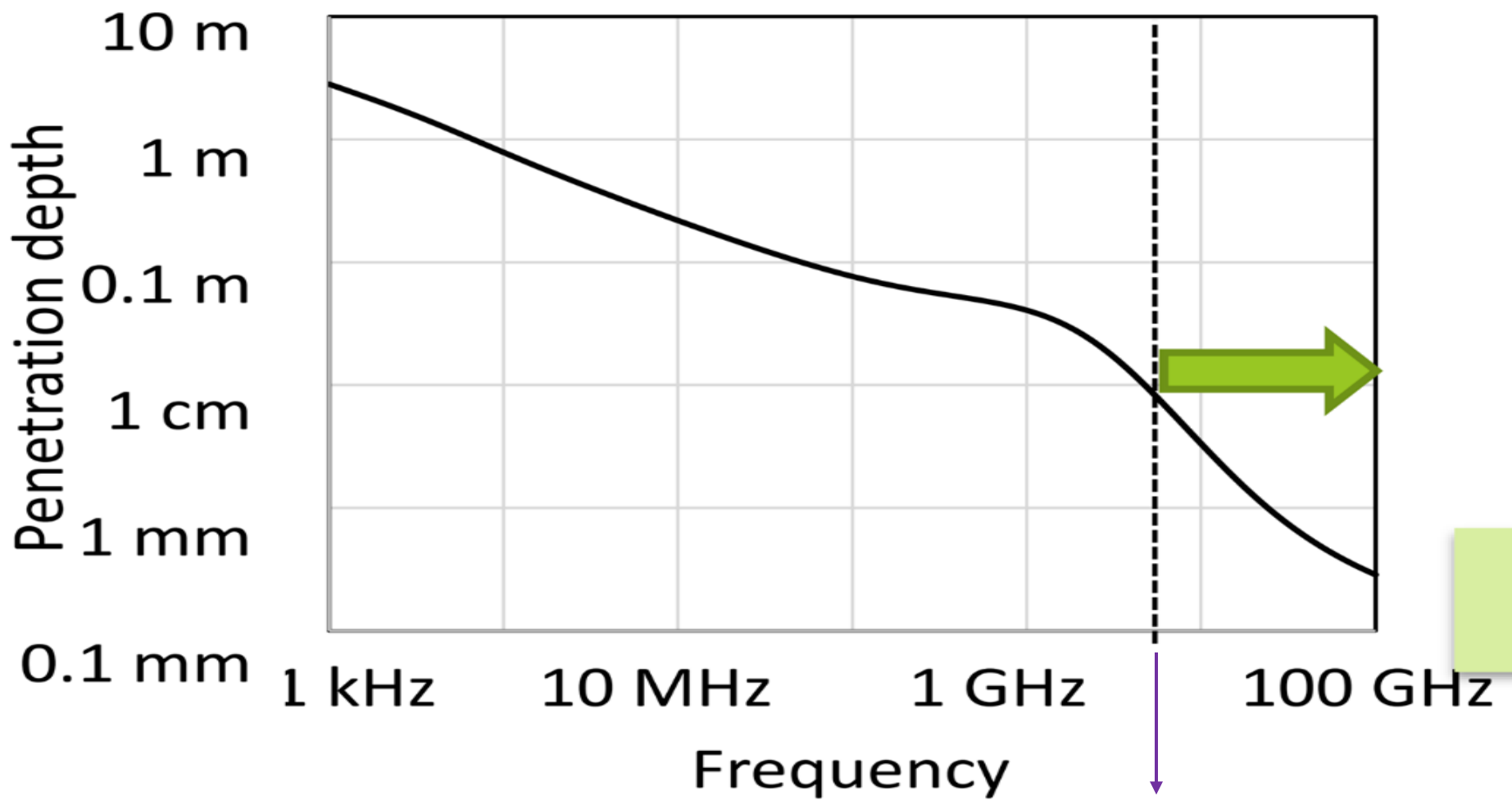
Band	Footnotes identifying the band for IMT		
	Region 1	Region 2	Region 3
450–470 MHz	5.286AA		
470–698 MHz	-	5.295, 5.308A	5.296A
694/698-960 MHz	5.317A	5.317A	5.313A, 5.317A
1 427–1 518 MHz	5.341A, 5.346	5.341B	5.341C, 5.346A
1 710-2 025 MHz	5.384A, 5.388		
2 110–2 200 MHz	5.388		
2 300–2 400 MHz	5.384A		
2 500–2 690 MHz	5.384A		
3 300–3 400 MHz	5.429B	5.429D	5.429F
3 400–3 600 MHz	5.430A	5.431B	5.432A, 5.432B, 5.433A
3 600–3 700 MHz	-	5.434	-
4 800–4 990 MHz	5.441B	5.441A, 5.441B	5.441B
24.25–27.5 GHz *	5.532AB		
37–43.5 GHz*	5.550B		
45.5–47 GHz*	5.553A	5.553A	5.553A
47.2–48.2 GHz*	5.553B	5.553B	5.553B
66–71 GHz*	5.559AA		

* revised at WRC-19

Questions to be raised

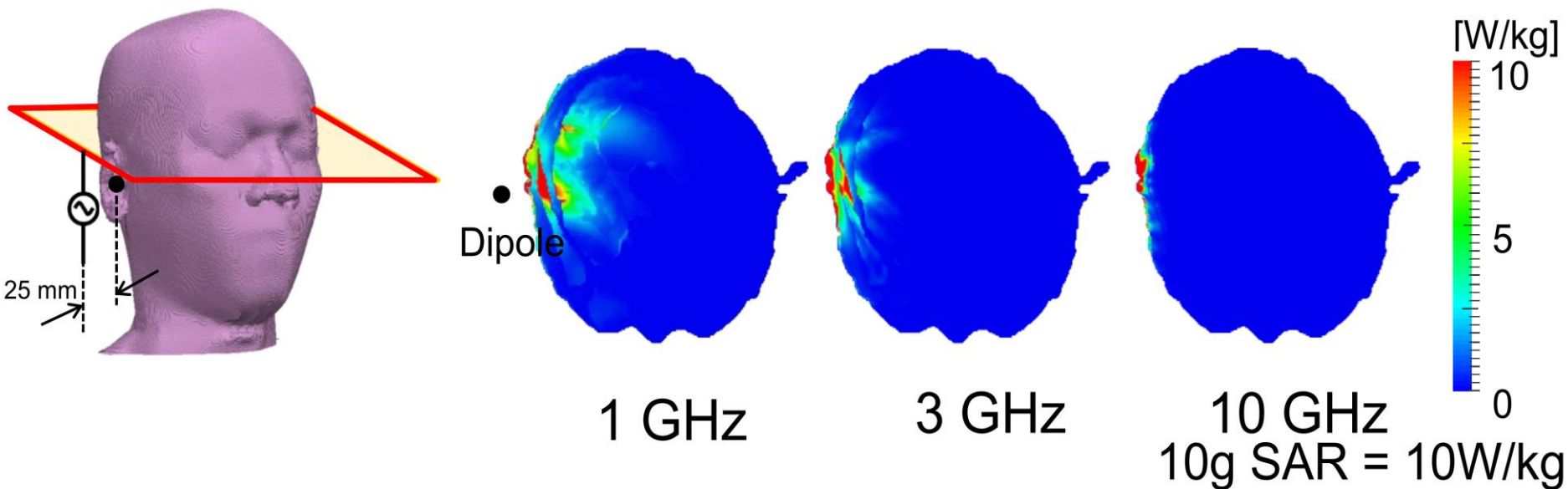
1. Global monitoring levels are very low, relative to ICNIRP reference levels.
2. Compliance calculations and some periodic measurements are essential.
3. However:
 1. Do we need to make so many nation-wide measurements?
 2. Maybe ICNIRP/IEEE reference levels are too liberal?

Penetration depth becomes shallower; source, Akimasa Hirata in 5G higher RF

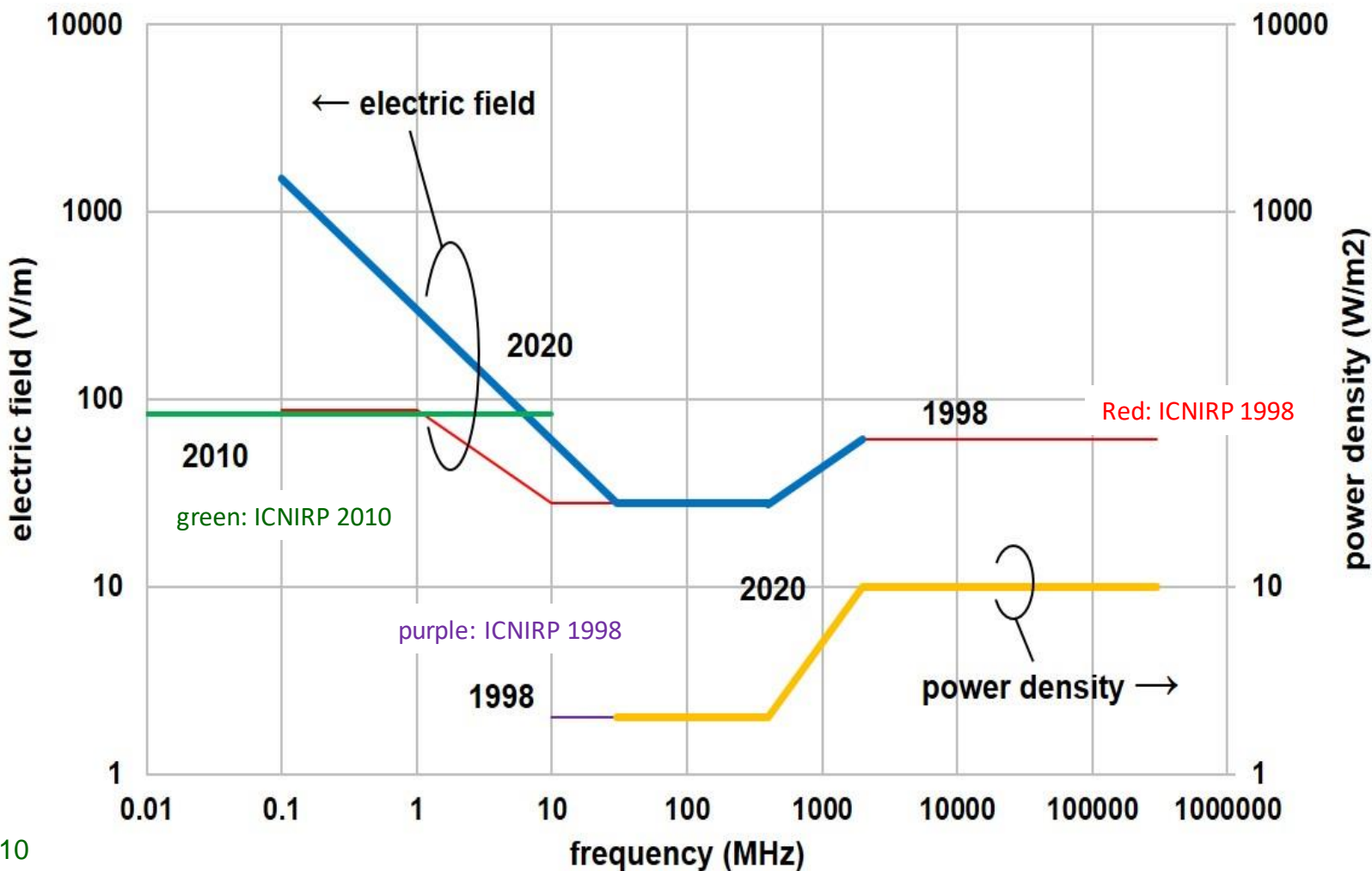


Above 6 GHz, skin surface heating is dominant

Measured power absorption in biological tissues; source, Akimasa Hirata in 5G higher RF

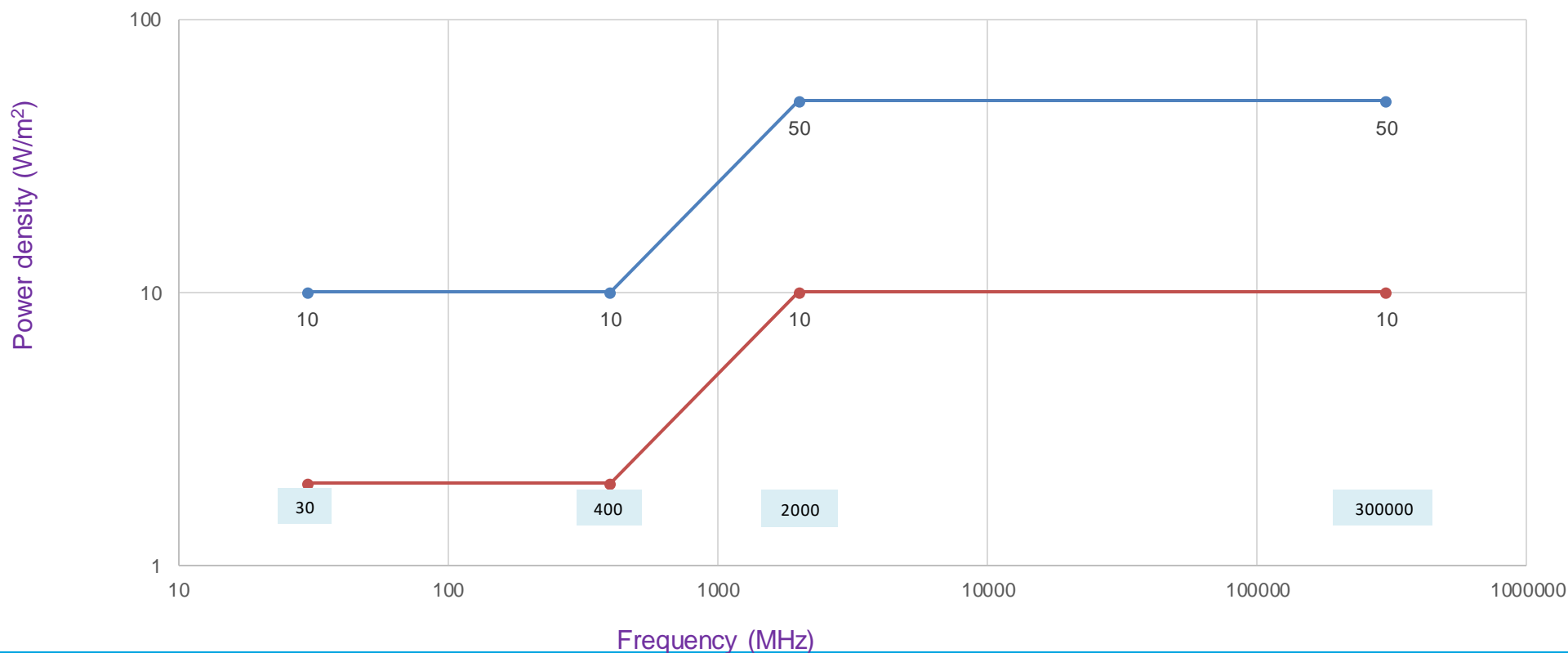


ICNIRP 2020 Web Fig. 2, based on Table 6 the **general public** applying to **whole-body exposures ≥ 6 min**, for the ICNIRP 2020 guidelines only

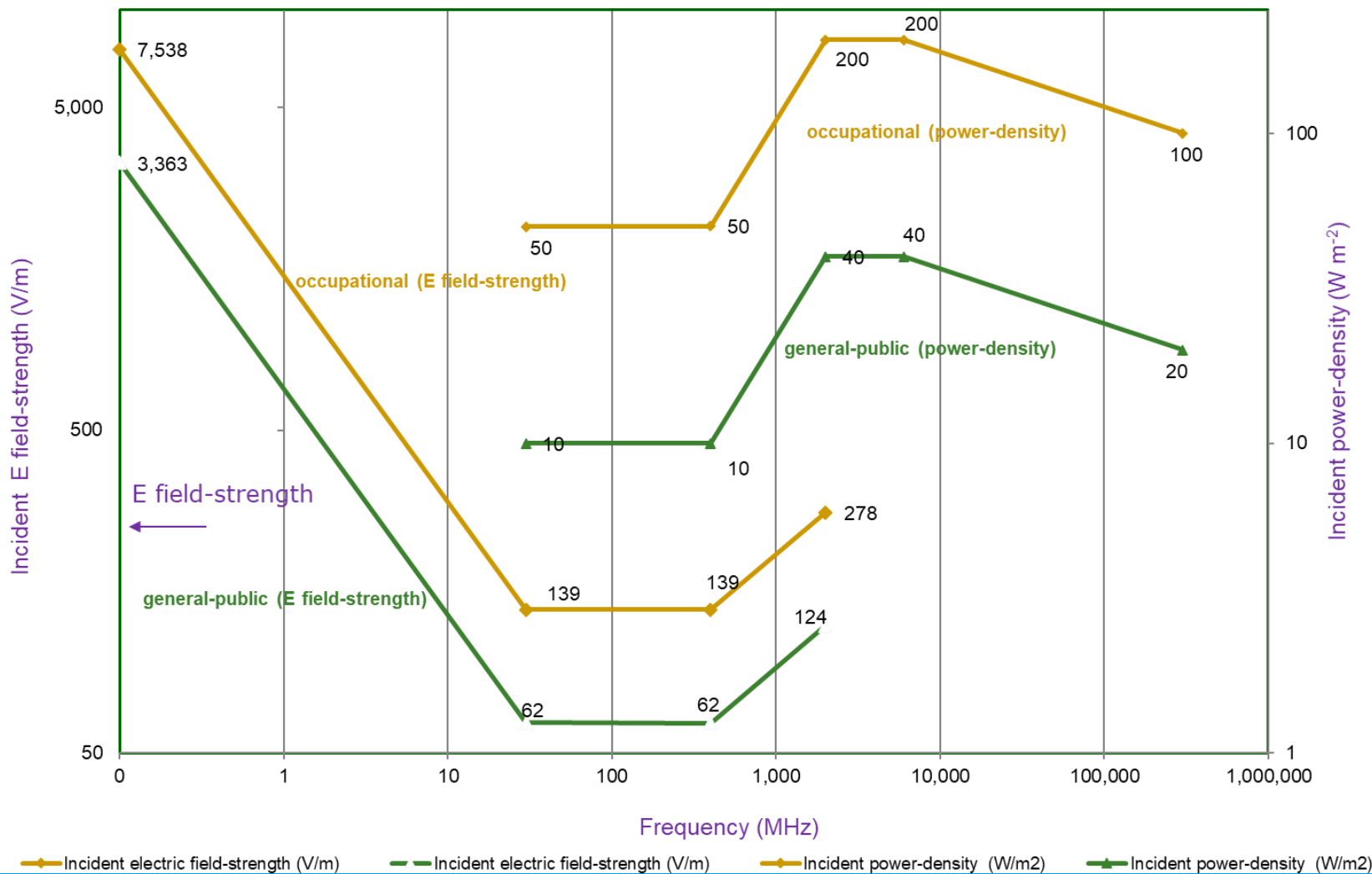


Comparing ICNIRP 2020 **power-density** for occupational & general-public exposures, **30 MHz–300 GHz**, based on **Table 5**, p. 495: **averaged over 30 minutes and the whole body** (source, Mazar)

— Occupational — General public



Comparing ICNIRP 2020 incident electric field-strength & power-density for occupational & general-public exposures, 100 kHz–300 GHz, see **Table 6**, p. 496: **local exposure, averaged over 6 minutes** (source, Mazar)

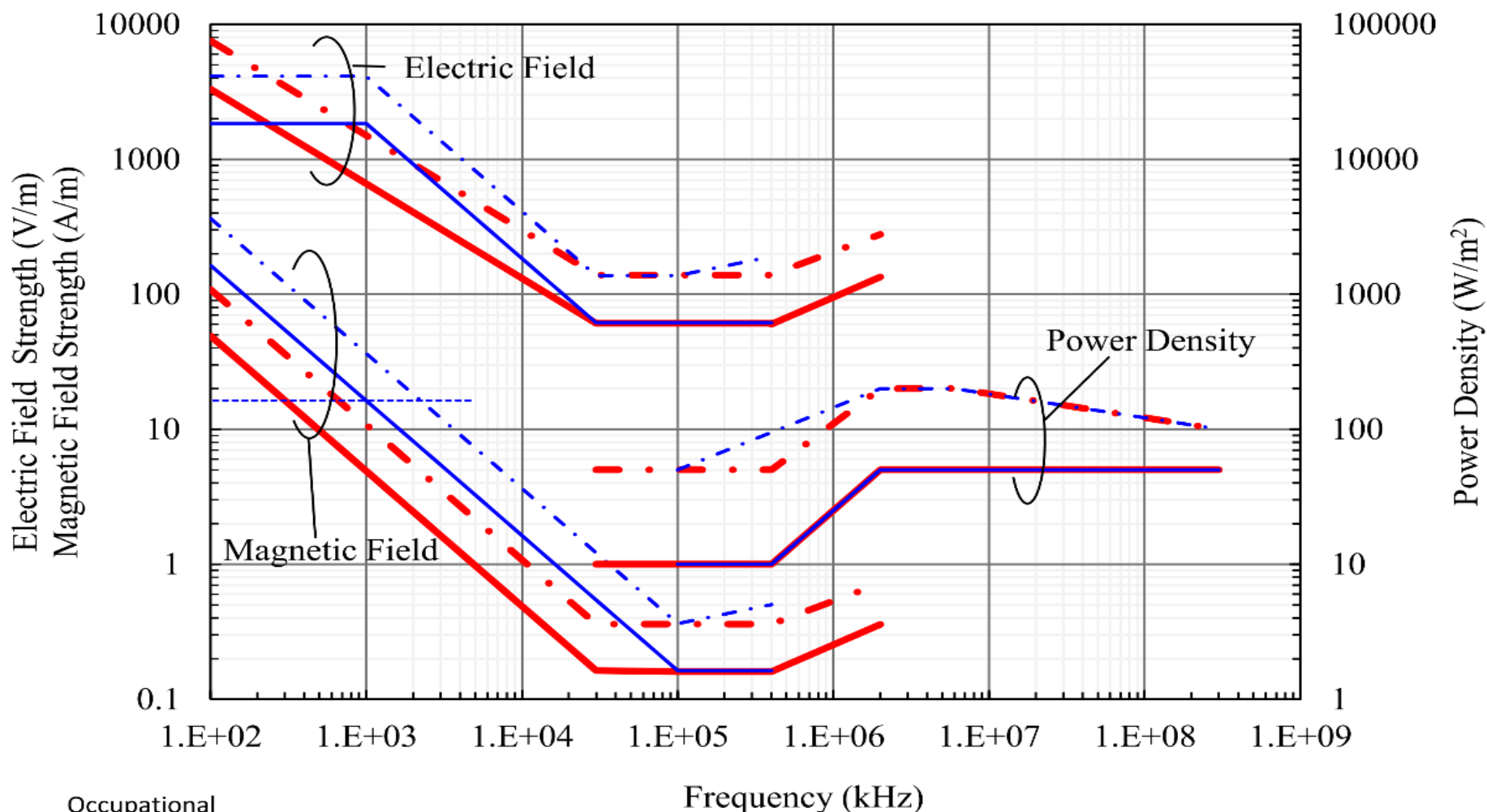


Note: unit of the figure's left-side is electric field-strength V/m, & the right-side is W/m² power-density

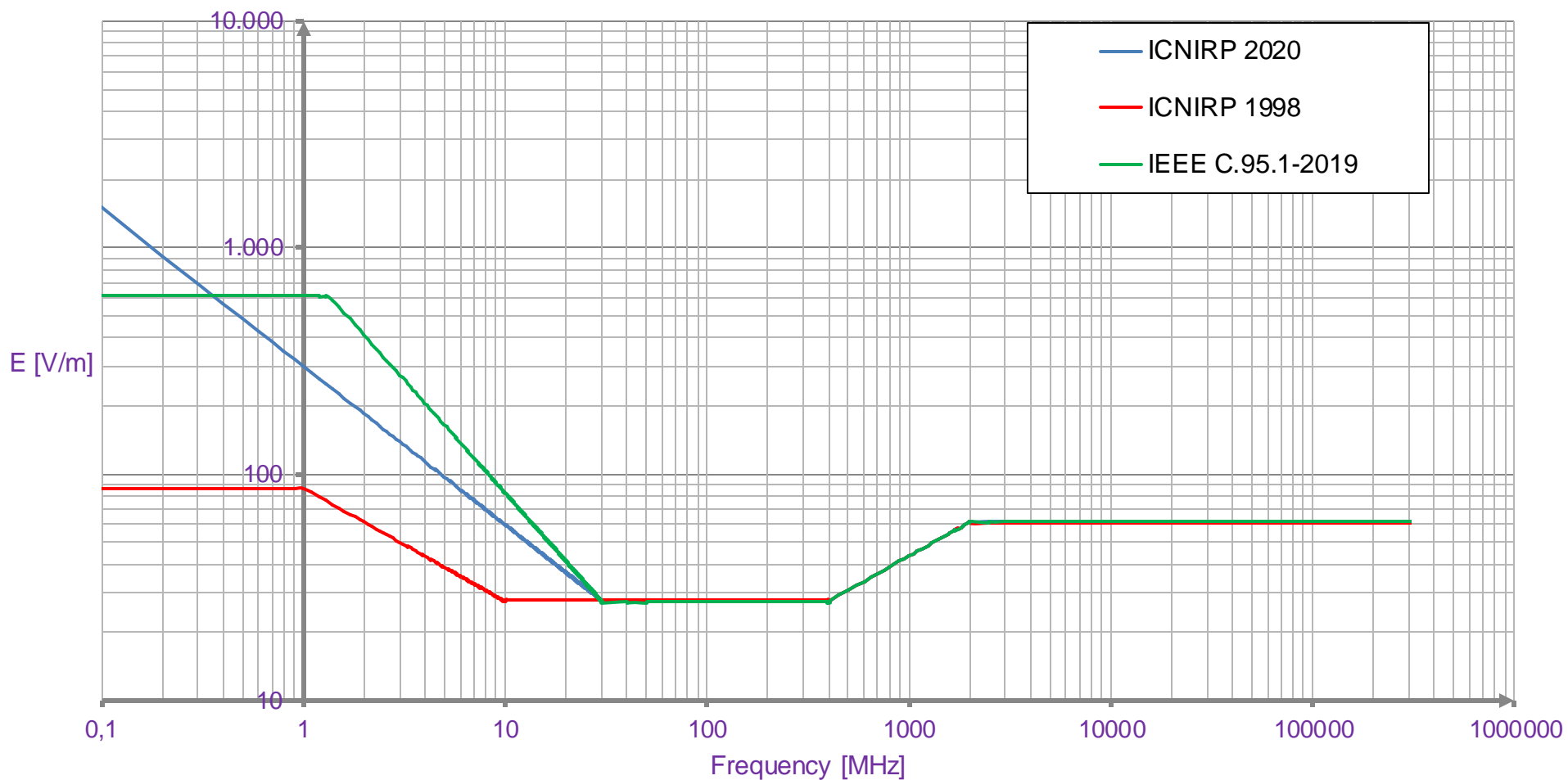


Akimasa **Hirata**, Keynote-speaker, [EMC Europe 2020](#) open-session 23 Sept. 2020
 ‘Human Exposure Standards and Compliance Assessment– 5G and Beyond’

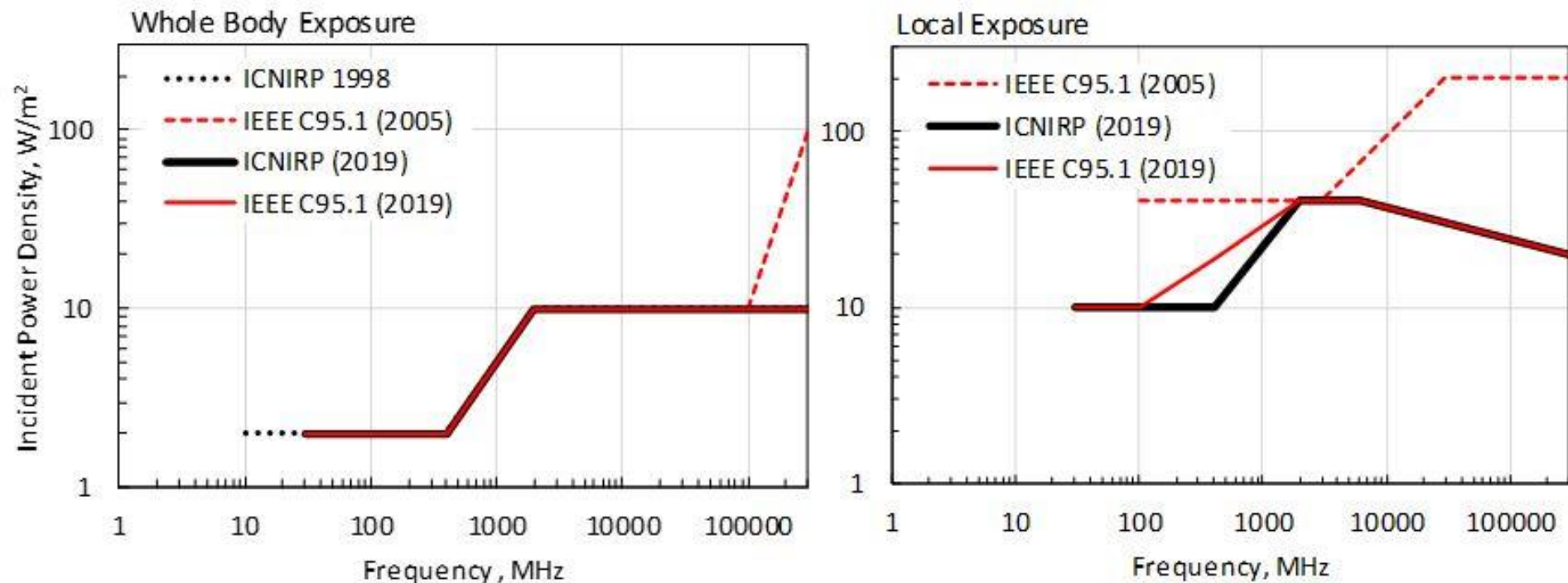
- ICNIRP 2019
- IEEE C95.1-2019
- Whole Body
- - - Local



Reference exposure levels general-public (V/m, also above 400 MHz)



ICNIRP vs IEEE: exposure reference levels for general public



Source [5G Communications Systems and Radiofrequency Exposure Limits](#); IEEE Future Net. Tech Focus, Volume 3, Issue 2, September 2019; Dr. Akimasa **Hirata** et al.

IEEE C95.1 2019 & ICNIRP 2020 Guidelines are largely harmonized

1. ICNIRP Guidelines (1998, and 2020) & IEEE Standard (2019) separate between general-public and occupational
2. The exposure levels of ICNIRP 2020 & IEEE Standard whole-body levels above 400 MHz are identical!
 - 1) SAR equals **2 W/kg** for general-public and **10 W/kg** for occupational
 - 2) Exposure reference-levels equals at:
 - **400 to 2000 MHz** $f_M/200 \text{ W/m}^2$ for general-public & $f_M/40 \text{ W/m}^2$ for occupational
 - **2000 to 300 000 MHz** 10 W/m^2 for general-public & 50 W/m^2 for occupational

Mitigation techniques to decrease the radiation level

1. Maximize RF to operators in order to decrease number of sites
2. Maximize sharing, including active frequencies sharing among cellular operators
3. Close the WI-FI access point when not in use

Summary

Administrations are encouraged to follow the ICNIRP Guidelines or IEEE Standard, or limits set by their own experts.

The best practice for Administrations that choose to use international RF-EMF exposure limits is to limit the exposure levels to the thresholds specified in [ICNIRP](#) (2020) Guidelines.

ITU workshop on modern policies, guidelines, regulations and assessments of human exposure to RF-EMF

Any Questions?

ITU, Geneva 10 Oct. 18

See workshop presentations at
<https://www.itu.int/en/ITU-D/Study-Groups/2018-2021/Pages/meetings/session-Q7-2-oct18.aspx>

