



עמותת מכבים

סיכוני קרינה משידורים אלקטרומגנטיים

ד"ר חיים מזר (מג'ר)

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9 יוני 2020 הרצאה בזום

<https://us02web.zoom.us/j/87419609965>

הרצאה זו נשלחה למר חזי לפיד



Hillel (ex) Radio Antenna; annulled due to fears

תחנת הילל נסגרה למרות שהוקמה ביישוב
צורן, ליד מושב פורת, עשרות שנים לפני בית
הספר הצמוד לתחנה. האנטנות הוסרו ב-2003
אף שהשידורים הופסקו חודשים לפני כן.



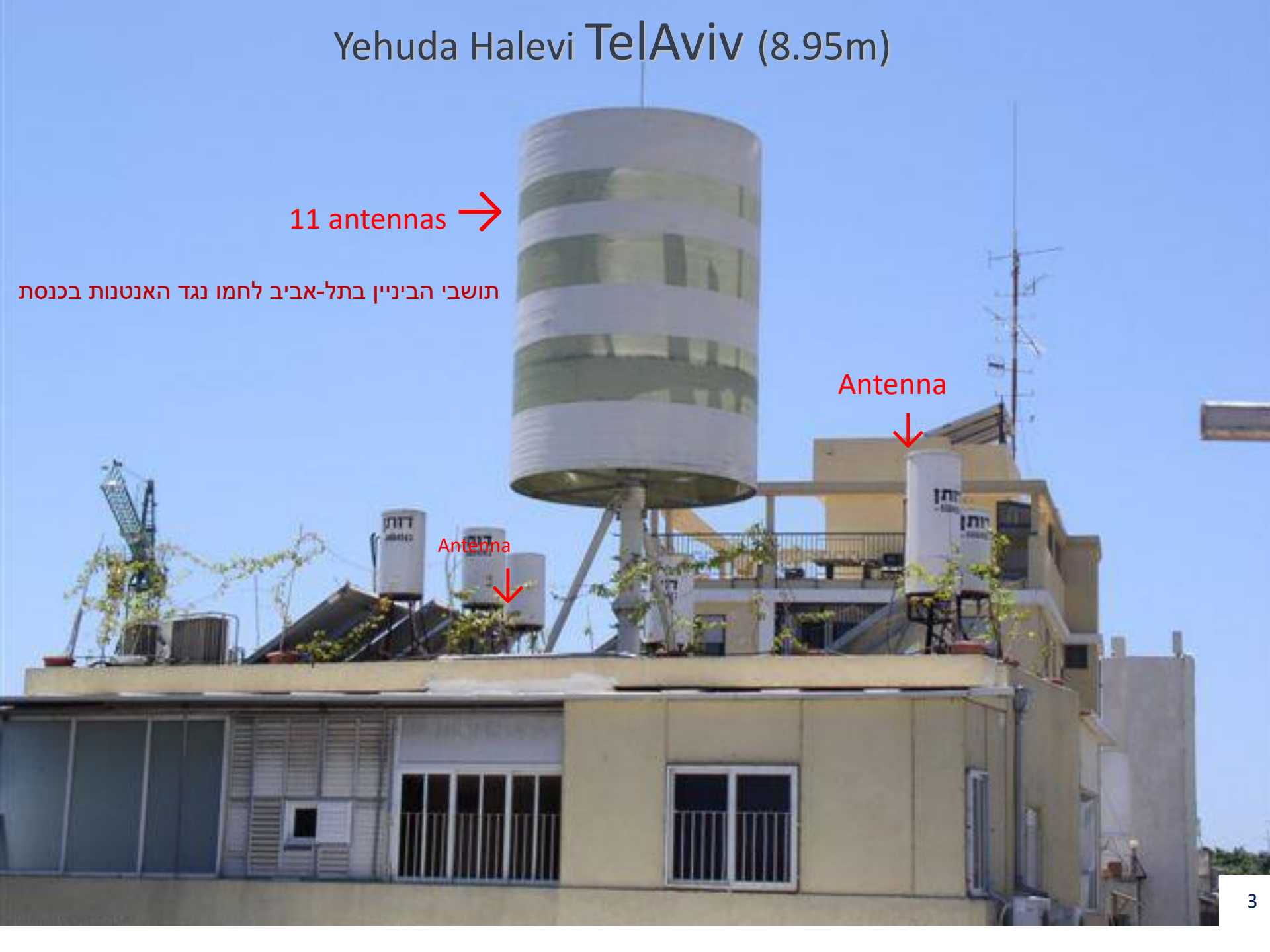
Yehuda Halevi Tel Aviv (8.95m)

11 antennas →

תושבי הביניין בתל-אביב לחמו נגד האנטנות בכנסת

Antenna

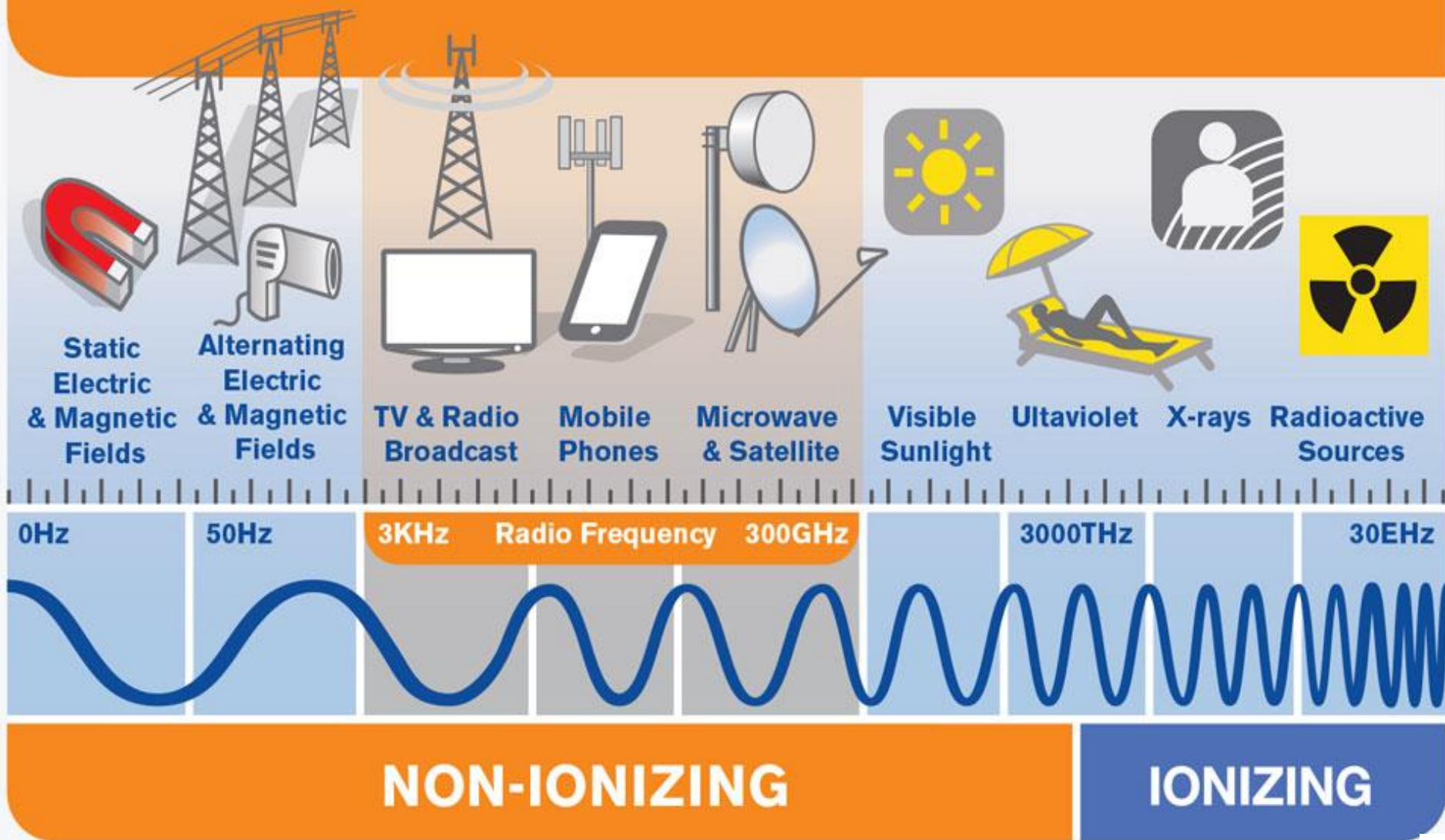
Antenna



Base Station Antenna Pattern: Azimuth and Elevation (Dr. Zamir Shalita)



THE ELECTROMAGNETIC SPECTRUM



RADIO COMMUNICATIONS IN THE COMMUNITY

TV & RADIO BROADCAST
1,000 – 120,000
WATTS



2-WAY RADIO BASES
50 – 100 WATTS



BASE STATION
< 2 – 100 WATTS



WIFI
0.1 - 4 WATTS



< INFILL SITE
2 – 50 WATTS



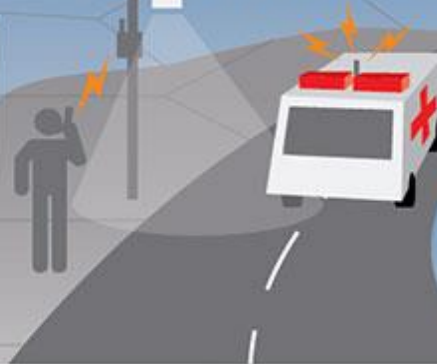
SMALL-CELL
2 - 10 WATTS



< BASE STATION



0.1 - 4 WATTS

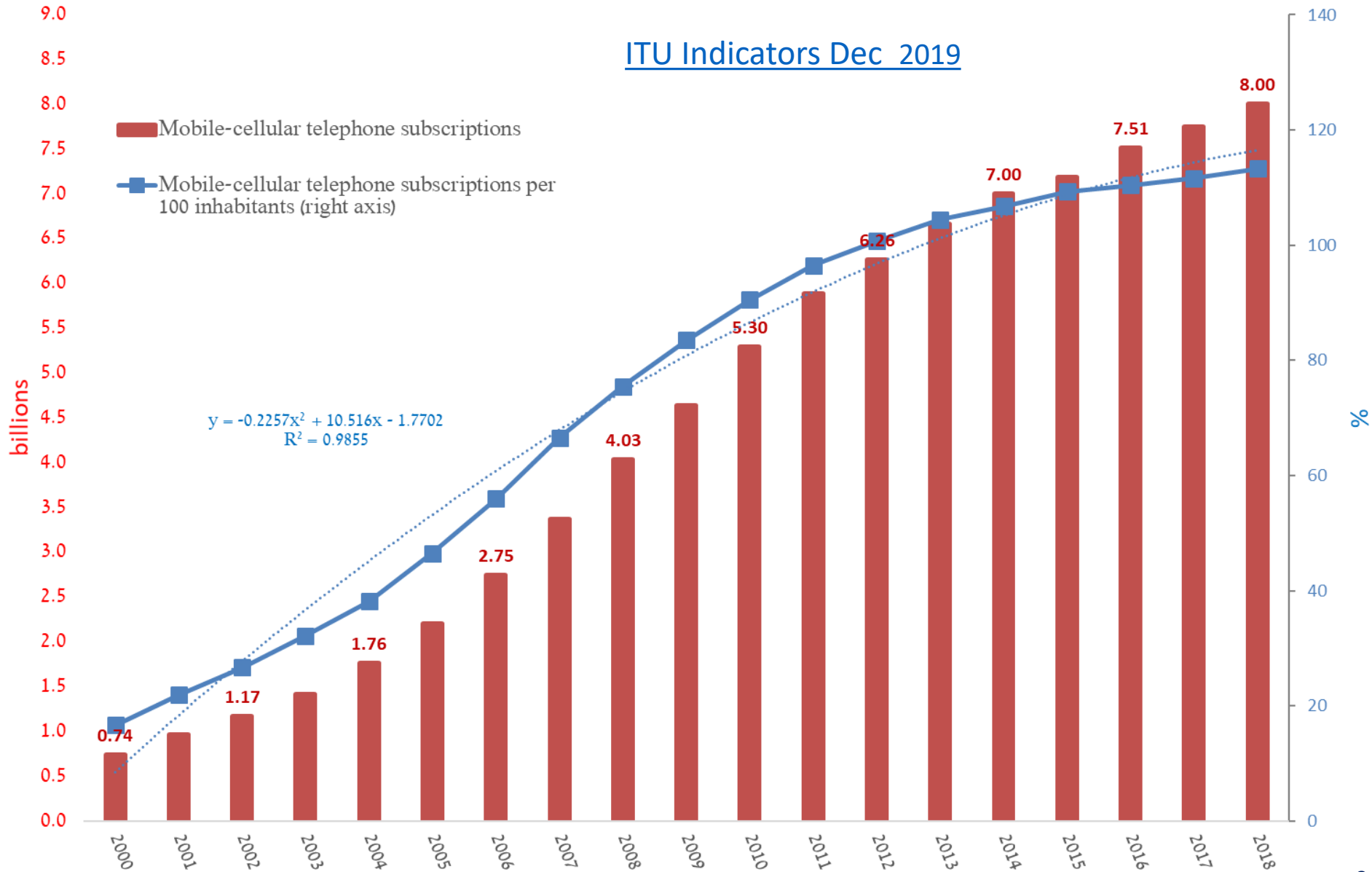


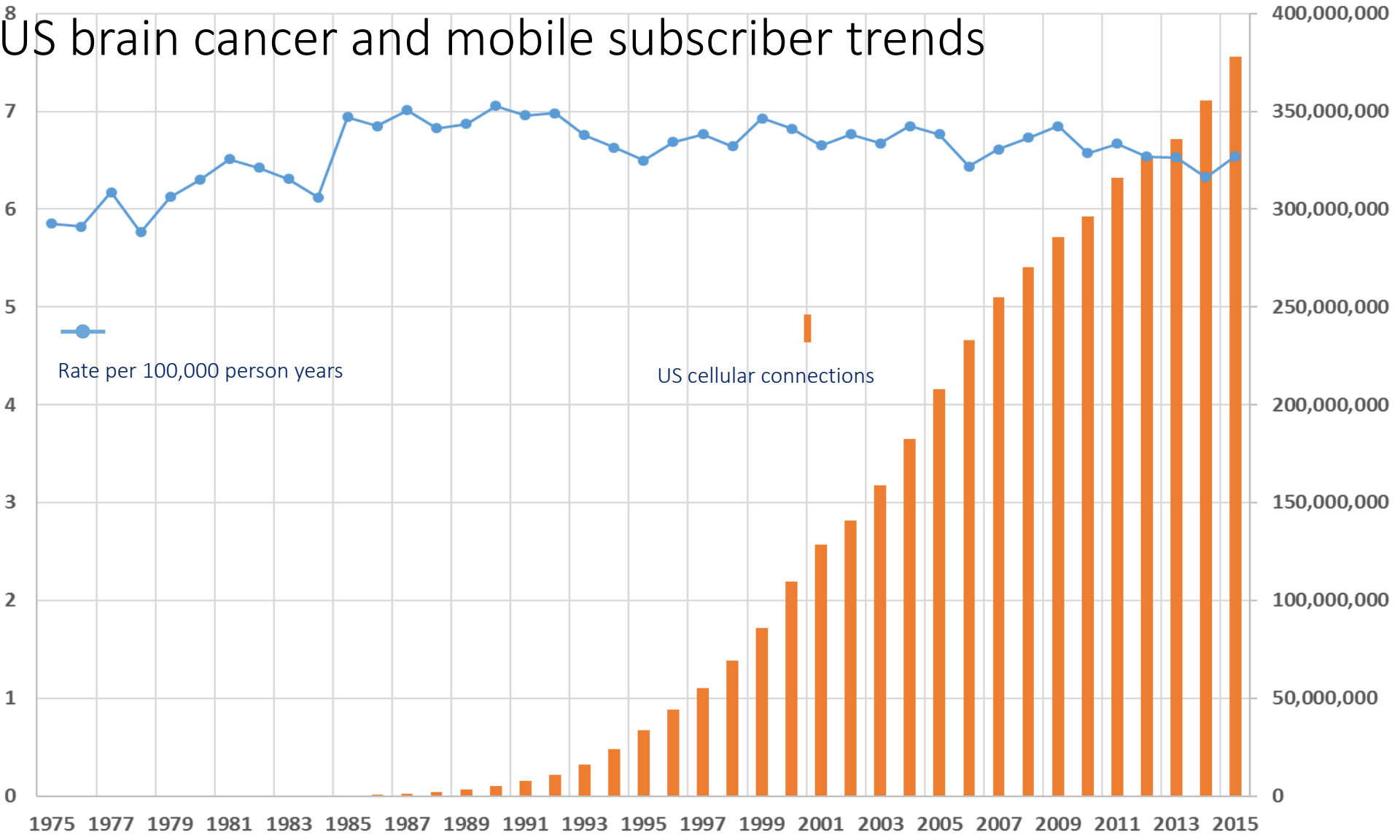
* typical power into each antenna

RF adverse effects: low-level effects

- No adverse effects have been established from low-level exposures, despite more than 70 years of research
- No known interaction mechanisms
- No meaningful dose-response relationship
- Speculative
- Inappropriate for standard setting

Mobile-cellular telephone subscriptions (billions) & Mobile-cellular telephone subscriptions per 100 inhabitants, 2000-2018





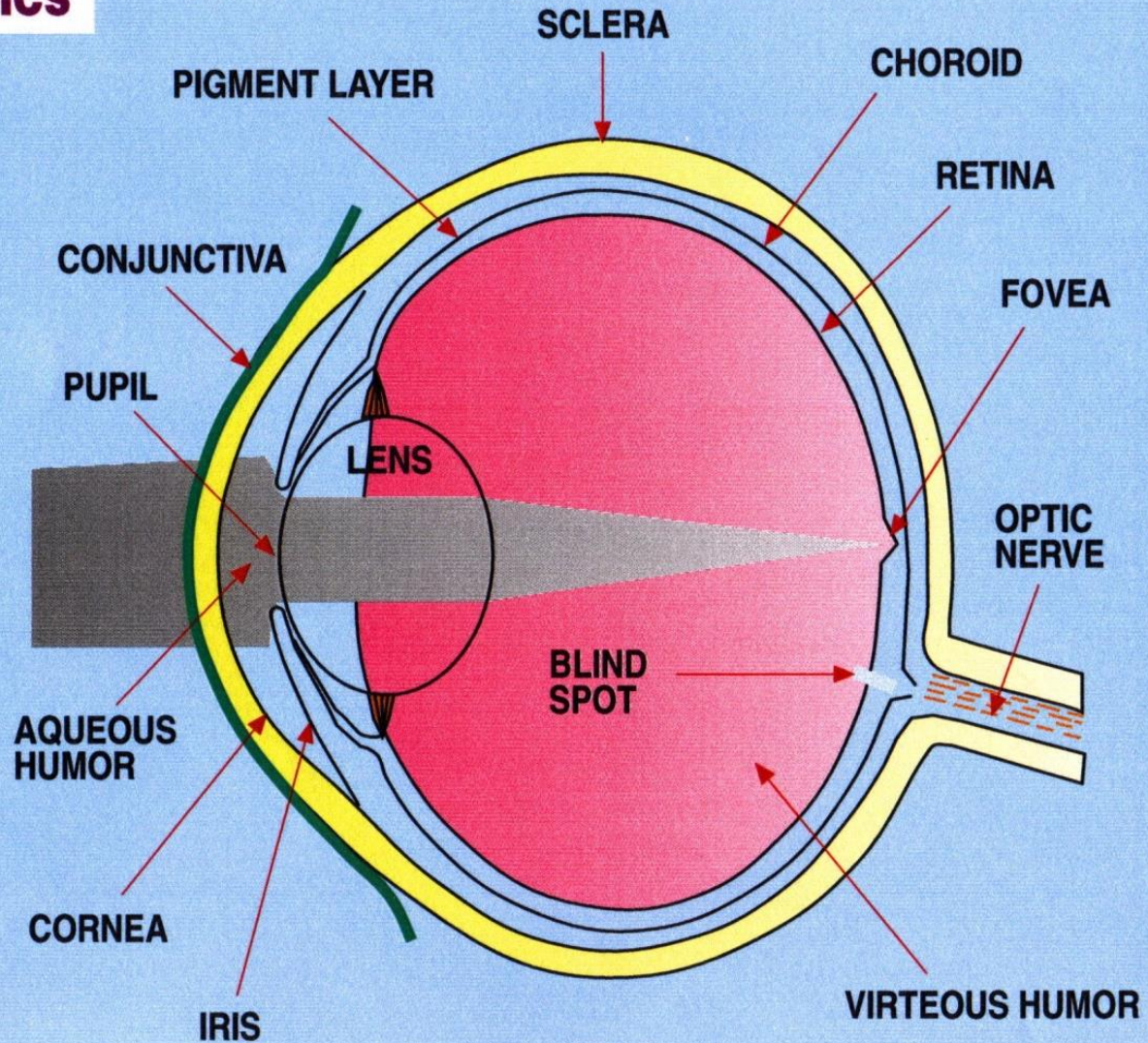
Overall, incidence data of the Surveillance, Epidemiology, and End Results (SEER) do not support the view that cellular phone use causes brain cancer

Based on CTIA and SEER data, and [Inskip et al., 2010](#)

The Human Eye (Moshe Netzer)

SUSCEPTIBILITY CHARACTERISTICS

- POOR BLOOD CIRCULATION
- LENSE OPACITY
- CORNEA DAMAGE
- RETINA RAPTURE



Summerised results 2017: 90% of exposure levels measured in 2017 in rural areas are below 0.95 V/m.

* Values below the typical sensitivity threshold of the measuring devices, which equals 0.38 V/m

	Mesurements n°	50% (median values)	90 %	99 %	Max
Rural	425; 16 %	0,25* V/m	0,95 V/m	2,8 V/m	3,95 V/m
Urban	2166; 84 %	0,4 V/m	1,67 V/m	5,6 V/m	11,25 V/m
Indoor	1666; 64%	0,31* V/m	1,34 V/m	4,1 V/m	10,54 V/m
Outdoor	914: 36%	0,52 V/m	1,93 V/m	6,3 V/m	11,25 V/m
Total	2591	0,36* V/m	1,57 V/m	5,5 V/m	11,25 V/m

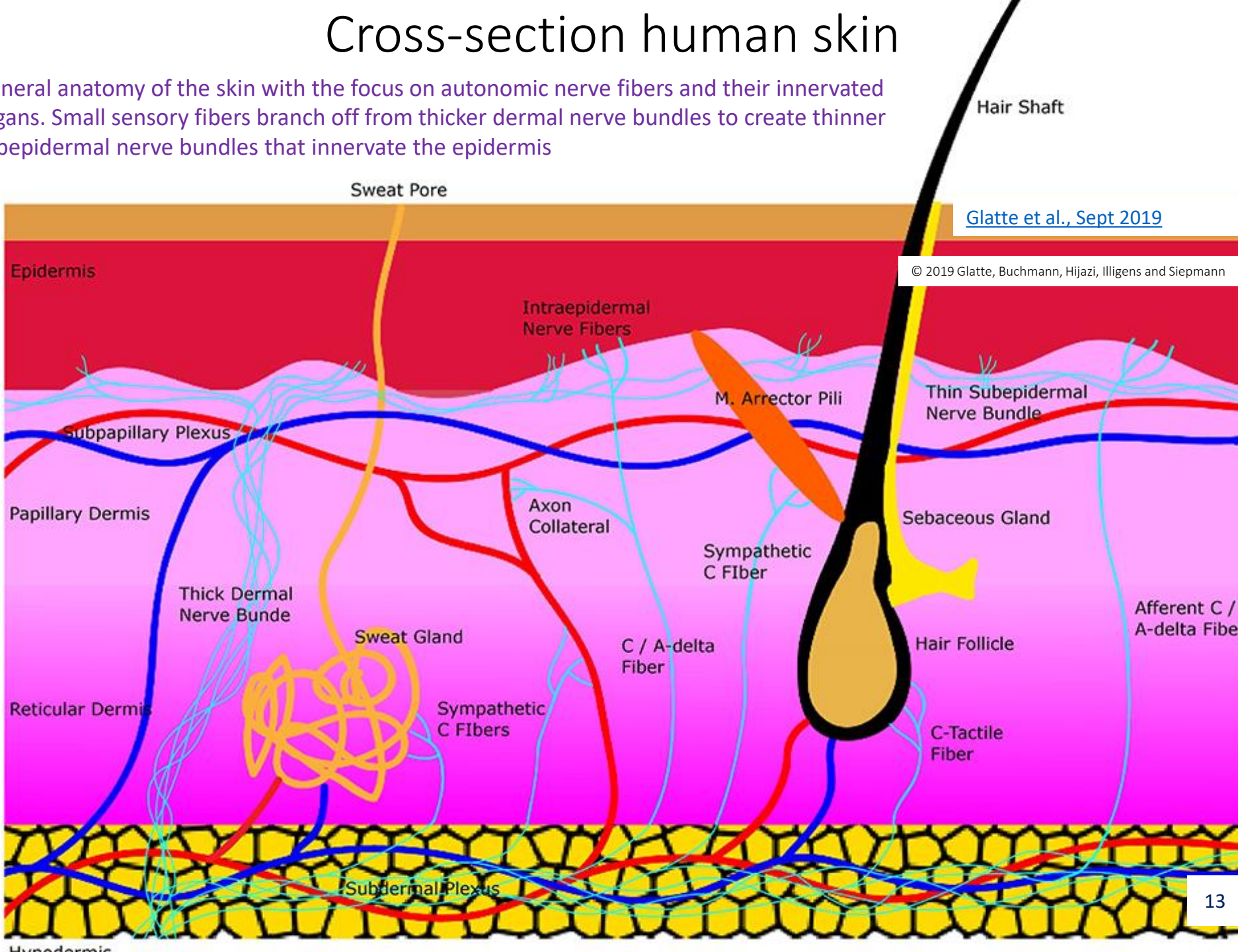
Questions to be raised

Compliance calculations and some periodic measurements are essential. However:

1. Why do we need to make so many nation-wide measurements?
2. May be ICNIRP reference levels are too liberal?

Cross-section human skin

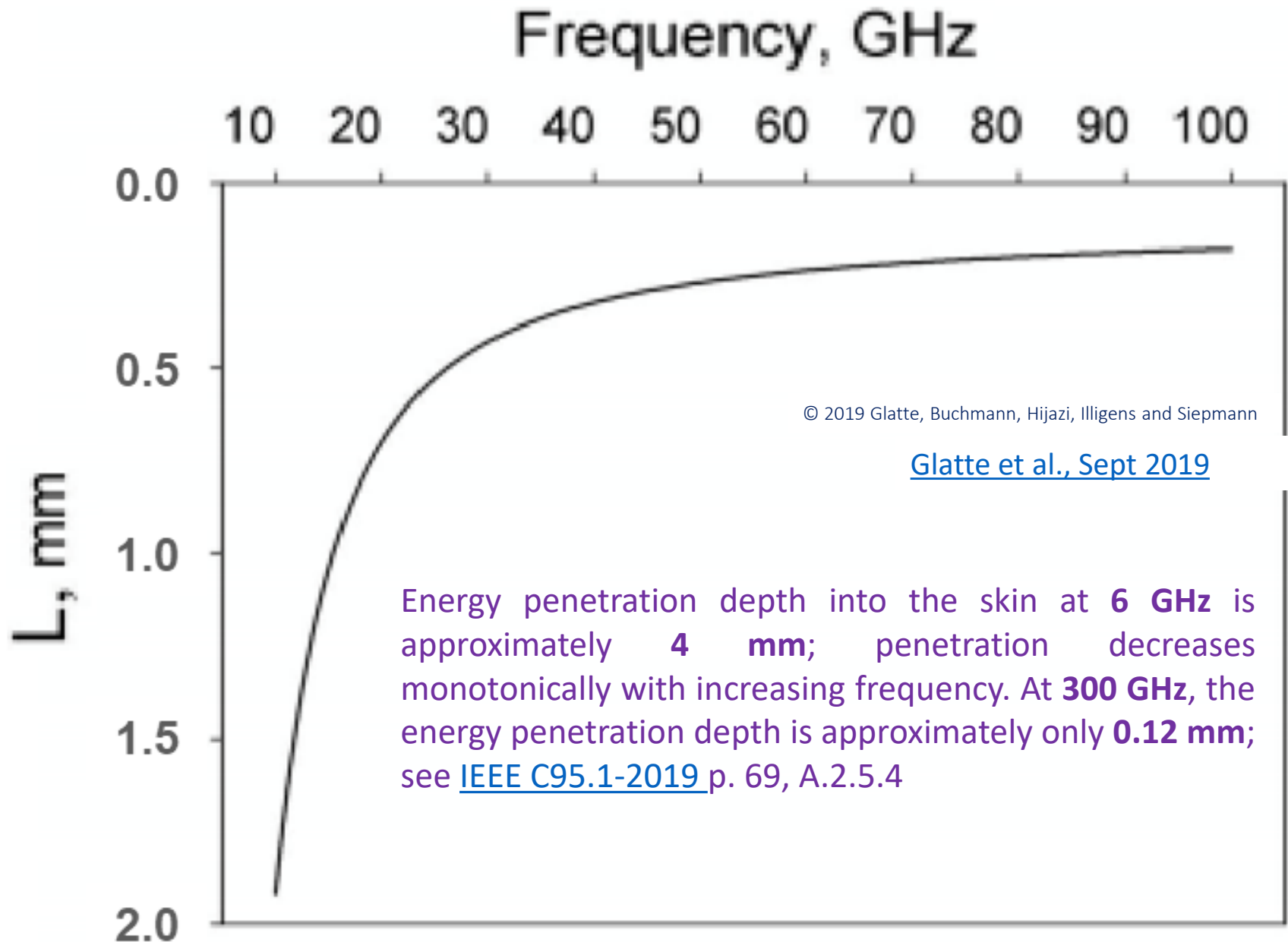
General anatomy of the skin with the focus on autonomic nerve fibers and their innervated organs. Small sensory fibers branch off from thicker dermal nerve bundles to create thinner subepidermal nerve bundles that innervate the epidermis



[Glatte et al., Sept 2019](#)

© 2019 Glatte, Buchmann, Hijazi, Illigens and Siepmann

mmWaves mostly absorbed in outer skin layers



International Commission on Non-Ionizing Radiation Protection (ICNIRP) 2020 guidelines for limiting exposure to electromagnetic fields (100 KHz to 300 GHz)

Published in: Health Phys 118(5): 483–524; 2020; [DOI: 10.1097/HP.0000000000001210](https://doi.org/10.1097/HP.0000000000001210)

ICNIRP reference levels are critical for compliance assessment

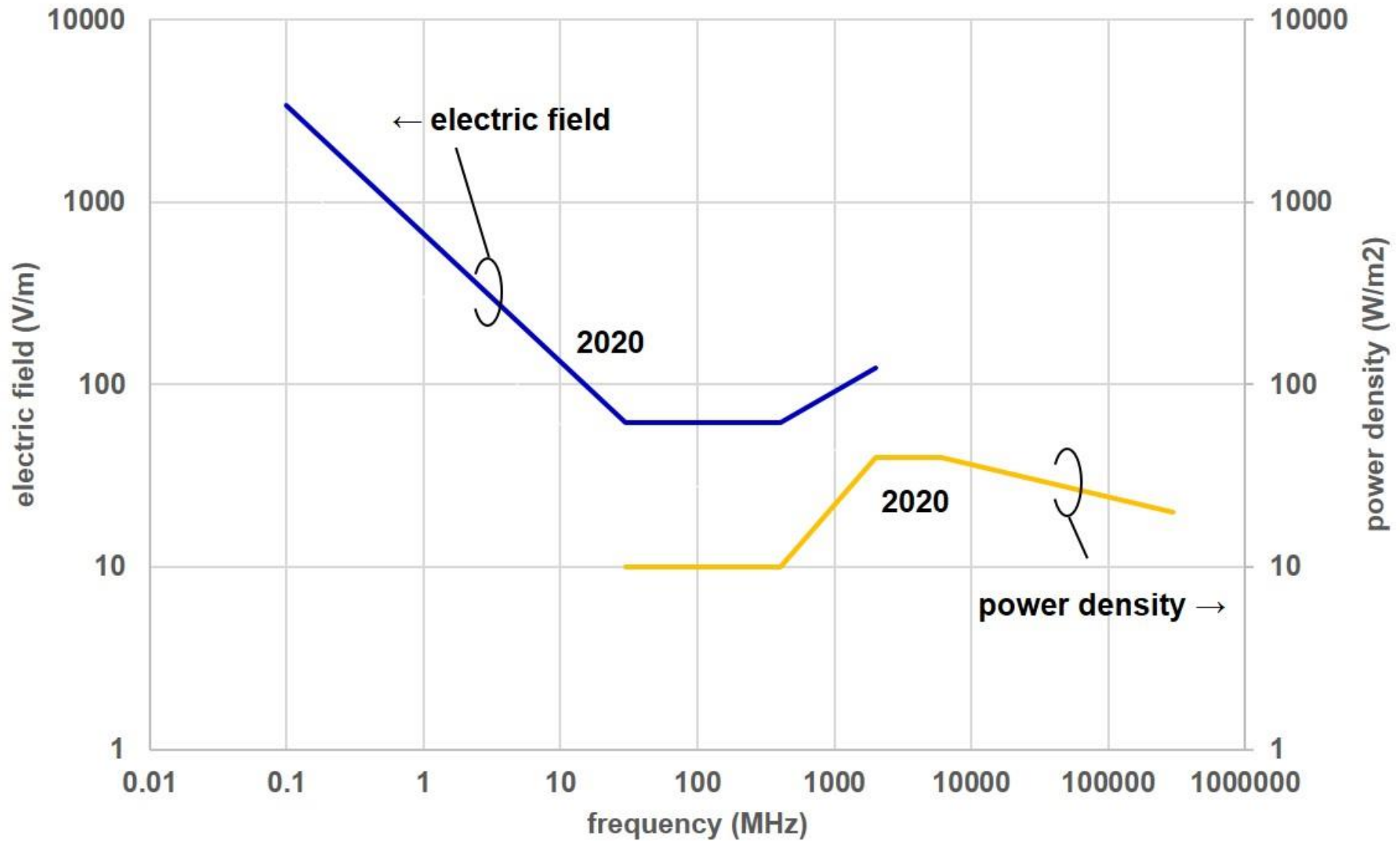
חוק הקרינה הבלתי מייננת, תשס"ו-2006

1. חוק זה מטרתו להגן על הציבור ועל הסביבה מפני השפעות של חשיפה לקרינה בלתי מייננת, ולהסדיר את העיסוק במקורות קרינה, הקמתם והפעלתם ובמתן שירות למדידת קרינה, בין השאר על ידי קביעת איסורים וחובות בהתאם לעקרון הזהירות המונעת.
2. תקנות הקרינה הבלתי מייננת, התשס"ט-2009
3. תקנות הקרינה הבלתי מייננת מסדירות את רישוי העיסוק במקורות קרינה בלתי מייננת ואת הרמה המקצועית הנדרשת מן העוסקים בנושא זה. התקנות גם מחייבות למדוד את רמות הקרינה הבלתי מייננת. התקנות הקרינה ממקור הקרינה שלגביו מבוקש השינוי לא תעלה על 10% מרמות החשיפה המרביות המותרות לקרינה, כאמור בתוספת השניה.

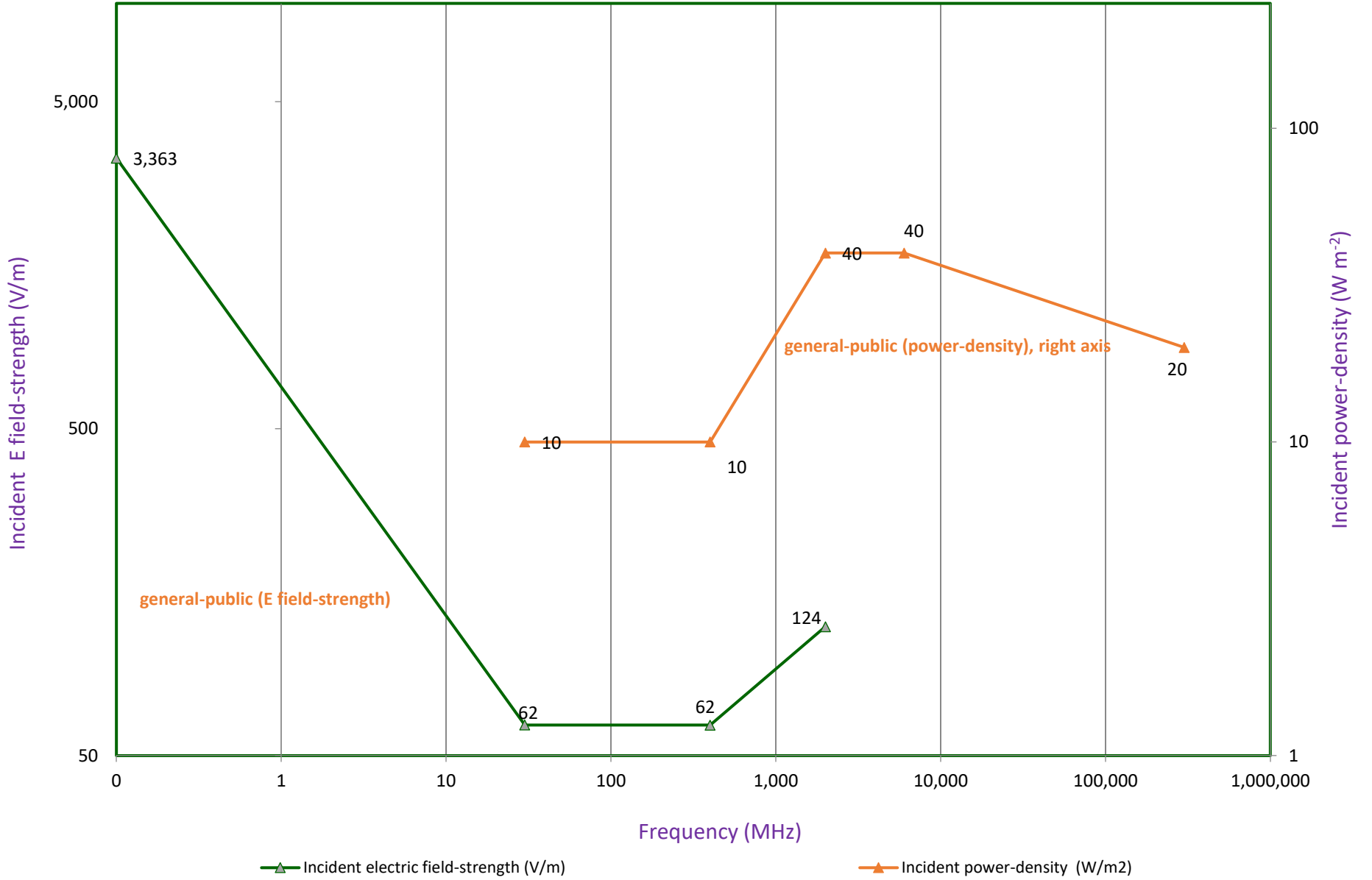
ICNIRP 2020: Table 1. Quantities and corresponding SI units used in these guidelines

Quantity	Symbol	Unit
Absorbed power density	<i>S_{ab}</i>	watt per square meter (W m ⁻²)
Incident power density	<i>S_{inc}</i>	watt per square meter (W m ⁻²)
Incident electric field strength	<i>E_{inc}</i>	volt per meter (V m ⁻¹)
Specific energy absorption rate	<i>SAR</i>	watt per kilogram (W kg ⁻¹)
Frequency	<i>f</i>	hertz (Hz)
Time	<i>t</i>	second (s)

[ICNIRP 2020](#) Web Fig. 4 **general public,**
local exposures ≥ 6 min 100 kHz to 300 GHz



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



Societal Concerns



Electromagnetic Hyper-Sensitivity; electro-phobia

Subjective phobia, phantom risk (?!)



Type I error imposes regulatory restrictions on factors that turn out to be harmless.

Type II error : acceptance of a null hypothesis that turns out to be false

Precautionary Principle: billions of cellular users phones and millions of base-stations worldwide

Photo's Source:???

There is no evidence of causality between pains and RF exposure

World Health Organization (1948) definition of “health”: a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

ICNIRP 2020 Guidelines in brief; not from the Guidelines

<https://www.icnirp.org/en/activities/news/news-article/rf-guidelines-2020-published.html>

Basic restrictions

Parameter	Frequency range	ΔT	Spatial averaging	Temporal averaging	Health effect level	Reduction factor	Workers	Reduction factor	General public
Core ΔT	100 kHz-300 GHz	1°C	WBA*	30 min	4 W/kg	10	0.4 W/kg	50	0.08 W/kg
Local ΔT (Head & Torso)	100 kHz-6 GHz	2°C	10 g	6 min	20 W/kg	2	10 W/kg	10	2 W/kg
Local ΔT (Limbs)	100 kHz-6 GHz	5°C	10 g	6 min	40 W/kg	2	20 W/kg	10	4 W/kg
Local ΔT (Head & Torso, Limbs)	>6-300 GHz 30-300 GHz	5°C	4 cm ² 1 cm ²	6 min 6 min	200 W/m ² 400 W/m ²	2	100 W/m ² 200 W/m ²	10	20 W/m ² 40 W/m ²

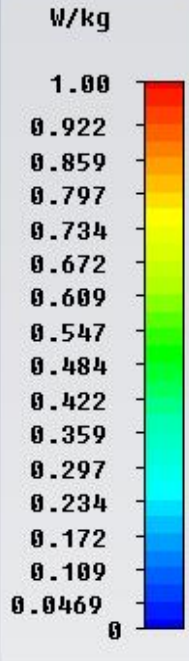
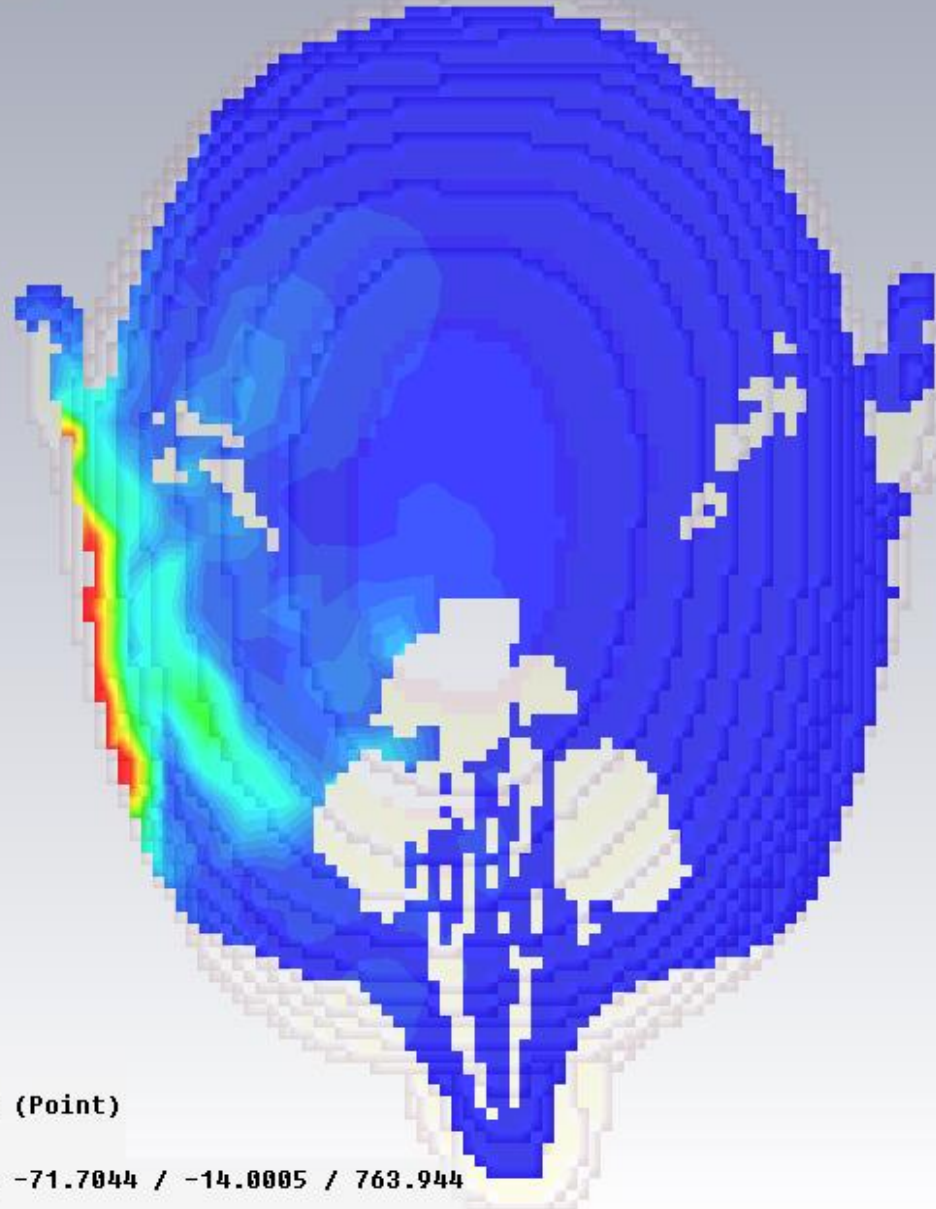
* WBA: whole body average

Mitigation techniques to decrease the radiation level (1)

1. Don't use terrestrial TV, as the Tx & Rx are fixed, and cable TV and satellites provide TV coverage
2. Maximize RF to operators in order to decrease number of sites
3. Maximize sharing, including active frequencies sharing among cellular operators
4. Close the WI-FI access point when not in use

SAR phantom simulation (Stefan Chulski & Stav Revich from HIT)

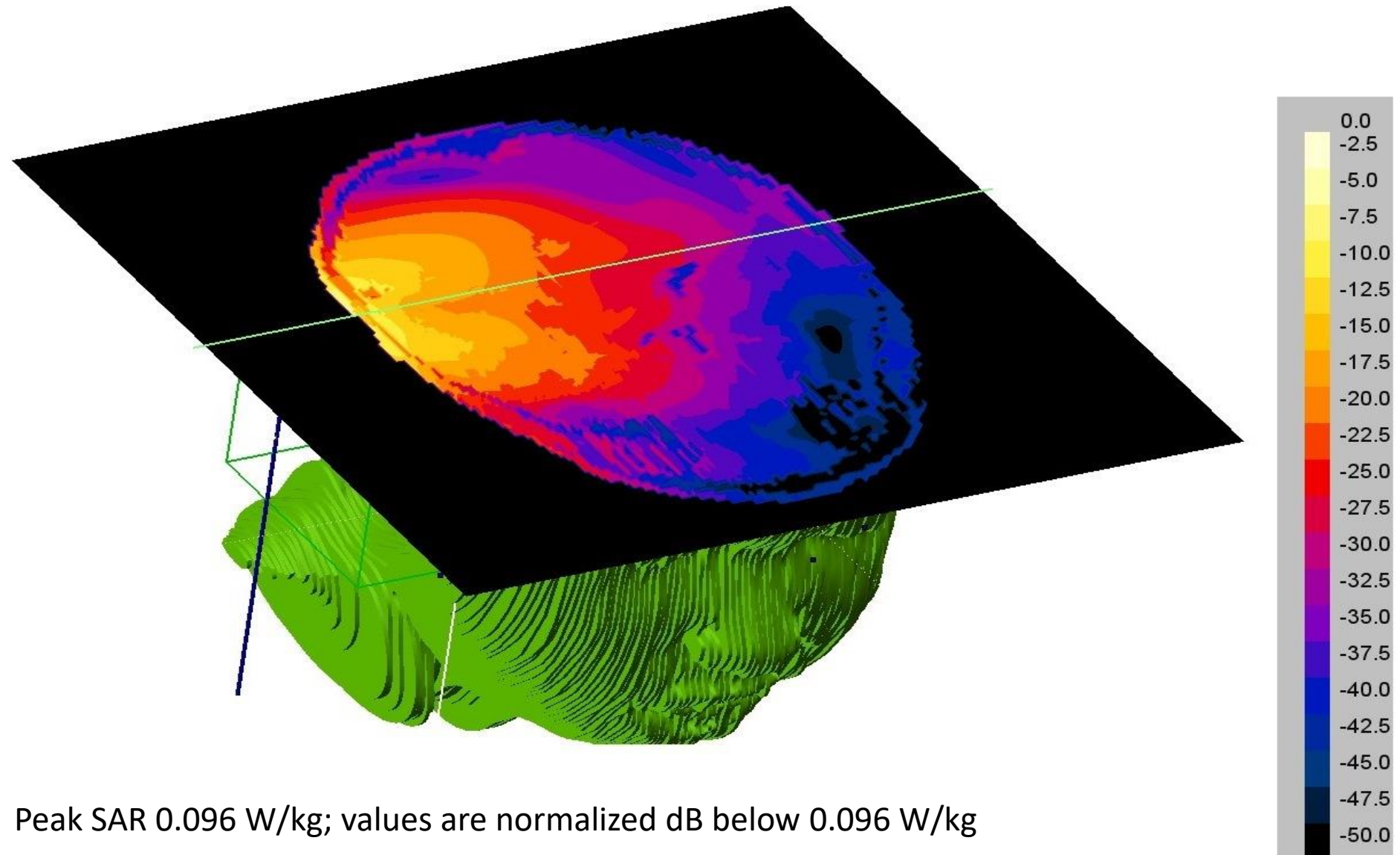
Clamp to range: (Min: 0 / Max: 1)



Type	SAR (rms)
Monitor	SAR (f=0.9) [1] (Point)
Plane at z	763.944
Maximum-2D	8.02639 W/kg at -71.7044 / -14.0005 / 763.944
Frequency	0.9

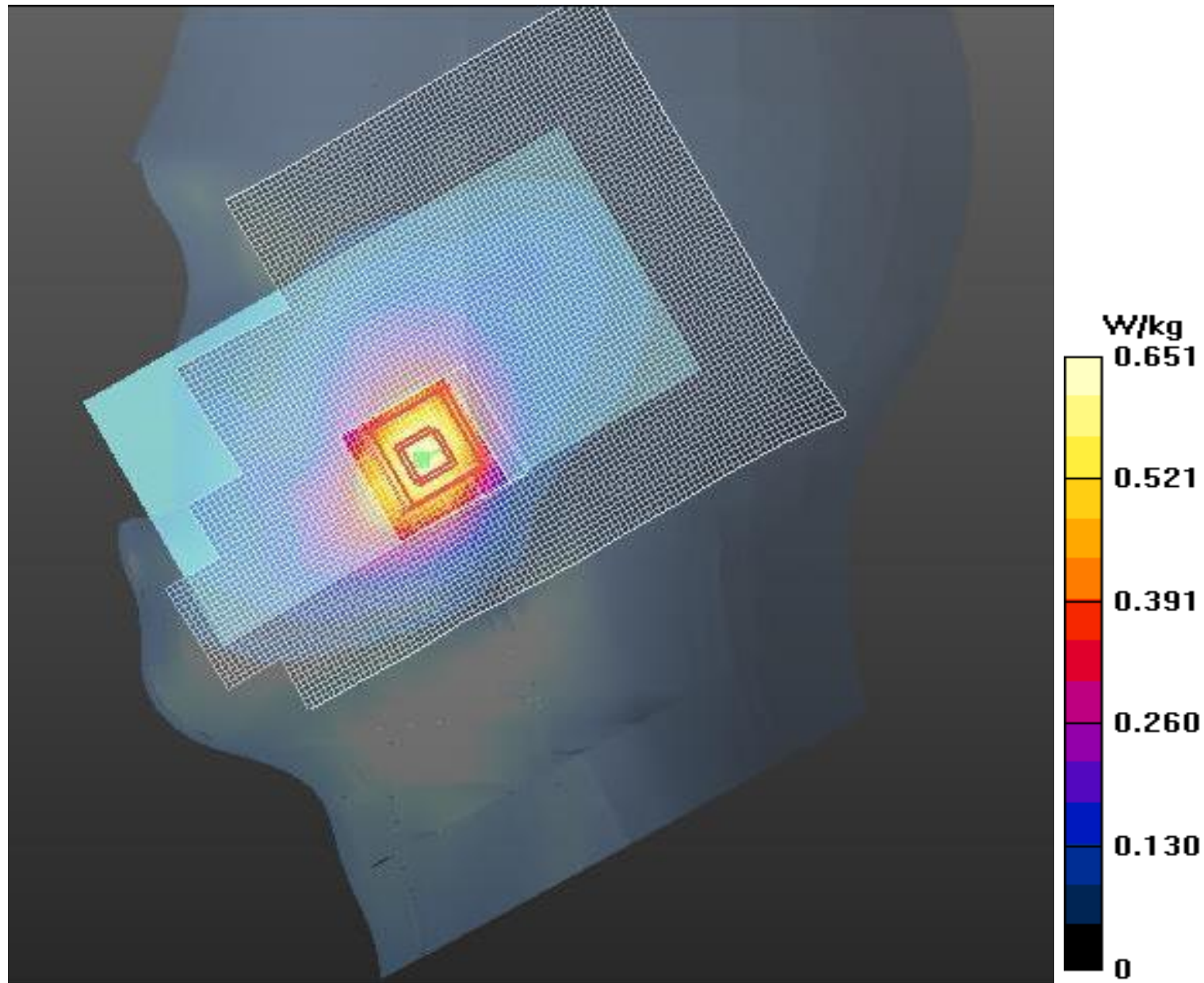
Numerical simulation of SAR; for a three years child

Source: Dr. Jafar Keshvari, Bio-electromagnetics Aalto University, Helsinki-Finland

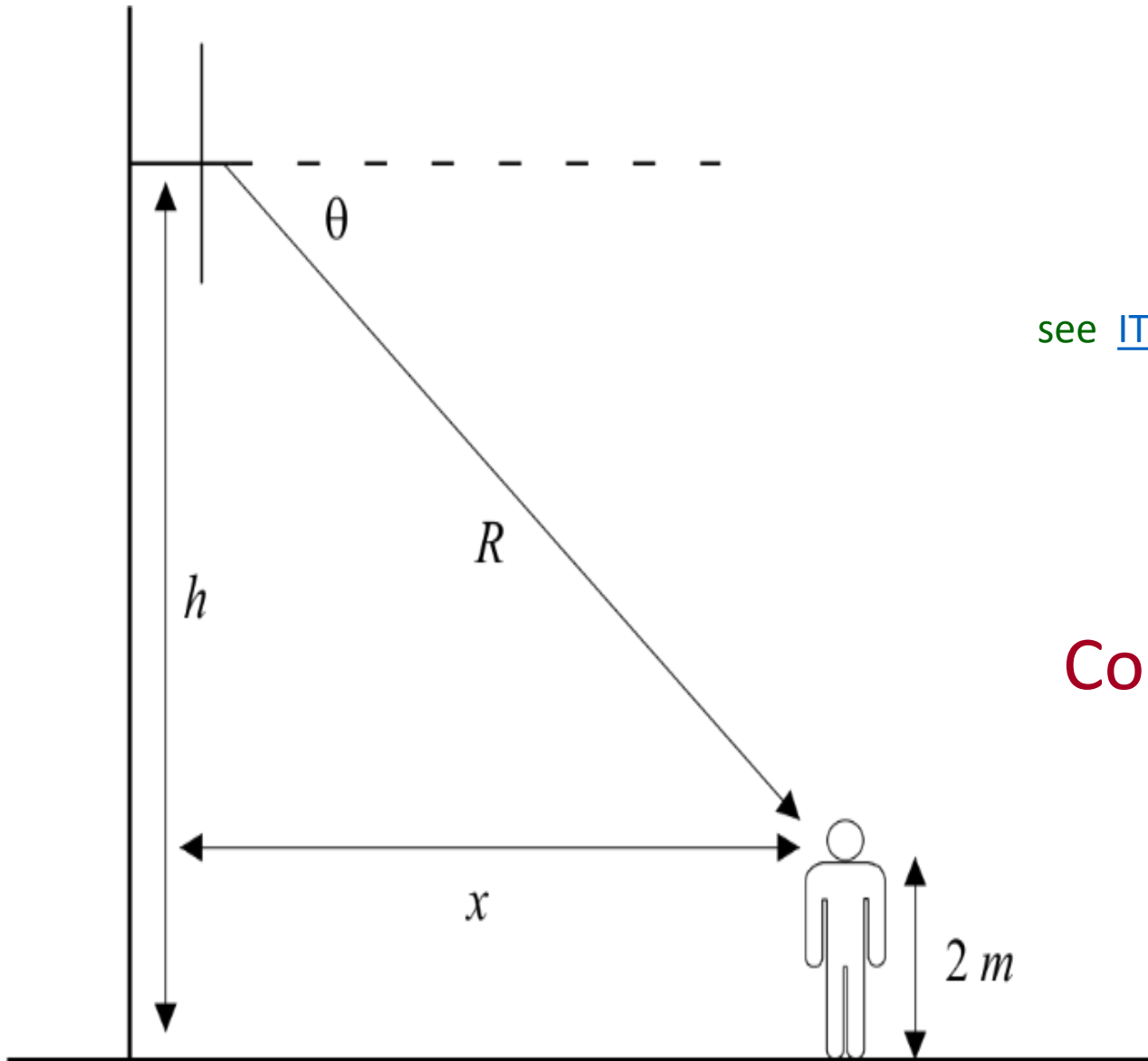


SAR real measurement for a commercial mobile phone

Source: Dr. Jafar Keshvari, Bio-electromagnetics Aalto University, Helsinki-Finland



Configuration for calculating exposure at ground level



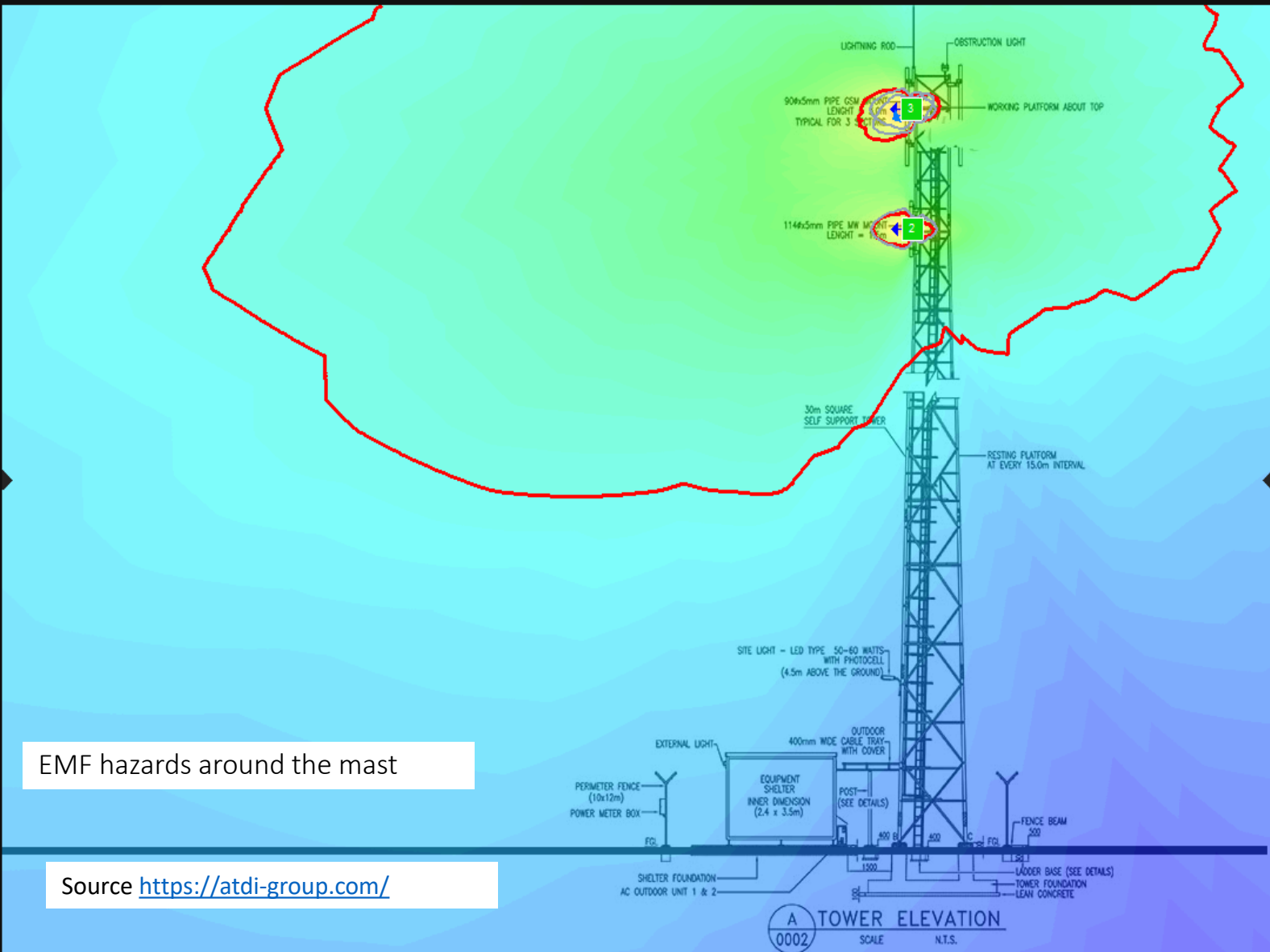
see [ITU-T 2018 K.52 Fig II.1](#)

Compliance

K.52(14)_FII.1

82.246
-0.708
0 m
0
0.0 m 0.0 us
0.0 0.0 0.0 °
142.0000 dBuV/m
-0.6 dBm 12.589 V/m

Tx/Rx
0001 -T:
0002 -T:
0003 -T:

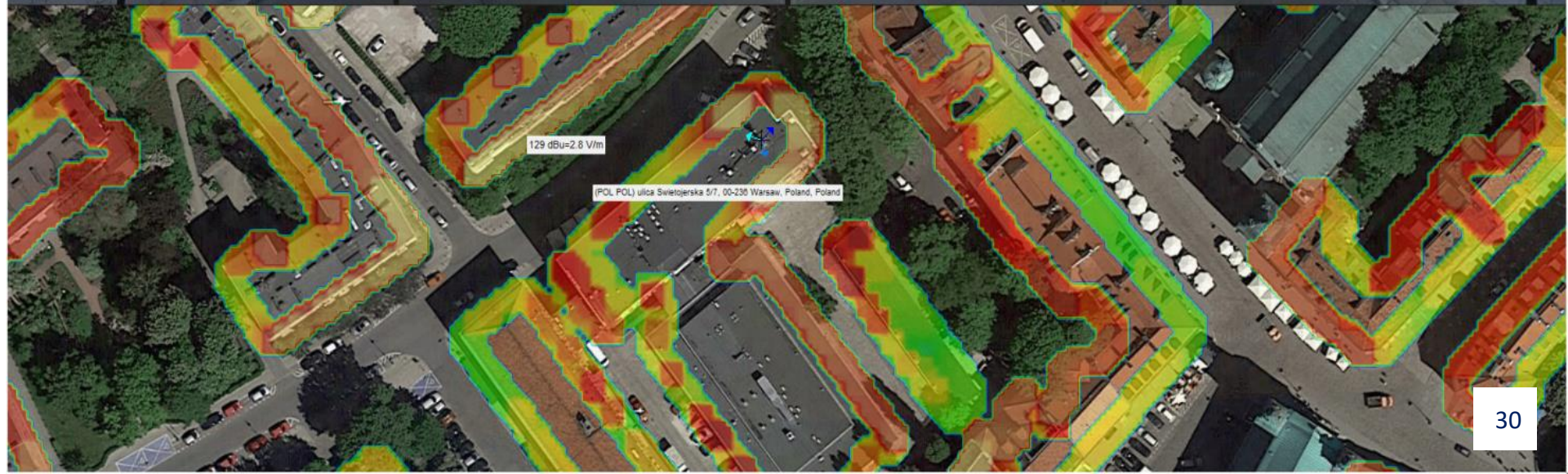


EMF hazards around the mast

Source <https://atdi-group.com/>

A TOWER ELEVATION
0002
SCALE N.T.S.

ATDI 3D coverage analysis, to find max exposure locations



Calculating far-field safety-distances around base stations using elevation ant. pattern

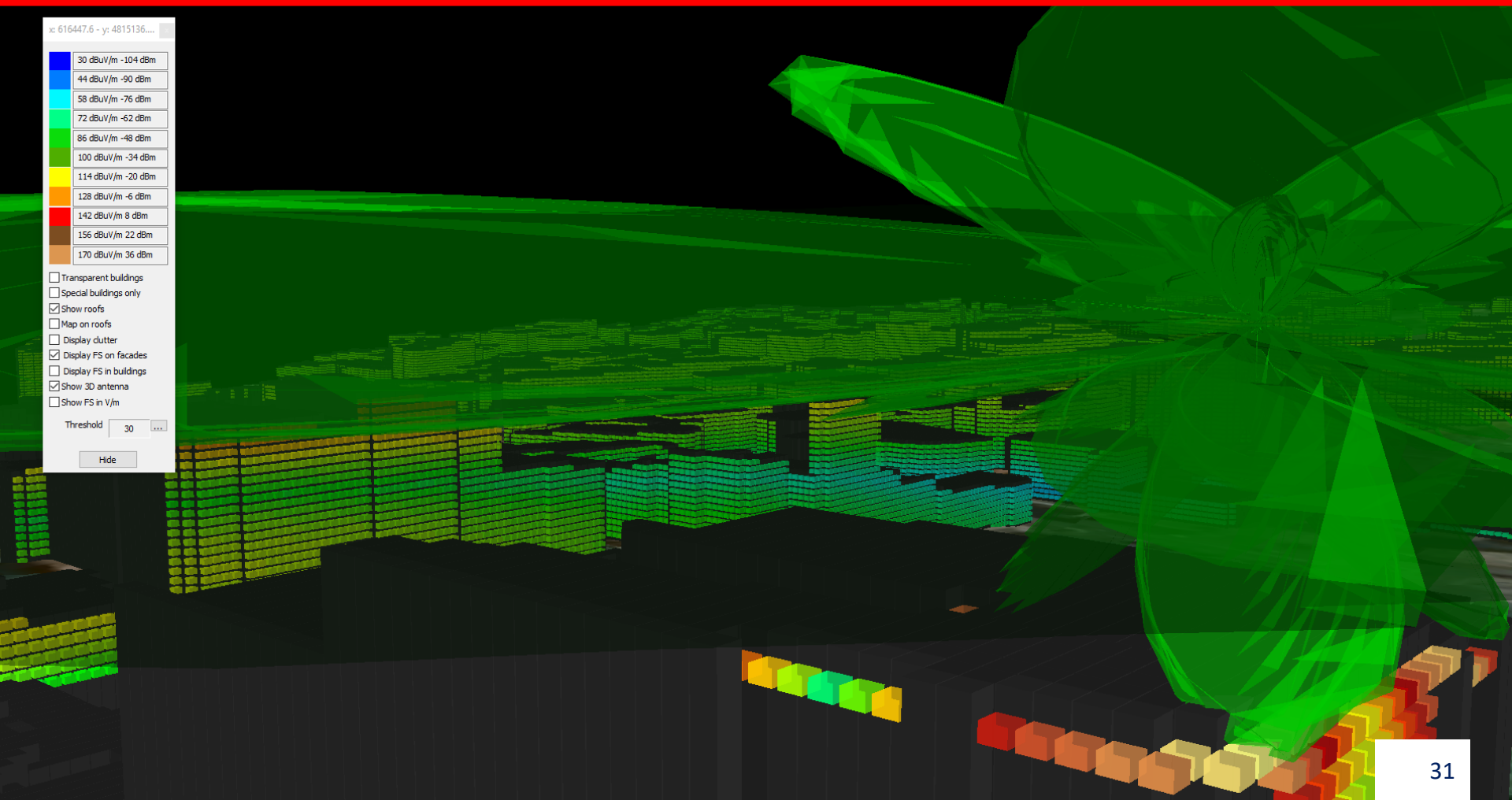
Ant. tilt 0 degrees; also in azimuth antenna pattern is analysed; typically in 3 sectors
5G, there is azimuth overlap: 6dB attenuation in $\pm 60^\circ$ & 3dB $\pm 45^\circ$, around mainbeam

ie: 616447.6 - y: 4815136...

30 dBuV/m -104 dBm
44 dBuV/m -90 dBm
58 dBuV/m -76 dBm
72 dBuV/m -62 dBm
86 dBuV/m -48 dBm
100 dBuV/m -34 dBm
114 dBuV/m -20 dBm
128 dBuV/m -6 dBm
142 dBuV/m 8 dBm
156 dBuV/m 22 dBm
170 dBuV/m 36 dBm

- Transparent buildings
- Special buildings only
- Show roofs
- Map on roofs
- Display clutter
- Display FS on facades
- Display FS in buildings
- Show 3D antenna
- Show FS in V/m

Threshold



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

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>



תודה על ההקשבה. פרסומים והרצאות של המרצה

- ITU Conferences on EMF
 - 1) [A Comparison Between European and North American Wireless Regulations](#), presentation at the 'Technical Symposium at ITU Telecom World 2011' www.itu.int/worl2011; the [slides presentation](#), 27 October 2011
 - 2) [2016 ITU R-D-T 'Intersectoral activities on human exposure to EMF'](#); Bangkok, 26 April 2016
 - 3) [2017 ITU Workshop '5G, EMF & Health'](#); Warsaw, Poland, 5 December 2017
 - 4) [2018 ITU workshop 'modern policies, guidelines, regulations and assessments of human exposure to RF-EMF'](#); Geneva, Switzerland, 10 October 2018 ; see [slide](#)
- Papers and Presentations
 - 1) Updated [Chapter 9](#) on EMF exposure of my Wiley book on [Spectrum Management](#)
 - 2) [Human RF Exposure Limits: Reference Levels in Europe, USA, Canada, China, Japan and Korea](#) EMC Europe 2016; Wroclaw, Poland, 9 Sept. 2016
 - 3) [Regulation of RF Human Hazards](#) Lusaka, Zambia; 13 January 2017
 - 4) [EMF Concerns and Perceptions](#) Modiin, Israel; 25 March 2019
 - 5) [EMF, New ICNIRP Guidelines and IEEE C95.1-2019 Standard: Differences and Similarities](#); Warsaw, Poland; 3 Dec 2019
 - 6) Module on EMF to the ITU Spectrum Training; April 2020
 - 7) PRIDA Track 1 (T1) Online training in [English](#) and in French; April and May 2020
 - 8) [Academic Course Advanced Wireless Communications Mazar3 Regulation EMC HumanHazards 2020.pdf](#)