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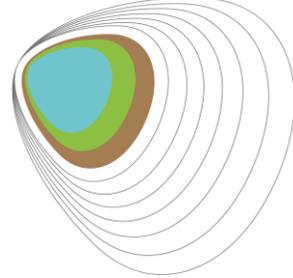
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National Institute
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IV International Conference

Electromagnetic field
and the future of telecommunication

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28 October - 22 November
Sharm El-Sheikh, Egypt

ITU WRC-19, additional spectrum allocations for IMT-2020 (5G mobile)

International Conference: EMF and the Future of Telecommunications
3-4 December, 2019

Dr. Haim Mazar (Madjar); h.mazar@atdi-group.com re-elected vice-chair ITU-Radio Study Group 5 (terrestrial services)



3 YEARS
OF EXPERIENCE



World Radiocommunication Conference (WRC) WRC-19, Participants

1. WRC-19 was attended by over 3,540 delegates from 165 Countries out of ITU's 193 Member States
2. Senior governments officials, hundred participants representing circa 130 other entities, incl. industry, as observers



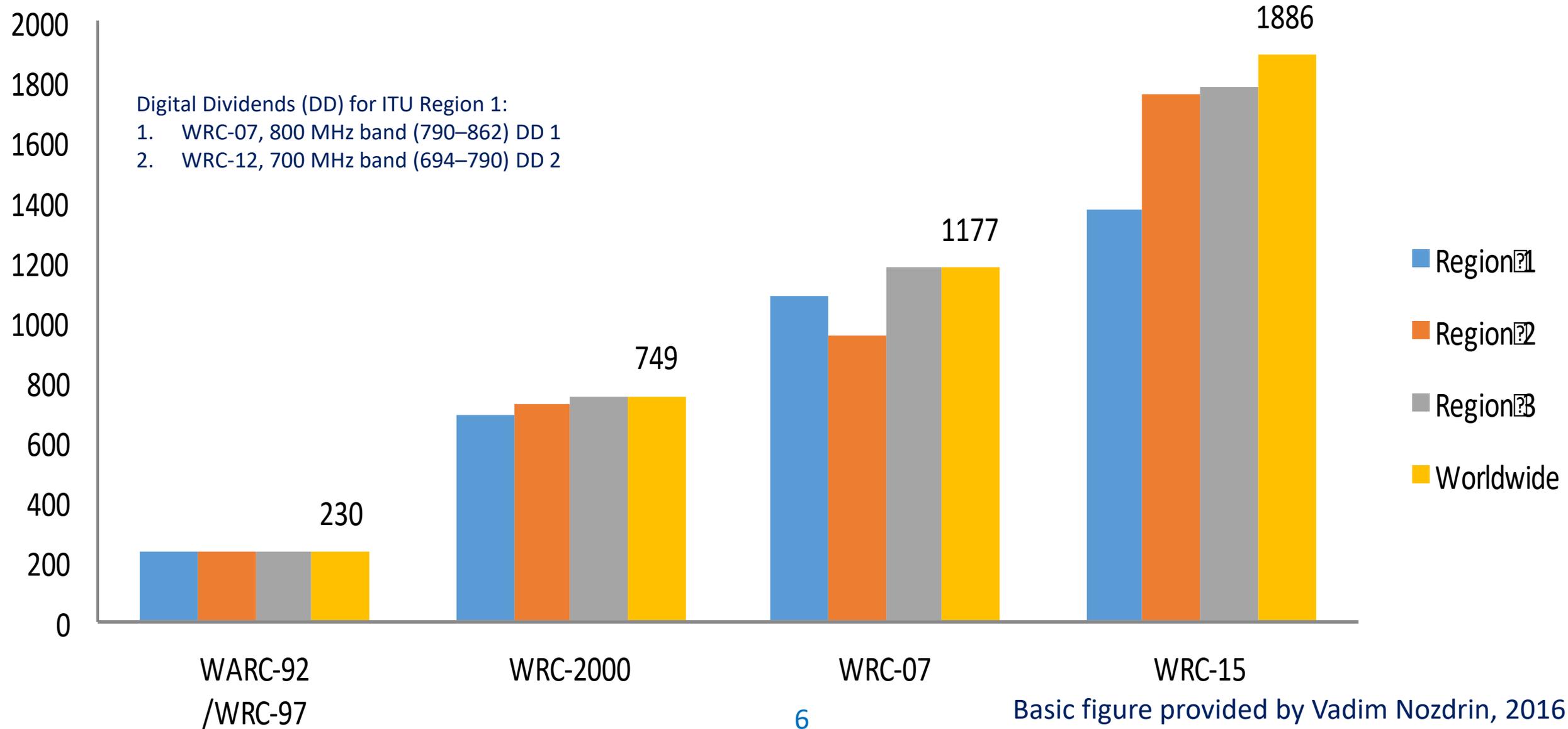
World Radiocommunication Conference (WRC)

1. WRCs are held every 3–4 years
2. WRC reviews & revises the Radio Regulations (RR): international treaty governing the use of the RF & the satellites orbits
3. Agenda is established four to six years in advance; final agenda set by the ITU Council , two years before the conference

Under terms of ITU Constitution WRC can

1. Revise the RR , associated RF assignment & allotment Plans
2. Address any radio matter of worldwide character
3. Instruct Radio Regulations Board & the R- Bureau, & review their activities
4. Determine Questions for study by the Radiocommunication Assembly and its Study Groups to prepare future Radio Conferences

Total amount of RF (MHz), ITU identified for International Mobile Telecommunications (IMT), 1992–2015



Main Outcomes; see [Provisional Final Acts WRC-19](#) published on 28 Nov.2019

1. Additional bands for IMT identified in **26** (24.25–27.5) , 40 (37–43.5, or range), 45.5–47, 47.2–48.2 and 66–71 GHz bands
2. Additional bands for high-altitude platform stations (**HAPS**) radios on aerial platforms hovering 20–25 km to increase wide coverage-areas for broadband access in rural and remote areas
3. High-altitude IMT base stations (**HIBS**), future Possible use of same frequency bands as ground-based IMT base stations on HAPS for extended mobile broadband connectivity to underserved communities and remote areas
4. Vision 2023: Some areas of the **WRC-23 Agenda** (see next slide)

Conference Preparatory Meeting (CPM)

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2. The first CPM meeting is usually immediately after WRC (CPM-19 closing meeting on 26 Nov 2019).
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*700 MHz is potential 5G band in Poland; but it s still occupied by DVB-T

Table of contents of the CPM Report to WRC-23

Chapter 1 [Topic(s): Terrestrial issues]

Agenda items: [1.1, 1.2, 1.3, 1.4, 1.5]

Chapter 2 [Topic(s): Aeronautical and maritime issues]

Agenda items: [1.6, 1.7, 1.8, 1.9, 1.10, 1.11]

Chapter 3 [Topic(s): Science issues]

Agenda items: [1.12, 1.13, 1.14]

Chapter 4 [Topic(s): Satellite issues]

Agenda items: [1.15, 1.16, 1.17, 1.18, 1.19, 7]

chapter 5 [Topic(s): Other issues]

Agenda items: [2, 4, 9.1.1, 9.1.2, 9.1.3]

Annex 1 [Information on WRC-23 agenda item 10]

See Document [CPM23-1/10](#) 22 Nov. 2019

ITU Regulating 5G

1. ITU facilitates the development of 5G around the world
2. IMT-2020, ITU name used for 5G, continues to be developed from 2020 onwards
3. On May 2016, ITU-R SG5 established a dedicated Task Group (TG 5/1) to deal with complex issues related to WRC-19 agenda item 1.13: 'identification bands for IMT, between 24.25 and 86 GHz
4. ITU-R Working Party 5D is responsible for IMT-2020; 5D evaluates the technologies to offer 5G performances
5. WP 5D advances eagerly the IMT-2020 Recommendations and Reports
6. The first full-scale commercial deployments for 5G are expected sometime after IMT-2020 specifications are in force

The Needs for Additional RF for 5G

1. Ultra-low latency and very high bit-rate applications of IMT require larger contiguous blocks of spectrum
2. Enabling the growth potentials of Internet of Things (IoT), Artificial Intelligence, Cloud Computing, big data and geospatial analytics
3. Harmonized worldwide bands for IMT facilitate global roaming and the benefits of economies of scale

WRC-19 Achievements on 5G

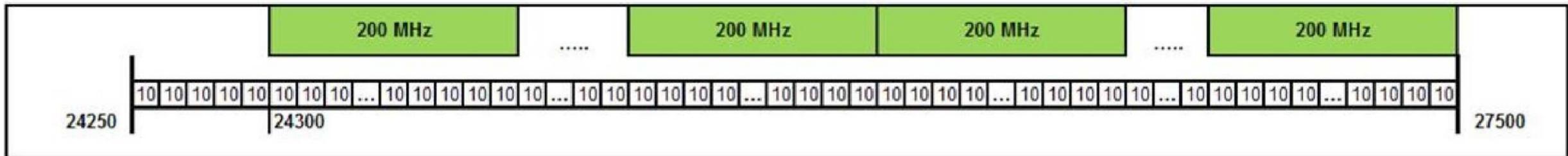
1. WRC-19 identified **17.25 GHz**, compared to **1.9 GHz** before (slide [Total amount of RF](#))
2. **14.75 GHz harmonized** worldwide, reaching **85%** global harmonization
3. WRC-19 defined studies to identify RF for **new components of 5G**
4. Mobile connectivity by High Altitude IMT Base Stations (**HIBS**). HIBS may serve **terrestrial IMT networks** to provide mobile connectivity in underserved areas where it is difficult to be covered by ground-based IMT base stations
5. Resolution COM6/1 (WRC-19) **Agenda for the 2023 WRC**
Agenda Item 1.4 ‘the use of HIBS in the mobile service below **2.7 GHz** already identified for IMT, on a global or regional level’
Issue 9.1 Study the use of IMT for fixed wireless broadband in the frequency bands allocated to the fixed services on primary basis

WRC-19 approves new bands above 24.25 GHz for 5G

1. The lowest new band 26 GHz is essential also for 5G in Poland (very high speed data and small cells), and maybe implemented in near future
2. WRC-19 identified 24.25–27.5, 37–43.5, 45.5–47, 47.2–48.2 & 66–71 GHz for 5G
3. New FN: **5.A113** The frequency band 24.25-27.5 GHz is identified for use by administrations wishing to implement the terrestrial component of IMT
4. Draft New Resolution [COM4/X] (WRC 19) 'Terrestrial component of IMT in the frequency band 24.25-27.5 GHz'

5G Channel- Arrangements

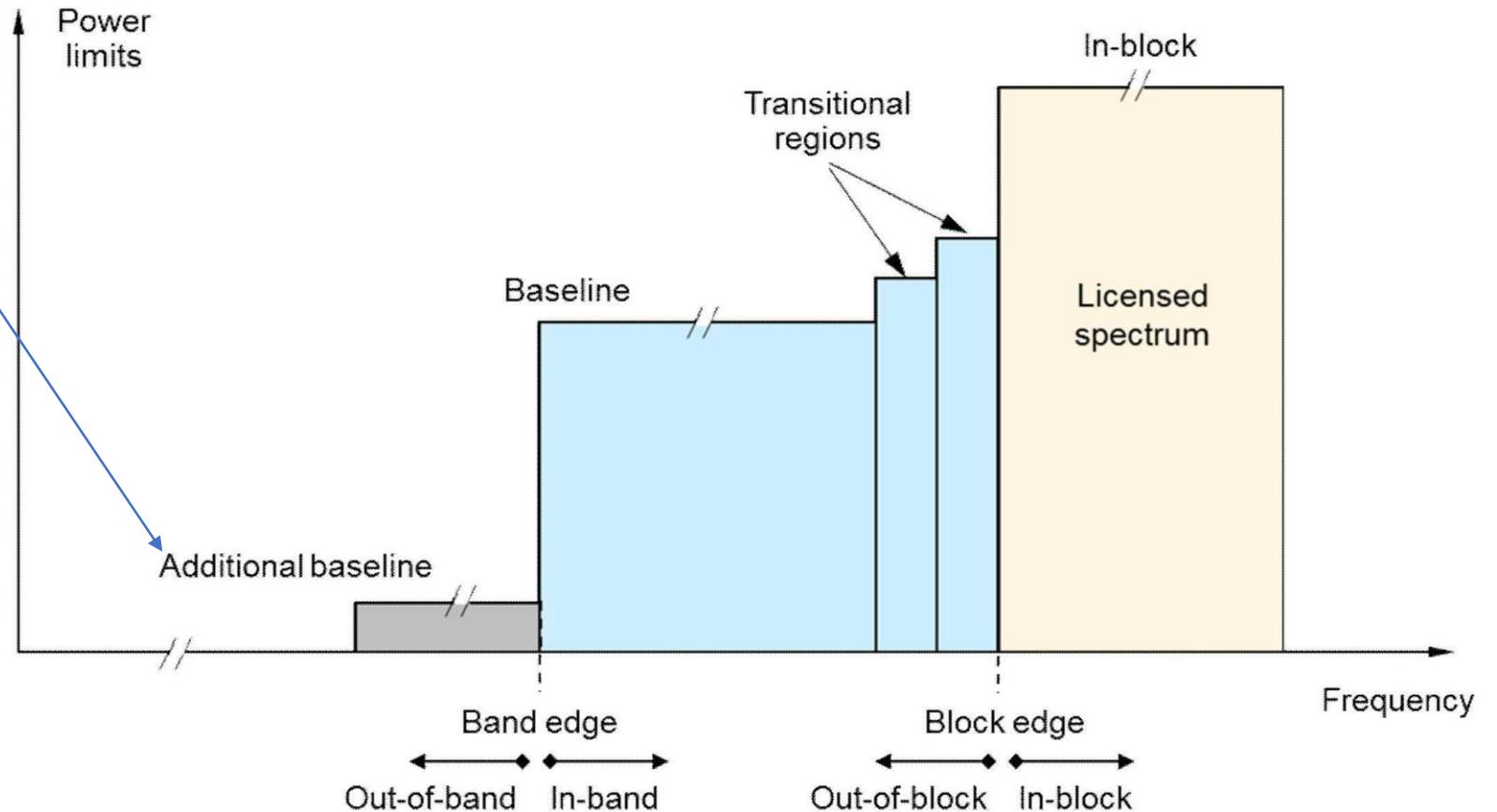
1. [RA-19](#) (week before WRC-19) approved the Revision of Recommendation [M.1036](#) 'Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations'
2. Decision (EU) [2019/784](#) 14 May 2019 'harmonisation of the 24,25-27,5 GHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services in the Union
3. Example of a channelling arrangement within the 24.25-27.5 GHz frequency band; [2019/784](#) Fig. 1



EU 2019/784 5G Block Edge Mask; restrictive relative to the softer US additional baseline power limit 23,6-24,0 GHz, on 200 MHz

2019/784 Fig. 2

- 1. Total radiated power (TRP), base-station **-42 dBW**, Table 4
- 2. terminal-station **-38 dBW** Table 6



WRC-19 5G 26 GHz Out-of-Band Emission Limits (see also next slide)

1. WRC adopted an innovative time-delay mechanism in the high-profile 26 GHz band, to globally harmonise the spectrum and turn it into a major 5G band
2. WRC-19 ensured an appropriate protection of the Earth Exploration Satellite Services, including meteorological and other passive services in adjacent bands
3. Under the newly adopted regulatory regime, 5G **handsets** and infrastructure will need to protect the satellite observations of Earth by limiting their emissions in **24 GHz** band to **-29 dBW** now and to **-35** after **2027**. Similarly, the 5G **towers** emissions will be limited to **-33 dBW** now and **-39 dBW** after **2027** ([Provisional Final Acts](#) p.353)
4. e.i.r.p. limits for IMT base stations towards GSO orbit in the band **25.25-27.5 GHz** WRC-19 [Doc 447](#) 17 Nov. 2019, for ties users, Table 1

WRC-19 5G 24.25-27.5 GHz Out-of-Band Emission Limits; Compatibility between the Earth exploration-satellite service (passive) and Mobile service; Resolution 750 (REV.WRC 1519)
see [Provisional Final Acts WRC-19](#)

1. -33^a dBW in any 200 MHz of the EESS (passive) band for IMT base stations
2. -29^b dBW in any 200 MHz of the EESS (passive) band for IMT mobile stations⁵

NOTES

⁵ The unwanted emission power level is considered in terms of total radiated power (TRP). TRP is the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere

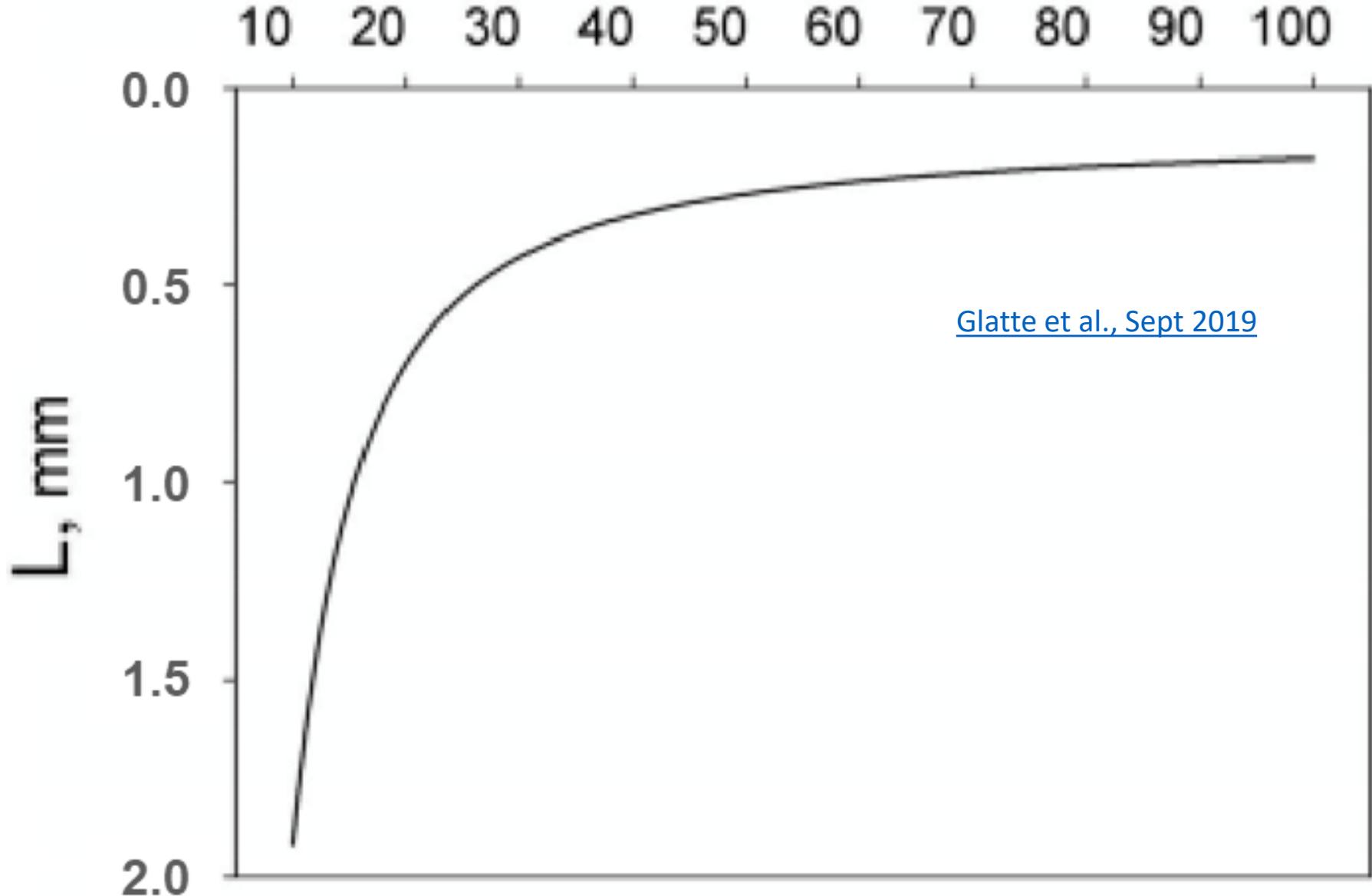
^a limit of -39 dB(W/200 MHz) will apply to **IMT base stations** after 1 Sept. 2027...
Before 2027, -33 dB(W/200 MHz).

^b limit of -35 dB(W/200 MHz) will apply to **IMT mobile stations** after 1 Sept 2027...
Before, the limit of -29 dB(W/200 MHz).

WRC-19 identifies additional frequency bands for High Altitude Platform Station systems (HAPS)

1. Allocations to the fixed service in **31-31.3 GHz**, **38-39.5 GHz** are identified for **worldwide** use by HAPS. Existing worldwide identifications for HAPS in **47.2–47.5 GHz** and **47.9–48.2 GHz** are confirmed
2. Frequency bands **21.4-22 GHz** and **24.25-27.5 GHz** by HAPS in the fixed service in **Region 2**

Frequency, GHz



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

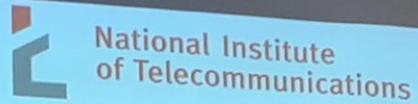
mmWaves mostly absorbed in outer skin layers

The energy penetration depth into the skin at 6 GHz is approximately 4 mm, and the penetration decreases monotonically with increasing frequency. At 300 GHz, the energy penetration depth is approximately only 0.12 mm; see [IEEE C95.1-2019](#) p. 69 A.2.5.4

Summary and Proposals

1. ITU WRC-19, added substantial amount of spectrum for IMT-2020 (5G mobile)
2. WRC-07 allocated in ITU Region 1 the 790–862 MHz as DD 1, and WRC-12 the 694–790 MHz as DD2
3. Poland (and other countries in Region 1) may soon license 5G at the 3,400–3,800 MHz and 694–790 MHz bands
4. Personal advices on assigning more RF to 5G (view of the Author):
 - 1) The abundance of the 5G allocations permits to assign RF bands, without an exhausting Auctions process
 - 2) Offer the minimum amount that the Operator accepts as the winning bid 'reserve price', and avoid at least one year delay of the frequencies assignment and unnecessary expenses
 - 3) Specify suitable RF annual-fees, to evade purchase of RF that is not really needed. Report ITU-R [SM.2012](#) 2018 'Economic aspects of spectrum management' details annual-fees in section 4.8 'Opportunity cost and administrative incentive pricing : simple, functional and linear equations'; contributed by Author

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RC-19, additional spectrum allocations for IMT-2020 (5G mobile)

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3-4 December, 2019

...zar (Madjar); re-elected vice-chair ITU-Radio Study Group 5 (terrestrial services)



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- 5 accredited laboratories
- 12 patents in force
- 250 patents total
- 1 notified body
- 100 publications a year
- 5 professors
- 36 PhDs
- 10 research departments
- 3



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