State of Israel

Ministry of Communications
& Ministry of Energy

Municipality of TelAviv

Human Exposure considerations in Smart Sustainable Cities

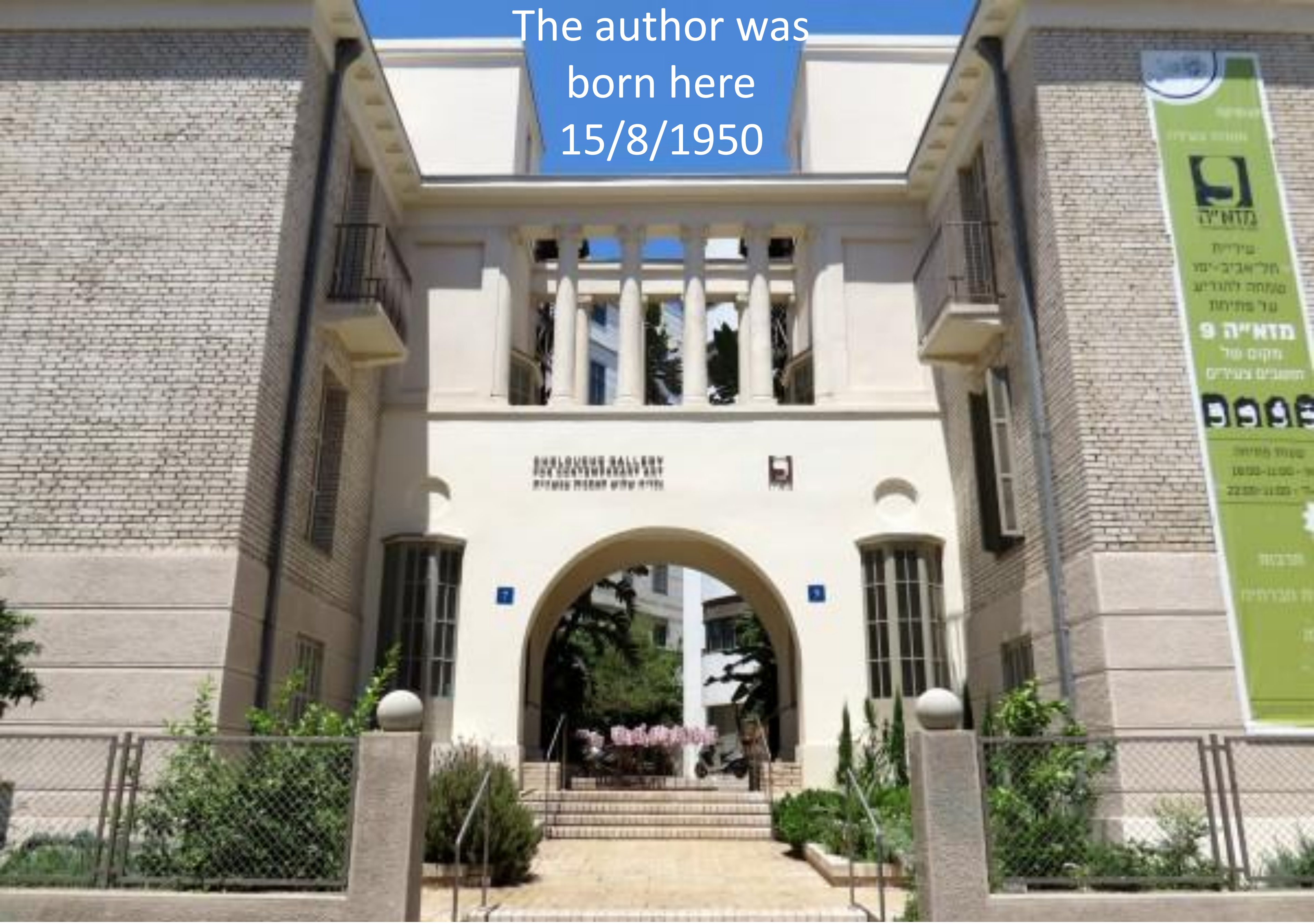
'Israel Smart Cities'; intra-ministerial commission

Tel Aviv, 21 January 2015

Presentation by Dr. Haim Mazar (Madjar)

See also ITU-T Focus Group on Smart Sustainable Cities 2014 *EMF Considerations in Smart Sustainable Cities*

Place of presentation
Youth House; Street Maze 9 TelAviv
Municipality of TelAviv



This building served as the TelAviv municipal hospital 1918-1992

Electromagnetic Fields EMF Hyper-Sensitivity; electro-phobia

Subjective phobia, phantom risk (?!)

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

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

Photo's Source:???

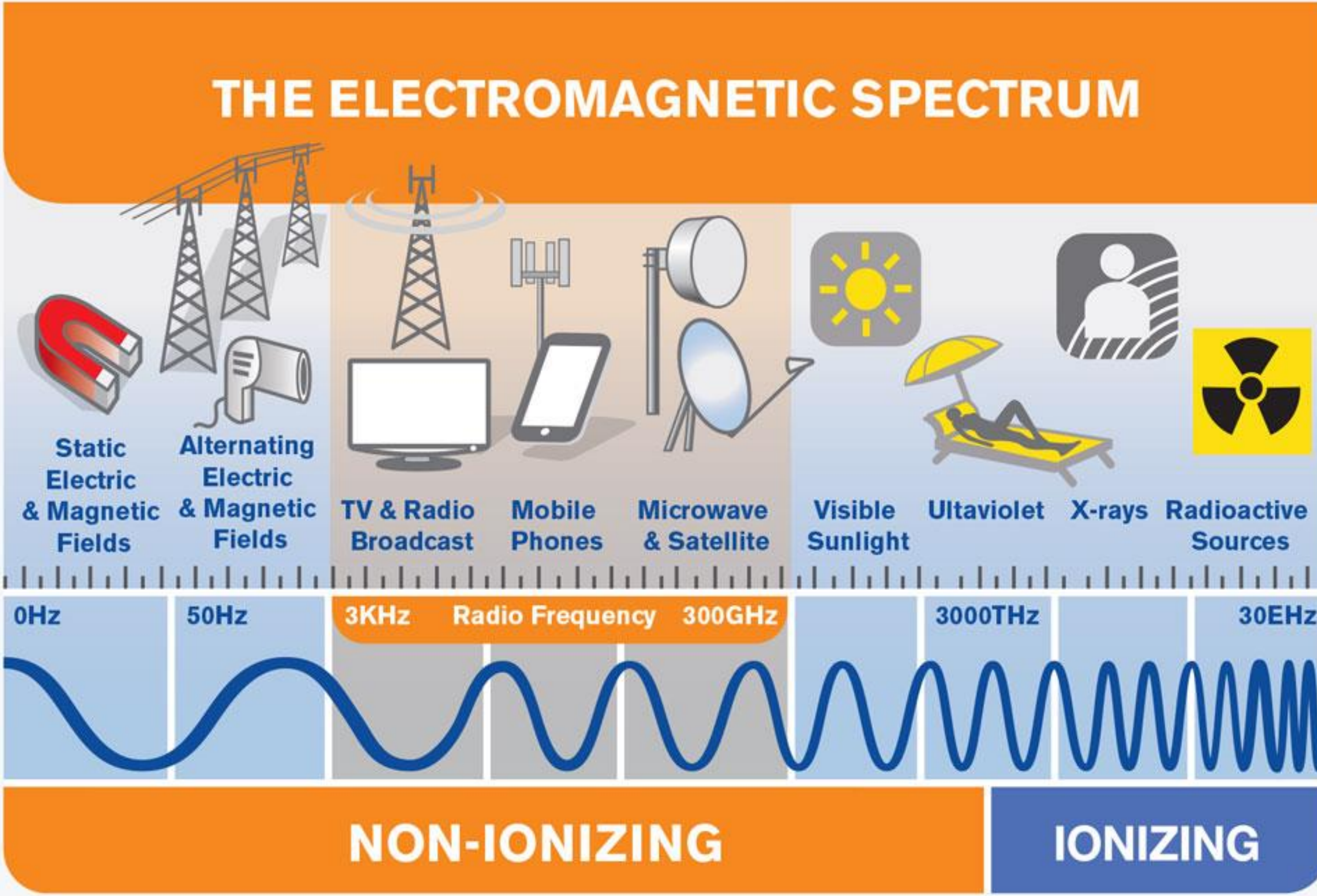
There is no evidence of causality between pains and RF exposure

EMF Technical Report – Overview

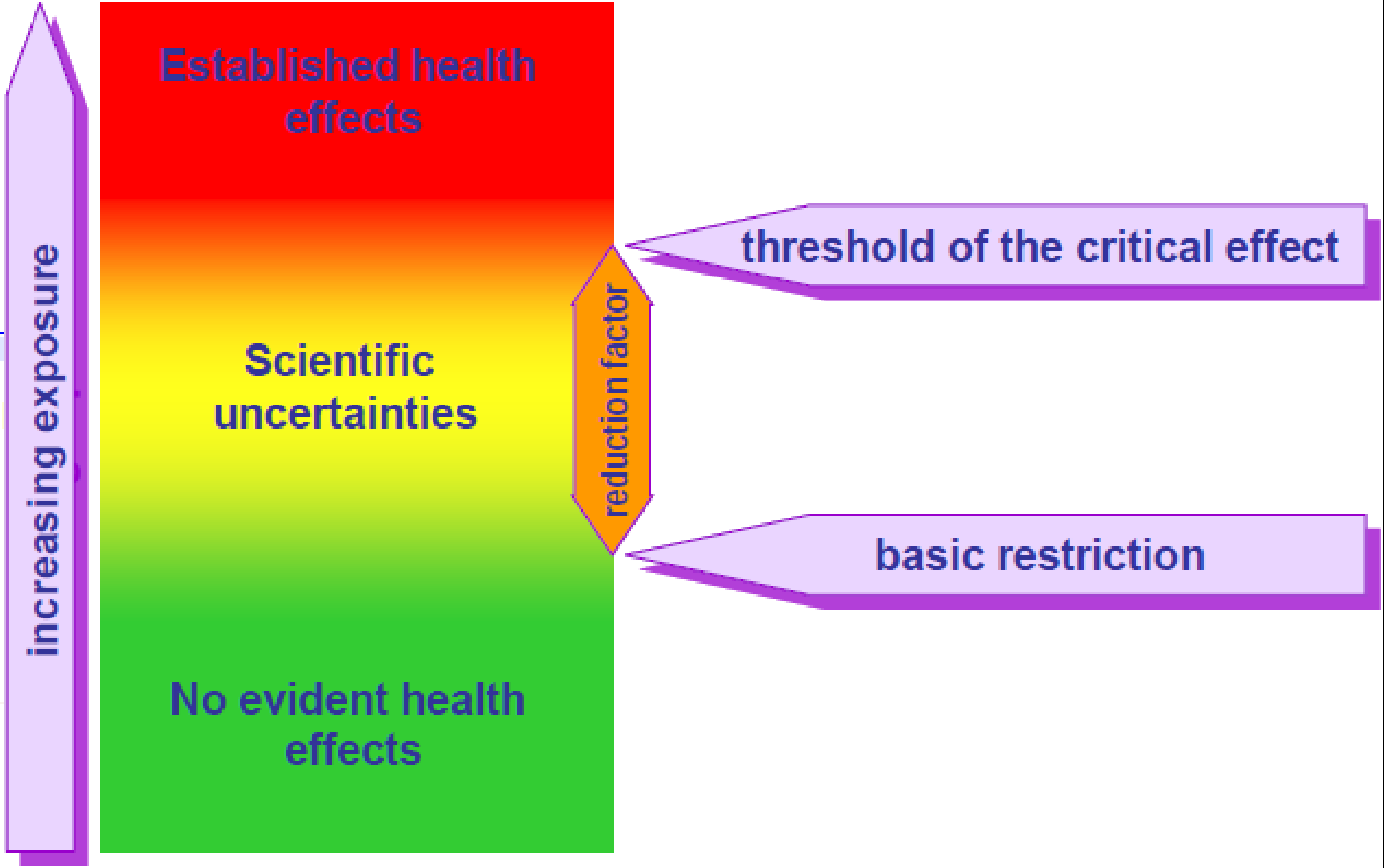
- Wireless networks provide vital infrastructure and connection of ICT's that underpin the Smart Sustainable Cities

- The effective design and careful deployment of wireless networks and Short Range Devices (SRDs) are vital to ensuring electromagnetic field (EMF) compliance and maximum efficiency for ICT's

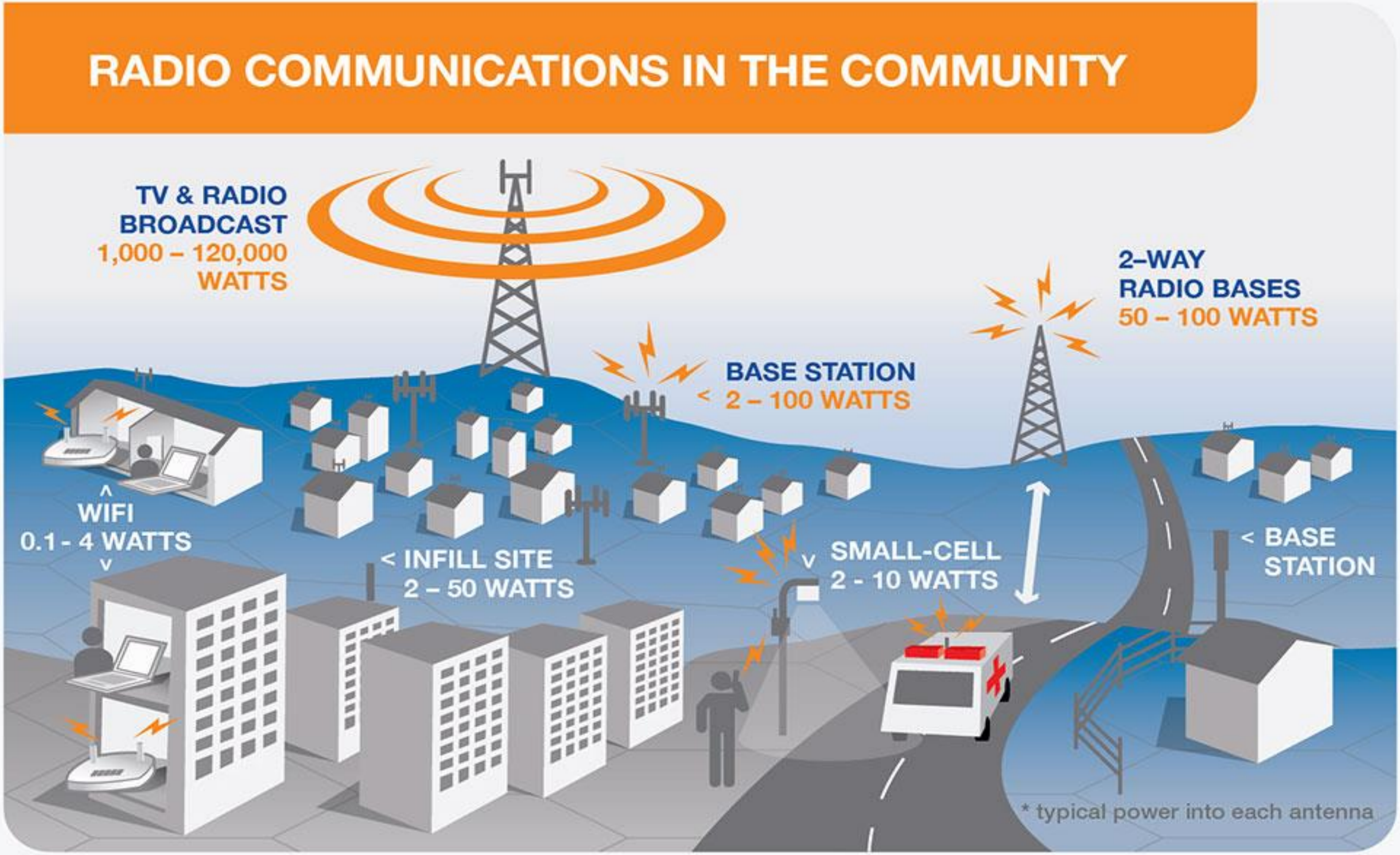
Source: ITU-T Focus Group on Smart Sustainable Cities 2014 *EMF Considerations in Smart Sustainable Cities*



Source: ITU-T Focus Group on Smart Sustainable Cities 2014 *EMF Considerations in Smart Sustainable Cities*



Source: ICNIRP View presented at the ITU Workshop on Human Exposure to Electromagnetic Fields, Turin, 9 May 2013



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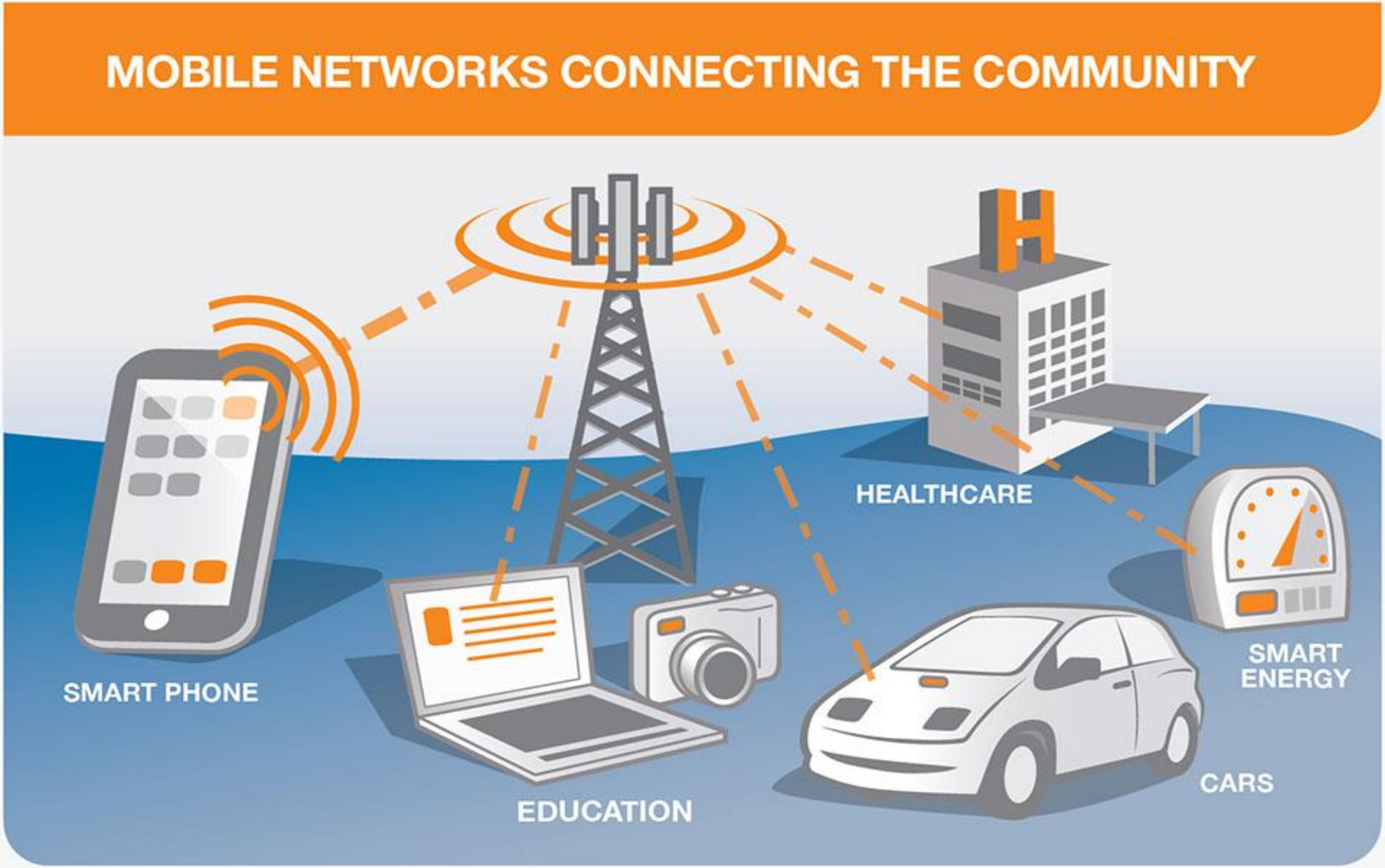

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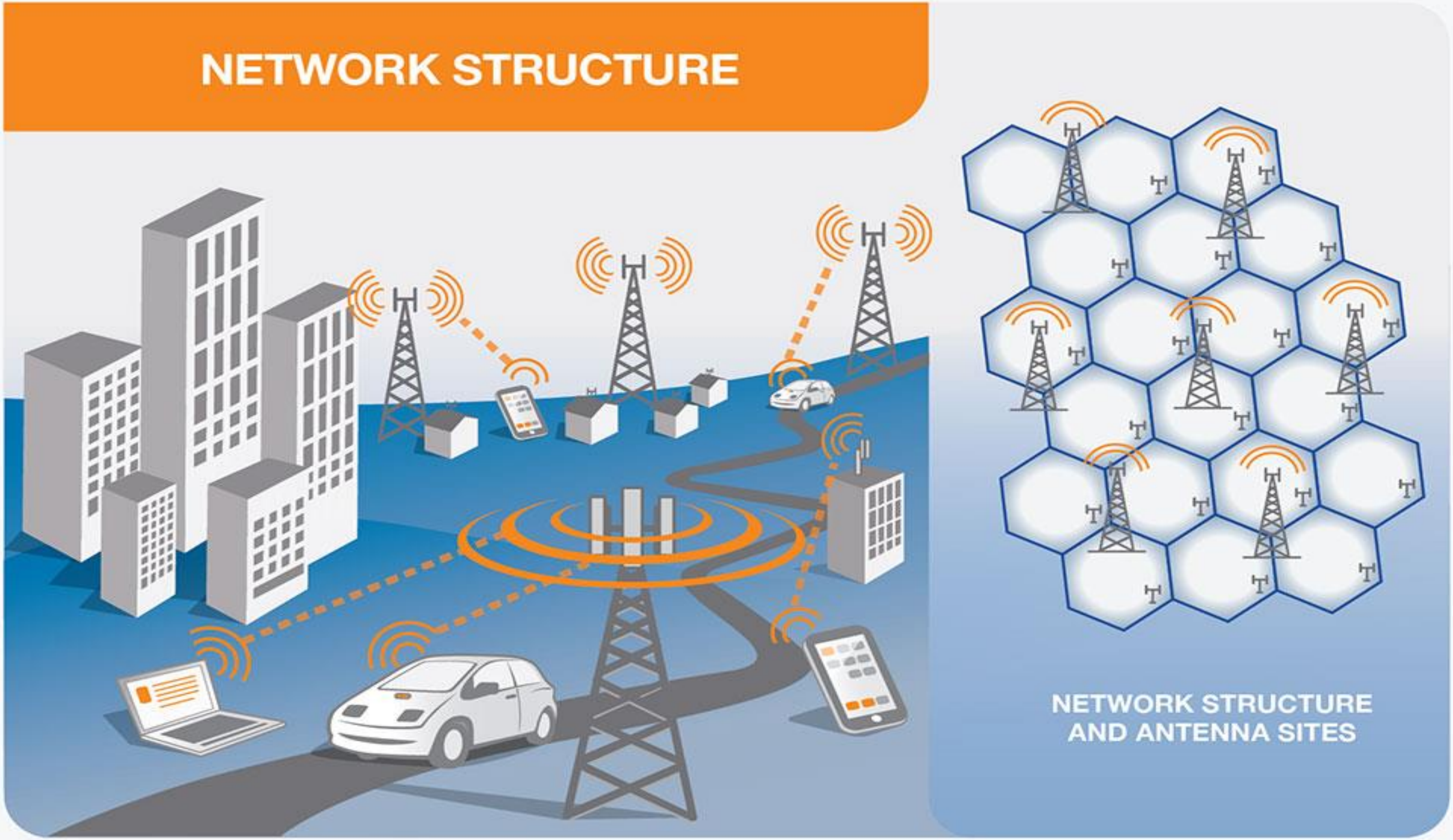

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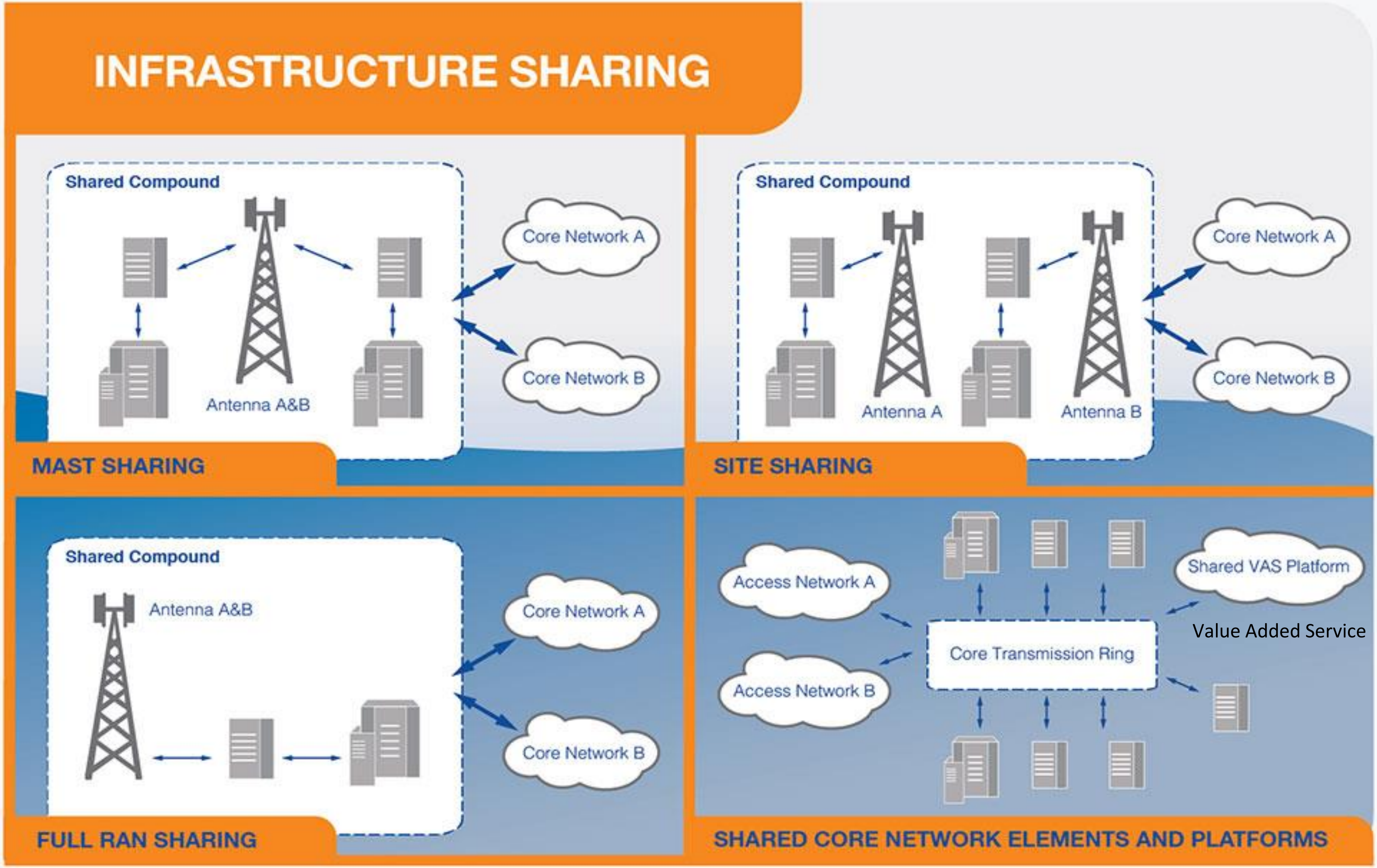

Source: ITU-T Focus Group on Smart Sustainable Cities 2014 *EMF Considerations in Smart Sustainable Cities*

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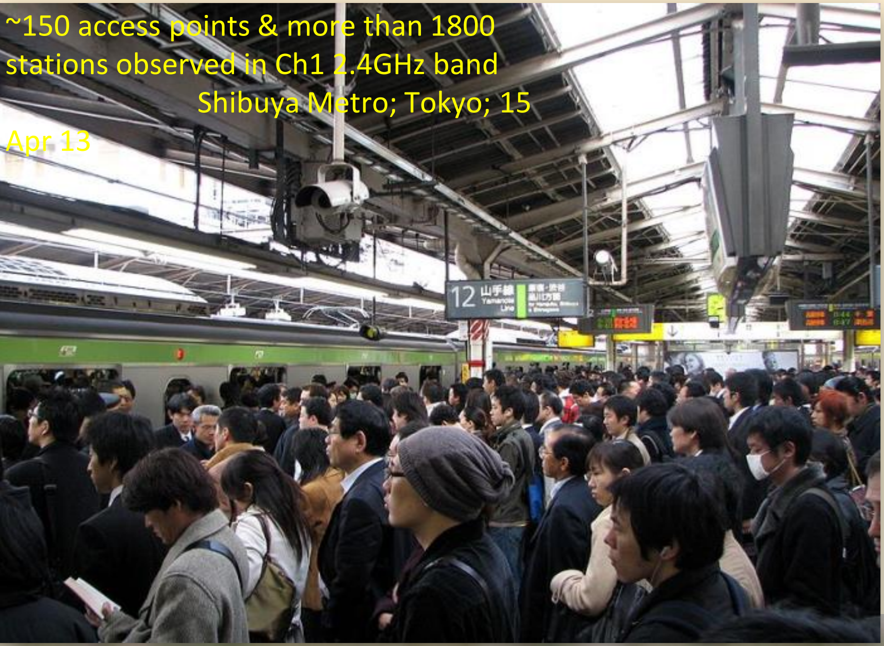
ICT's Connecting our world and smart cities; EMF fears in Israel



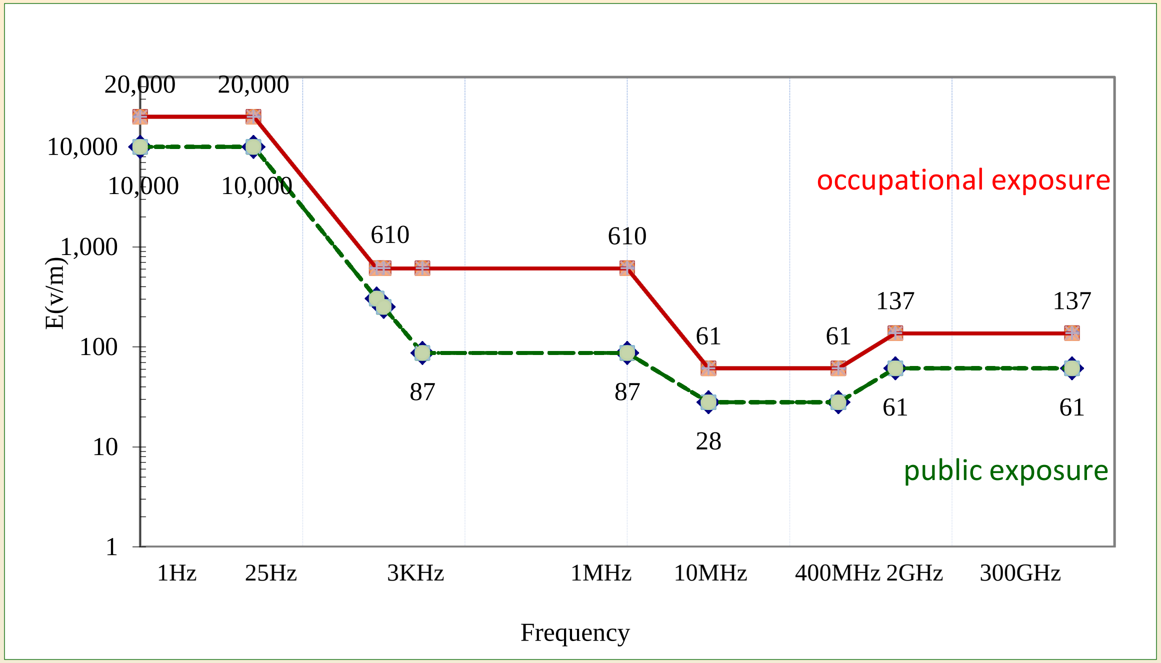
Z-Wave for remote controls, smoke alarms & security Sensors

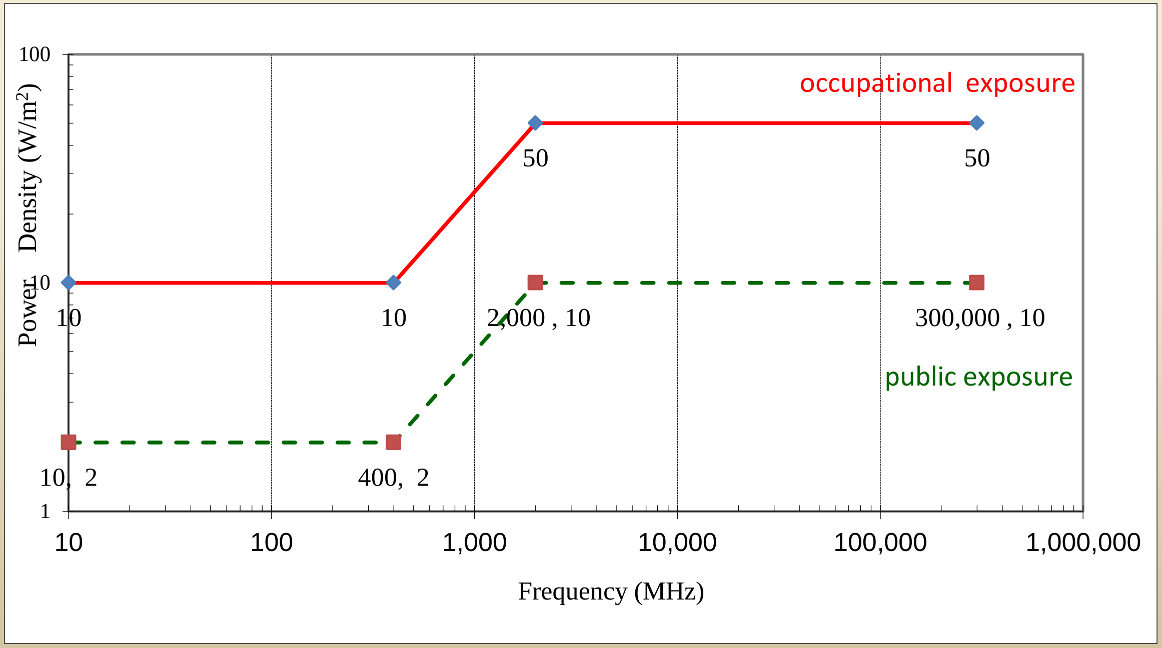
ICNIRP (1998:511) reference levels for occupational & general public exposure- table7

Frequency range	Electric field strength (V/m)		Equivalent plane wave power density S_{eq}(W/m^2)	
	general public	occupational	general public	Occupational
1-25 Hz	10,000	20,000	-	
0.025- 0.82 KHz	250/f(KHz)	500/f(KHz)	-	
0.82 -3 KHz	250/f(KHz)	610	-	
3-1000 KHz	87	610	-	
1-10 MHz	87/f $^{1/2}$ (MHz)	610/f (MHz)	-	
10-400 MHz	28	61	2	10
400-2000 MHz	1.375f $^{1/2}$ (MHz)	3f $^{1/2}$ (MHz)	f/200	f/40
2-300 GHz	61	137	10	50

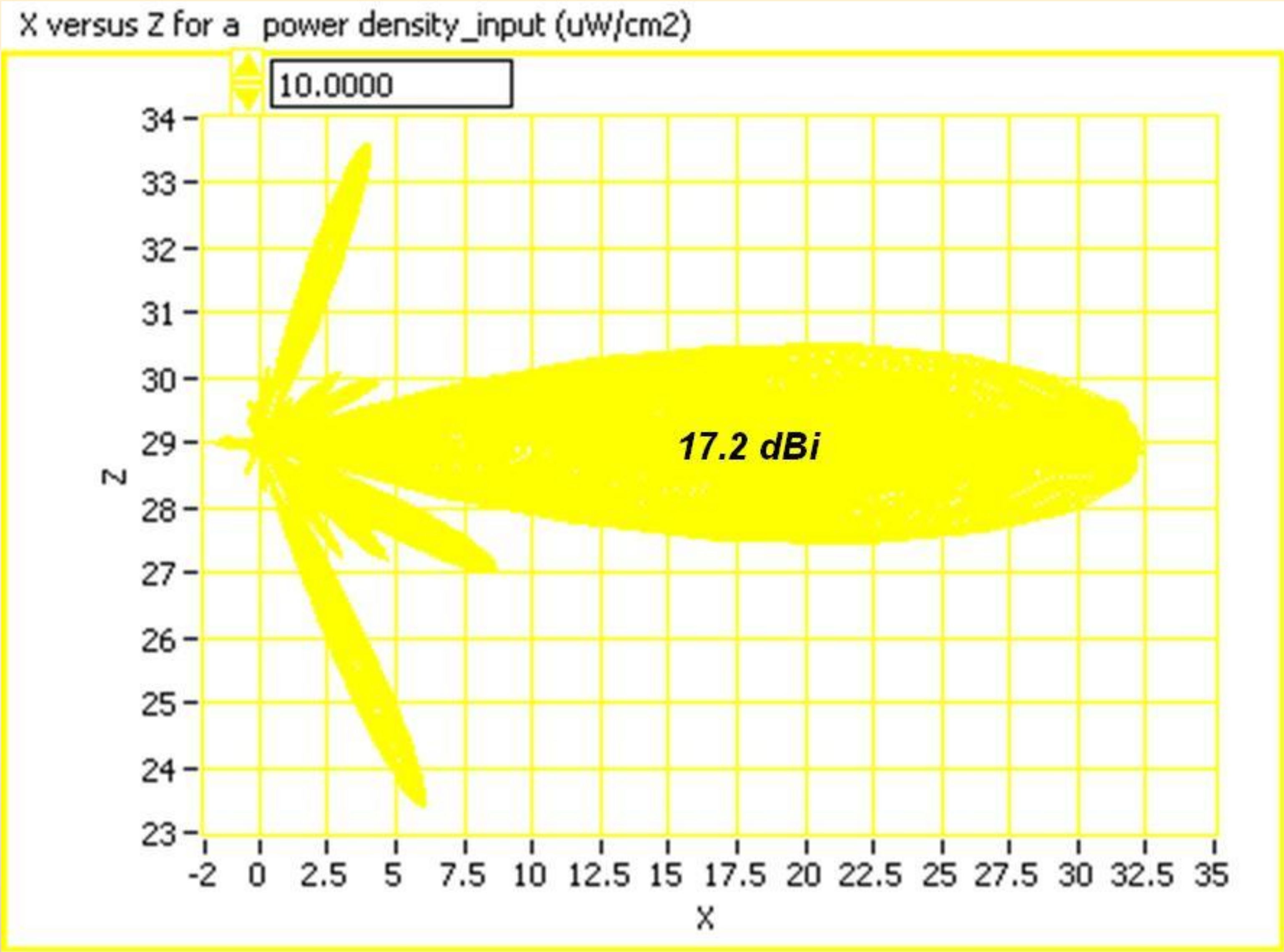
Israel divides the ICNIRP 1998 reference levels by 10

ICNIRP 1998 p.511 reference levels for occupational & general public exposure- graphs





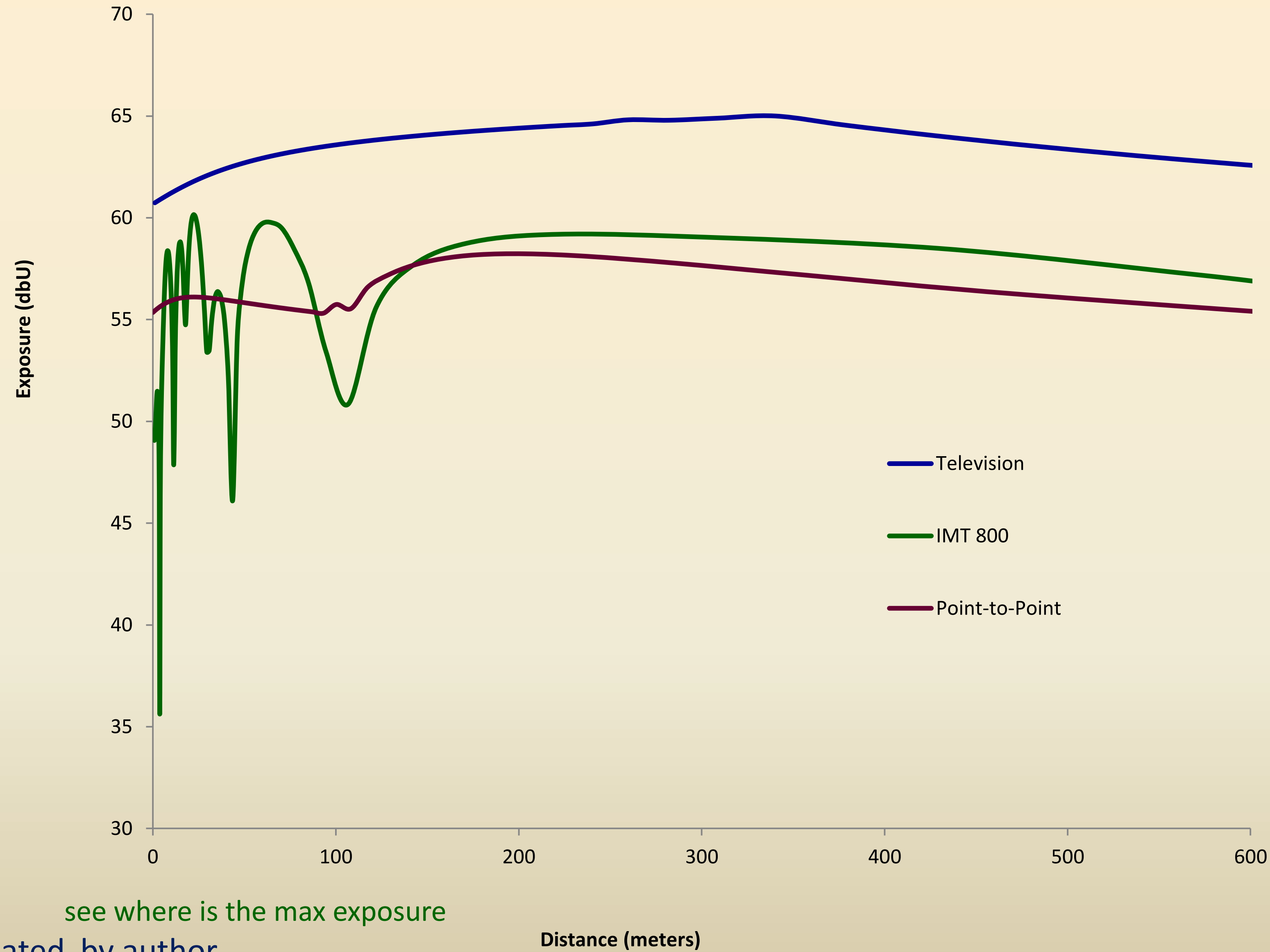
Typical Sectorial Antenna



אנטנה מסוג 739686, עבור תדר 850 מגא-הרץ, בשימוש במתקנים רגילים

Source: Ministry of protection of environment

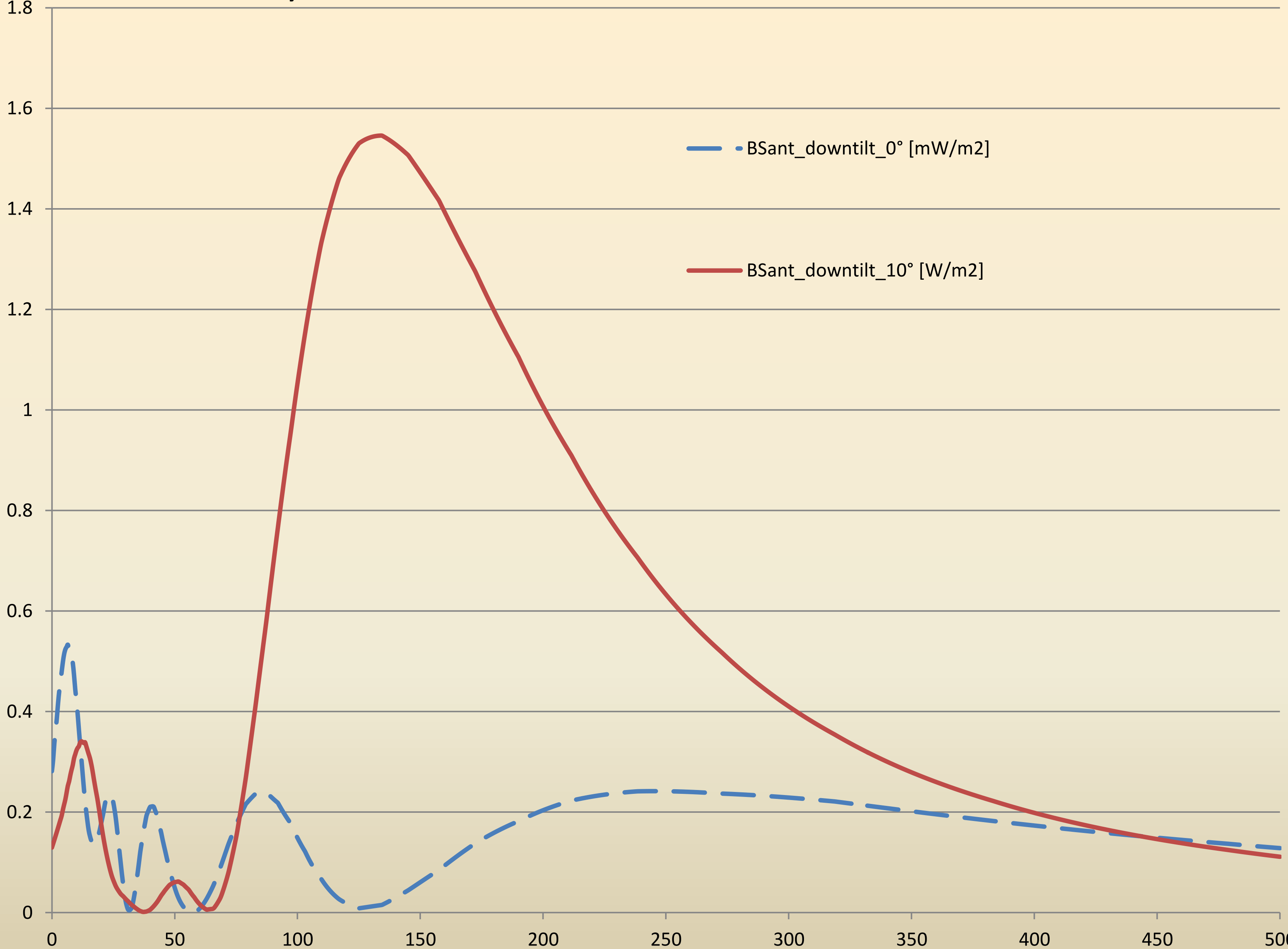
Field Strength (dBµV/m) vs. distance (m), co-located site TV, IMT 850 & Point 2 Point



see where is the max exposure

calculated by author

Power density vs. horizontal distance at co-located site near-field & far-field



see where is the max exposure

calculated by author

EMF Checklist; EMF Compliance; ICT Design; EMF Information

1. EMF compliance framework will protect the general public and workers from adverse effects of EMF
2. ICT devices meet ICNIRP RF-EMF exposure guidelines
3. Wireless networks meet ICNIRP RF-EMF exposure guidelines
4. Document RF-EMF compliance
5. Base station antennas are selected to suit the ICT network requirements
6. Wireless network antennas are located in close proximity to the ICT devices
7. Planning legislation incorporates ICT networks and antenna requirements
8. EMF ICT compliance information is available
9. General EMF information is available to the community
10. Existence of wireless network information programme

Source: ITU-T Focus Group on Smart Sustainable Cities 2014 *EMF Considerations in Smart Sustainable Cities*

Mitigation techniques to decrease the radiation level (1)

Author's views

- Avoid wireless communications if the transmitter & receiver stations are fixed
  - Avoid WiFi routers based on cellular infrastructure
  - Prefer Satellite and Cable TV's delivery
- Maximize sharing, including active frequencies sharing among cellular operators
- Provide wider spectral allocation to the RF to operators in order to decrease the number of sites

Mitigation techniques to decrease the radiation level (2)

- **Restrict access** to areas where the exposure limits are exceeded. Physical barriers, lockout procedures and adequate signs are essential; workers can use protective clothing (ITU-T 2004 K.52 p.19)
- **Increase the antenna height**. The distances to all points of investigation are increased and the radiation level is reduced. Moreover, additional attenuation to the radiation is achieved due to the increase of elevation angle and decrease of transmitting antenna sidelobe (ITU-T 2007 K.70 p.22)
- **Increase the antenna gain** (mainly by reducing the elevation beam width), and consequently decrease the radiation in the direction accessible to people. The vertical beam width may be used to reduce the radiation level close to the antenna. Moreover, the same value of the EIRP can be achieved by a low power transmitter feeding high gain antenna or by high power transmitter feeding low gain antenna. As far as the protection against radiation is concerned, a much better choice is to use the low power transmitter feeding the high gain antenna. (ITU-T 2007 K.70 p.22)
- **Minimize exposure to the min. needed** to maintain the quality of the service, as quality criterion. Decrease the Tx power & consequently decrease linearly the power density in all the observation points. As it reduces the coverage area, it is used only if other methods cannot be applied (2007 K.70 p.22)

Thanks to Mike Wood & Jack Rowley ITU-T EMF Technical Report leaders

Relevant files are found at the web:

- http://emfguide.itu.int/
- Academic_Course_Advanced_Wireless_Communications_Mazar3_Regulation_EMC_HumanHazards_2015.pdf
- International, regional and national regulation of SRDs

ITU Workshop on Short Range Devices Geneva 3 June 2014

- RF_Technical limits of Human Exposure_HIT_IEEE_Mazar_30Jan14.pdf
- Author's PhD Thesis
- Mazar's Book

You are welcome to visit my website http://mazar.atwebpages.com/

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