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Acceptable Electromagnetic Field levels for cost-effective 5G implementation – Polish case study

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Wireless technology is omnipresent and expands exponentially

Future 5G networks and Internet of Things (IoT) will dramatically expand penetration of wireless devices and enforce high infrastructure dencity.

Anticipated impacts of 5G implementation:

- 1000 times higher mobile data volume per geographical area.
- 10 times to 100 times higher number of connected devices.
- 10 times to 100 times higher typical user data rate.
- 5 times reduced End-to-End latency (5ms for 4G-LTE).
- Ubiquitous 5G access including in low density areas .

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Public demand for capacity drives wireless expansion

Achieving the sub - 1ms latency rate for 5G will require a significant increase in CAPEX spent on infrastructure for content distribution and servers.

Nowdays, inter-operator interconnect points are relatively sparse. In order to support a 5G service with 1 millisecond delay by achieving interconnection at every base station, there will have to happen a major change impacting the topological structure of the core network.

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Key issue

Polish exposure limit for the general public for the 300 MHz - 300 GHz frequency is **0.1 W/m² (6,14 V/m)**

Since ICNIRP reference levels above 10 MHz are between 2 (27,45 V/m) and 10 W/m² (61,4 V/m), Polish levels are from **20 to 100 times more restrictive**.

In the past, Poland used even more restrictive limits - two zones of exposure limits: temporary presence and constant presence (e.g. houses), the minimum zone limit was 0.1 W/m² and the second zone was 0.025 W/m² (3,07 V/m). Since 1998 this separation disappeared and there is only one limit of 0.1 W/m².

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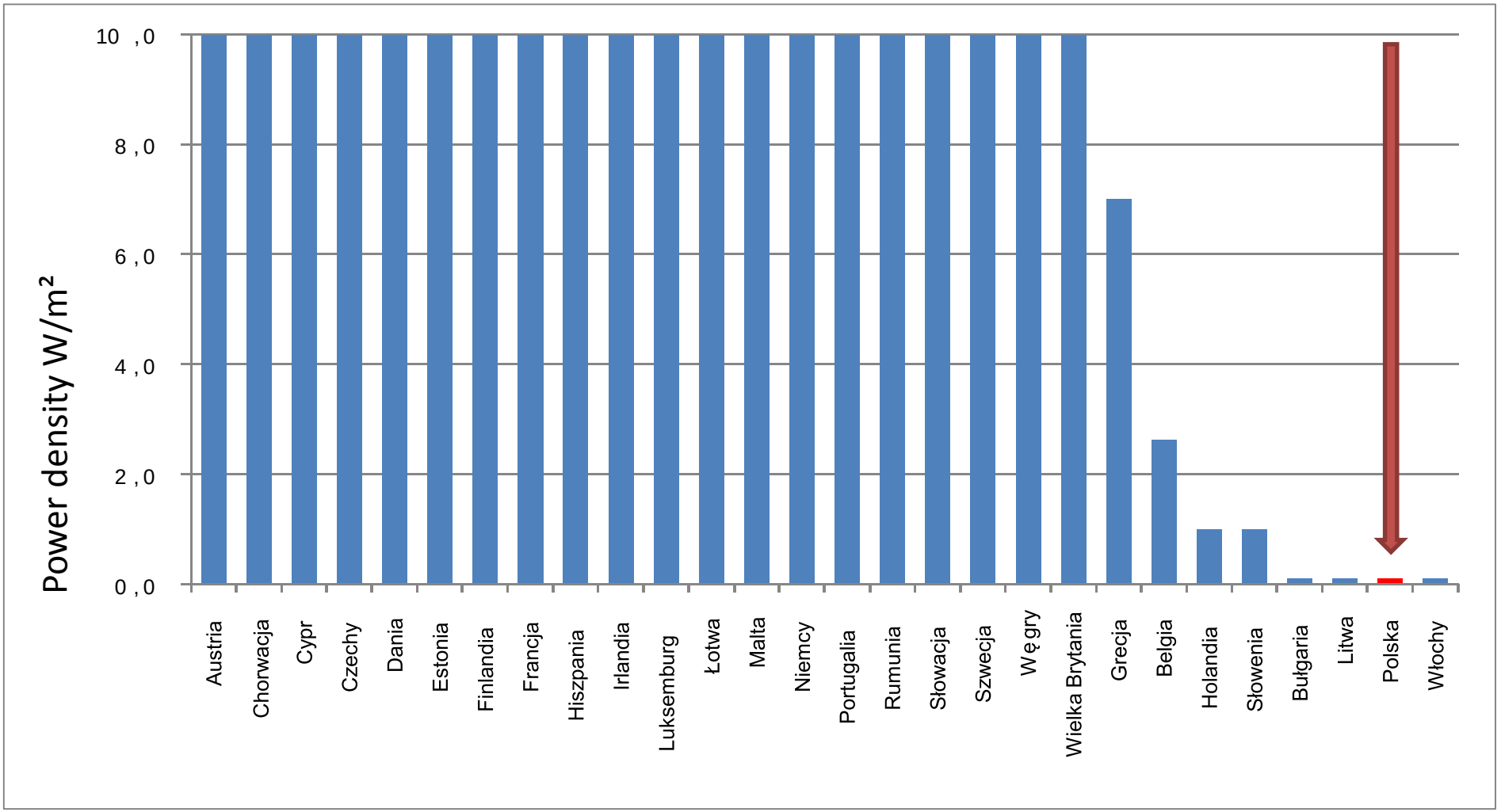

Source: Acceptable levels of electromagnetic fields in the European Union countries - on the example of frequencies greater than 2 GHz. Source: PIIT on the basis of the Commission Report on the application of Council Recommendation 1999/519/EC

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Key issue

Polish exposure limit such as **0.1 W/m² (6,14 V/m)** may lead to the following consequences:

- Limited range of the base station grids
- The necessity to build much denser net of base stations (cost inefficient) and thus enforce increase of oversized investments costs
- Inability to share with existing technologies

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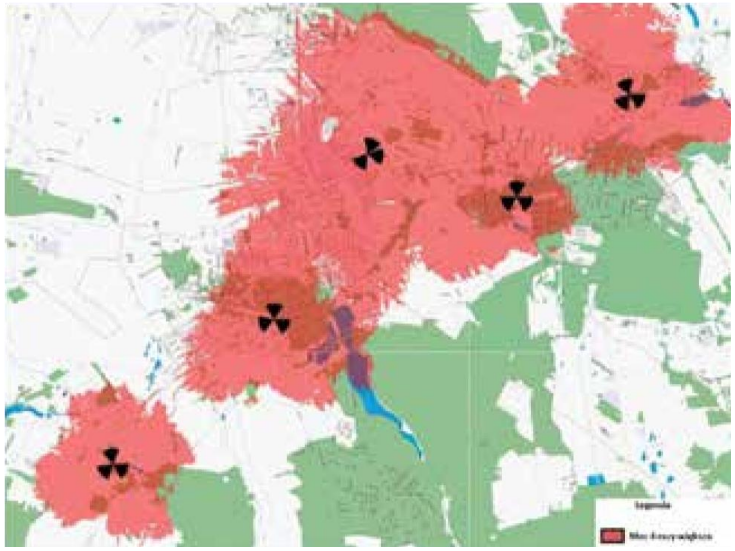
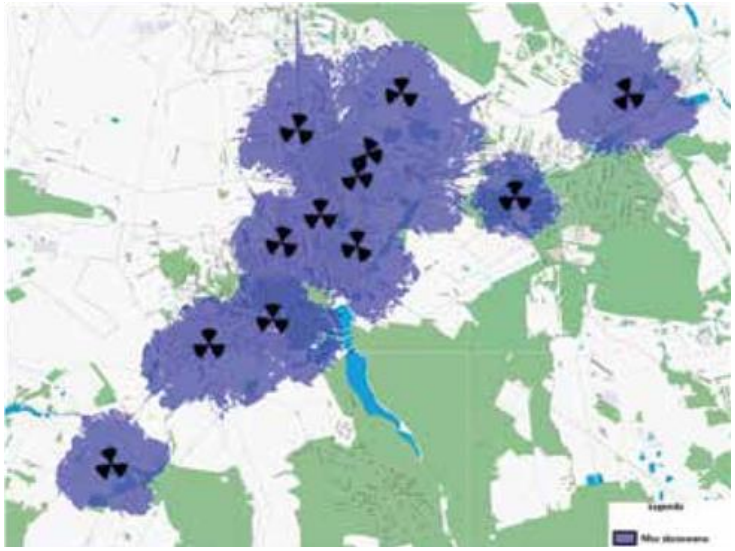
Example of how same/larger areas can be covered with a smaller number of base stations with EC recommended EMF exposure limits (red) versus restrictive limits (purple)





Source: Arbitrary Radio Frequency exposure limits: Impact on 4G network deployment Case Studies Brussels, Italy, Lithuania, Paris and Poland, GSMA.

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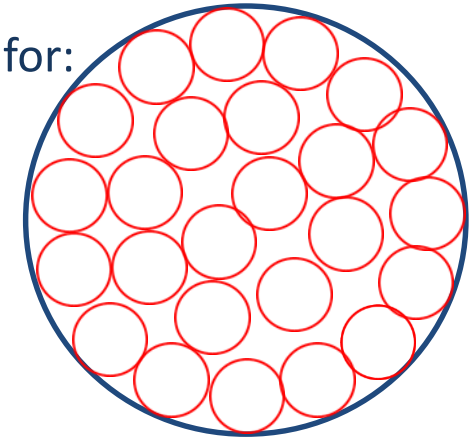
Lower exposure limits (10 W/m² vs. 0.1 W/m²) will cause the 5G cell range degradation (app. from 280m to 56m respectively) due to the required transmit power reduction.

Difference in the cell surface area for:

- 10 W/m² (61,4 V/m)
- 0.1 W/m² (6,14 V/m)



With a 5G radio operating in 28 GHz, in most EU countries the acceptable distance of human from the transmitter would be app. 1,1 m, while in Poland 10 times higher.

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Conclusion

The permissible exposure levels of EMF in Poland are too low to allow optimal distribution of the network across multiple frequency bands in one place.

Present regulations governing the permissible power of the electromagnetic field will slow down the development of next-generation infrastructure in comparison with other European countries.

With regard to the future deployment of the 5G network, this will become a key issue.

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Proposed scope of action

1. In order to implement innovative and intelligent solutions, based on 5G networks, efforts should be made to guideline a coherent approach for the standardized EMF levels across the ITU countries.
2. Taking into account present variety of EMF levels across the ITU countries, it should be estimated in various scenarios which EMF levels will grant the minimum requirements for the 5G establishment.
3. Exchange of good practices in the field of social information campaigns on increased power limits and their environmental impact.

Thank you

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