5G:
balancing investment certainty and flexibility
experience from the Polish market

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„The EECC and its impact on investment in very high capacity networks”
FSR, EUI, Florence, 13 December 2019

Orange Polska and Polish market in a snapshot

Polish market in a snapshot

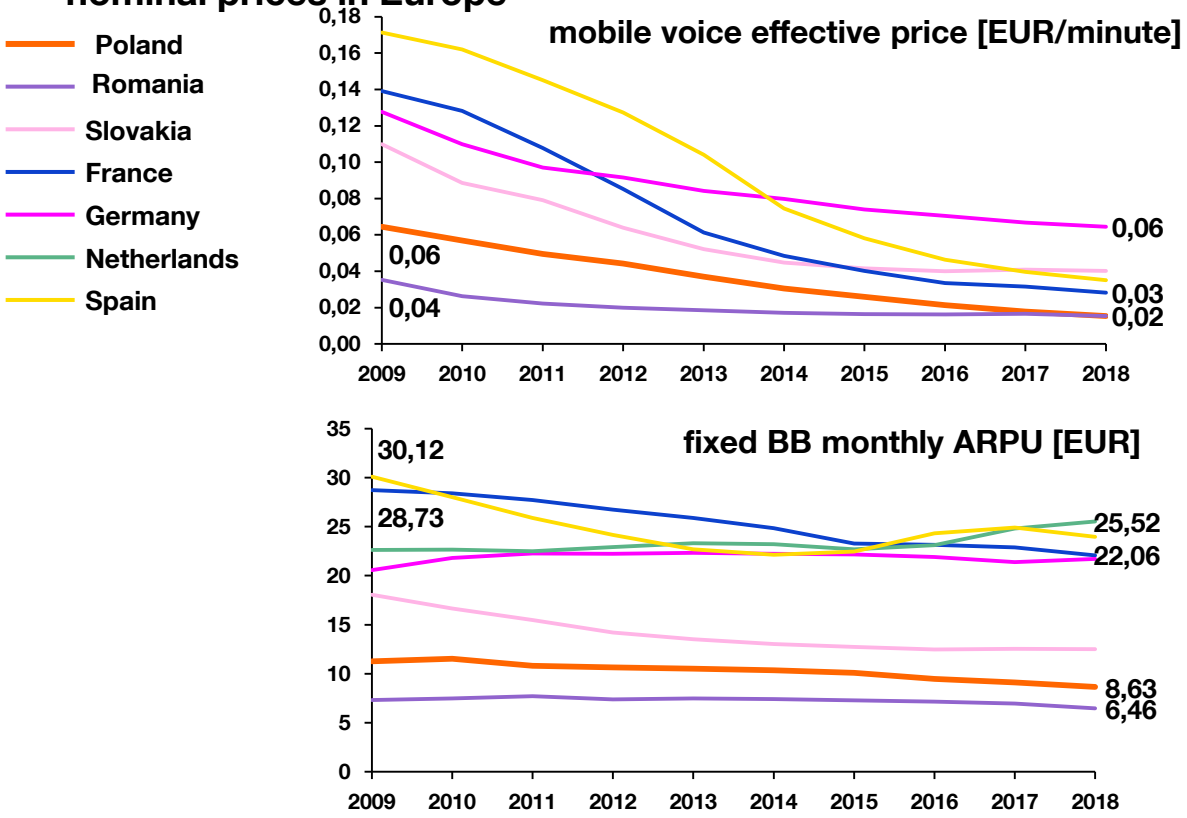
- Very competitive market
- 4 largest MNOs (Orange Polska, T-Mobile, Play, Plus) represent 95,2% (users) and 96,8% (revenue) of the market
- Large fix operators: Orange Polska, UPC, Netia, Vectra, Multimedia, Inea
- One of the lowest prices in Europe

General market data*

- EUR 9,1 bln – total market value and slightly decreasing year to year
- 8% decrease of revenues from mobile compared to 2017
- EUR 6,6 – average ARPU on broadband market
- 15,8 mln broadband users (8,1 fixed)
- 134% - mobile penetration
- 98% - 4G/LTE coverage
- EUR 1,84 bln – total investments

*Office of Electronic Communications – Report on the state od telecommunications market in 2018

Poland has one of the lowest mobile voice & fix broadband nominal prices in Europe



Orange Polska in a snapshot

15.1 million mobile customers

2.6 million broadband accesses

4.0 million FTTH connectable HHs&Bus

3.2 million fixed voice services

1.0 million TV customers

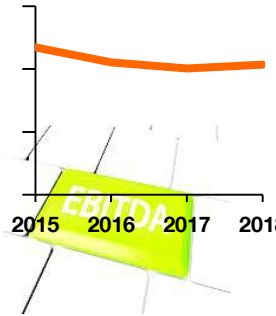
1.3 million of B2C convergent customers

2.2 billion PLN (EUR 500 mln) invested in 2018

150+ thousand km of fiber network

12.2 thousand employees

11.1 PLN billion**



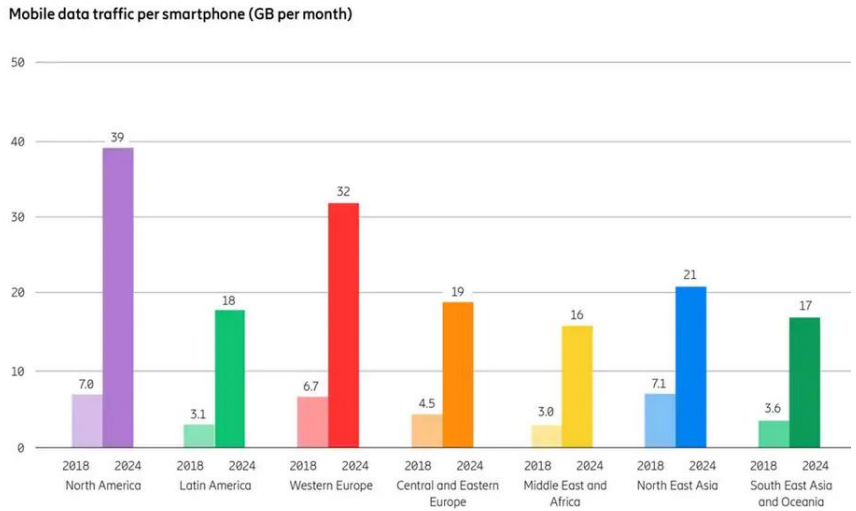
Turn around in EBITDA in 2018

2.9 PLN billion**

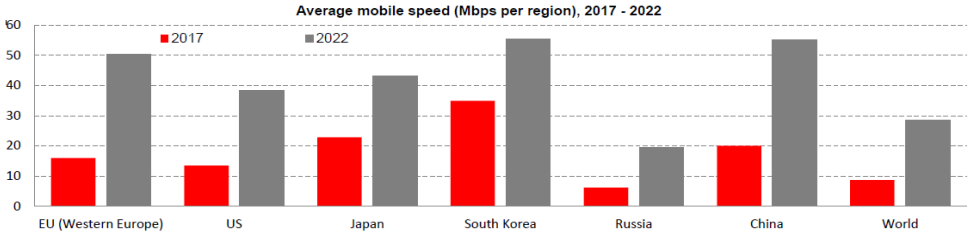
* Operational KPIs as of the end of 3Q 2019
** financial results for 2018 FY (IFRS15 standard)


Why 5G, what
5G is all about?

Data traffic boom



Source: Ericsson, Mobile data traffic outlook: Mobility Report 2019

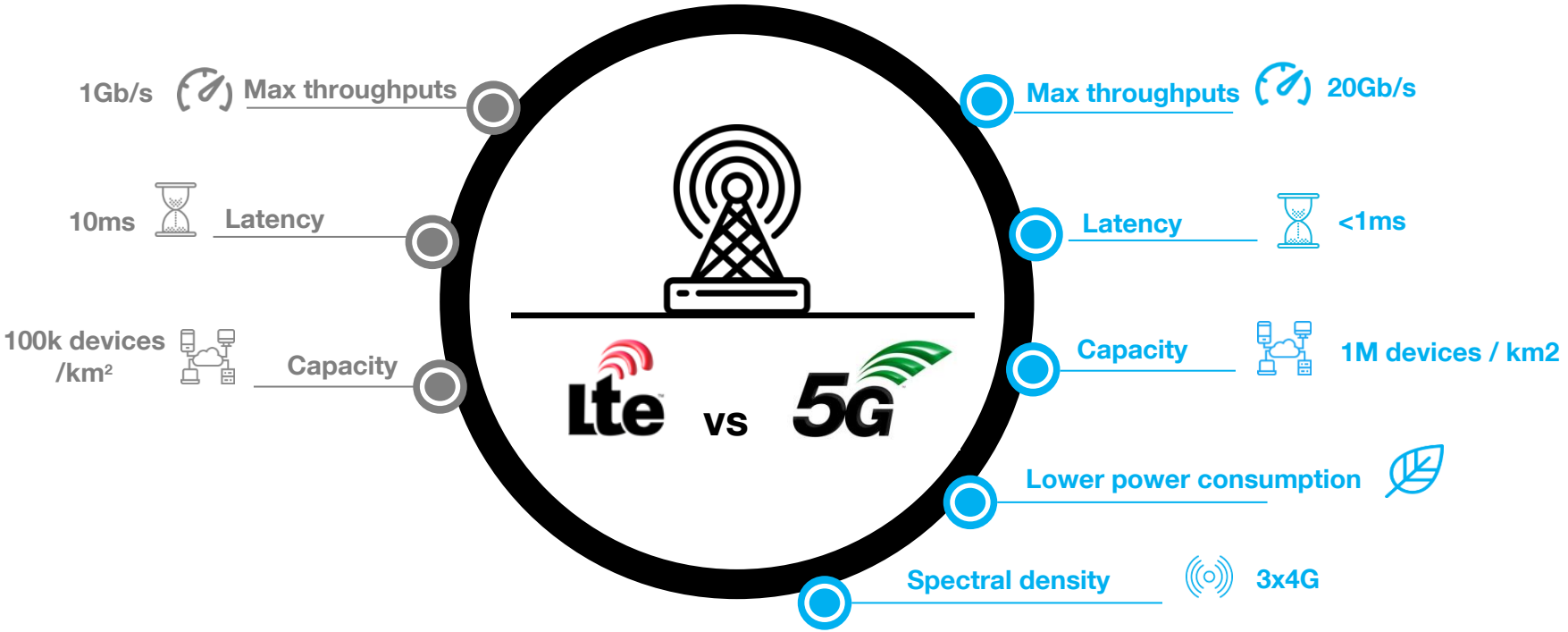


Source: Digital Economy and Society Index Report 2019 Connectivity

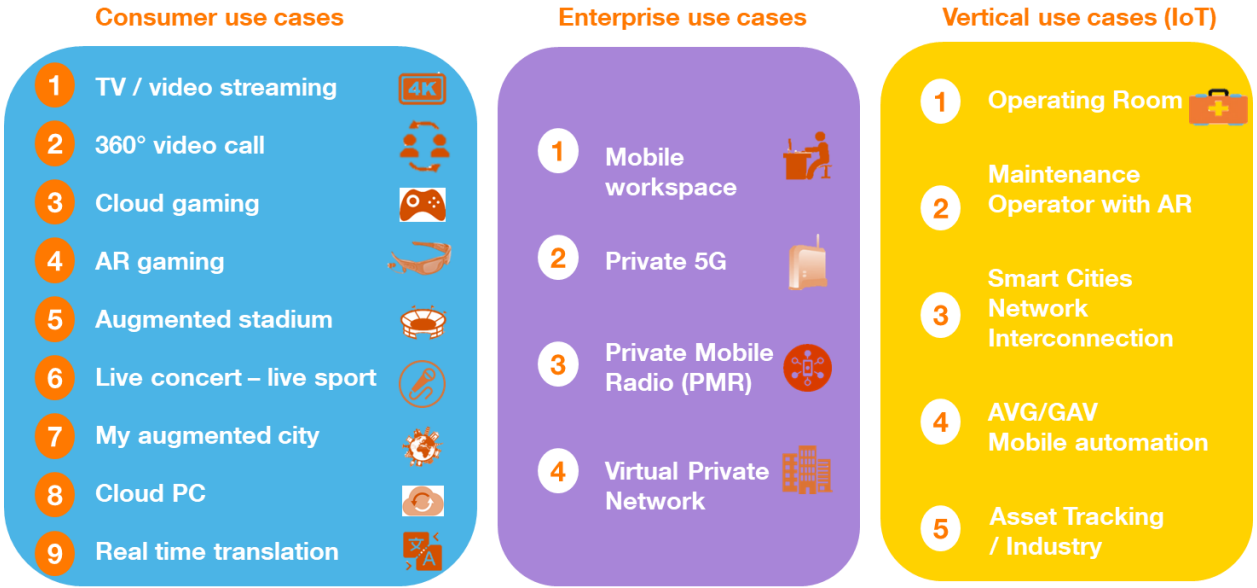
- It is estimated that the volume of mobile data traffic will increase several times in the coming years (for example in Europe by over 4 times by 2024)
- the average data transfer speed will also increase
- 79% of the world's mobile data traffic will be video by 2022 (source: Cisco Global Mobile Data Traffic Forecast)
- 20,4 billion IoT devices by 2020 (Gartner)
- Existing 4G infrastructure will not be able to handle the growing traffic

Therefore…

5G is the next generation of technology that responds to the growing requirements of network capacity and speed



Who will be the beneficiary of 5G?



- **The tangible difference 5G will make primarily for B2B solutions**
- **Due to the anticipated uses of the 5G network, OTTs and vertical industries can be major beneficiaries of its implementation**

5G in Poland – state of play

5G in Poland – key strategic documents

✓ **„5G Strategy for Poland”:**

- **In January 2018, the Ministry of Digital Affairs published for consultations a draft of the 5G Strategy for Poland**
- **It specified the plan for implementing the 5G network in Poland, including the necessary legislative measures (removing legislative barriers in the investment process), 5G implementation schedule and milestones**
- **the Strategy has not been formally adopted**

✓ **National Broadband Plan (NBP):**

- **Update of the NBP submitted for public consultation in September 2018**
- **Specifies, among others the costs of implementing the 5G network in Poland and the key legislative barriers needed to be removed**
- **the update of National Broadband Plan has not been formally adopted yet**

✓ **Ordinance of the Minister of Digital Affairs on the schedule for the allocation of specific frequency resources:**

- **30 June 2020 – final deadline for issuing reservation decisions for the C-band (3600-3800 MHz)**

5G in Poland – operators getting ready for the implementation

- 5G tests
- Expecting auction launch

OPL 5G tests

2018 | 2019 | 1H 2020

✓ Gliwice

3.5 GHz

✓ Zakopane

26 GHz

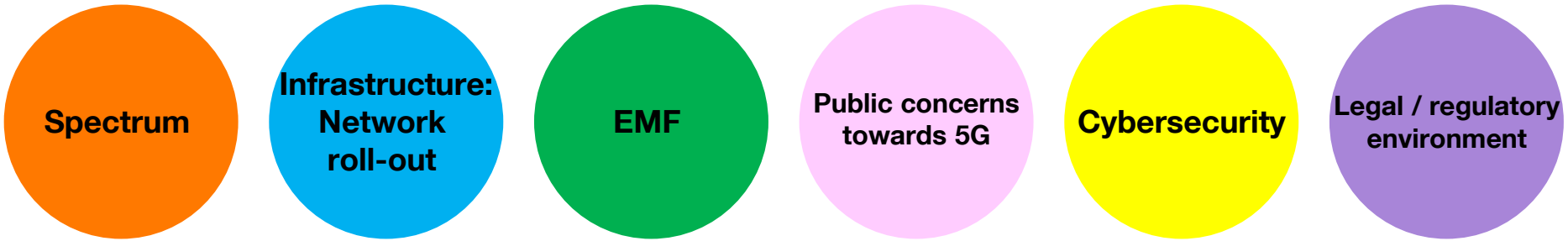
Warszawa
Lublin

3.5 GHz

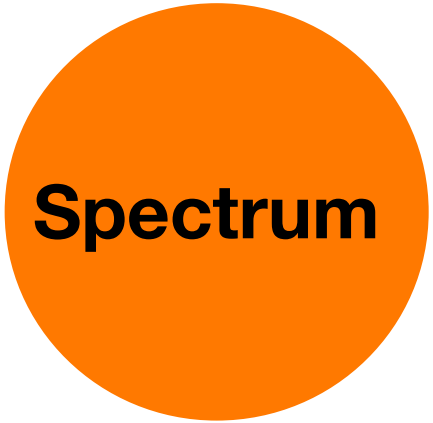
3480 – 3800 MHz
Auction

5G - critical factors, challenges, uncertainties

5G - Critical factors I Challenges I Uncertainties



5G - Critical factors I Challenges I Uncertainties



5G Critical factors: Spectrum (availability)

	Band	Range	Areas
2020	3.5 GHz		√ Urban areas, main capacitive layer
2021+	26 GHz		√ Dedicated installations - Fixed 5G solutions
2022+	700 MHz		√ Whole country area

5G Critical factors: Spectrum (availability)

5G spectrum distribution timeline in Poland

mid 2020

- Electronic auction and 80 MHz per operator expected
- 10/12/2019 – launch of public consultation of auction documentation
- Spectrum to be assigned in mid 2020

2021 ?

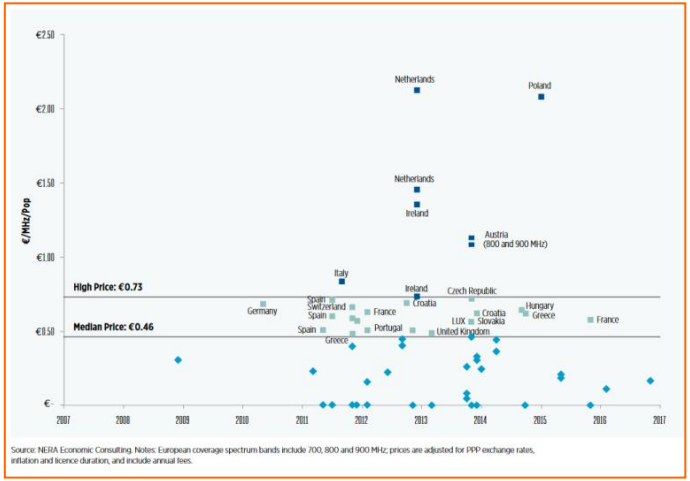
- 400 MHz reserved only for operators and the next 400 MHz shared between army and operators already available

2022 +

- Formally Poland informed that process will be delayed (derogation until mid 2022)
- Existing TV broadcasters licences to be moved
- Transborder coordination with Russia is an issue – current status does not allow to launch 5G in 700 MHz in north Poland

5G Critical factors: Spectrum (pricing)

- **4G/LTE auction in Poland, 2015 – operators paid in total PLN 9, 23 bln (ca EUR 2 bln) for 800 MHz/2600 MHz**



Source: GSMA, Effective Spectrum Pricing in Europe

- **5G („C-band) in Poland, 2020 – ?**
- **Reserve price ca EUR 105 mln per 80 MHz block (4 blocks available)**

5G auction pricing

Country	total mln €
Romania - 2015	10,1
Slovakia - 2015	3,6
Hungary - 2016	2,9
Czech - 2017	38,1
Ireland - 2017	68,2
Lotva - 2017	6,5
Lotva - 2018	0,5
Finland - 2018	77,6
Spain - 2018	437,6
UK - 2018	1 315,2
Italy - 2018	4 346,8
Germany - 2019	4 175,5

5G Critical factors: Spectrum (model and conditions of distribution)

- **Lessons learned after LTE auction – necessary changes in law have been introduced to seal the patch holes in the process (to ensure participation only of credible entities, and consequences for withdrawal which should prevent „speculative" bidding)**

5G auction: proposed conditions for C- band (3480 – 3800 MHz)

Subject of the auction

- **4 nationwide 80 MHz** spectrum reservations
- Blocks are concrete - each block is described with specific frequency range
- Each block has different **local limitations in usage**
- Spectrum licenses length is **15 years**
- **Spectrum cap** is 80 MHz (one operator / capital group is allowed to get **one block only**)

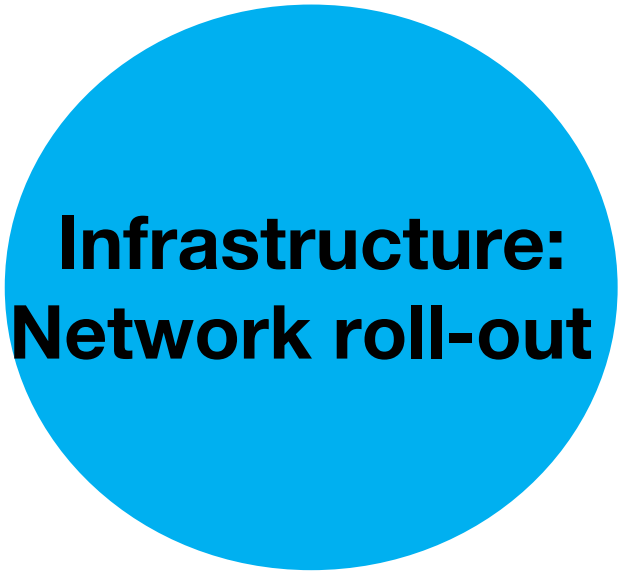
Requirements for participants

- **Investment** at minimum level of **PLN 1 bln in 2016-2018**
- Participant **must have access to at least one** of the following nationwide spectrum resources: 800, 900, 1800, 2100, 2600 MHz
- **Bid bond PLN450 m** per block
- **Deposit mechanism** – up-front payments required as prices in the auction increase

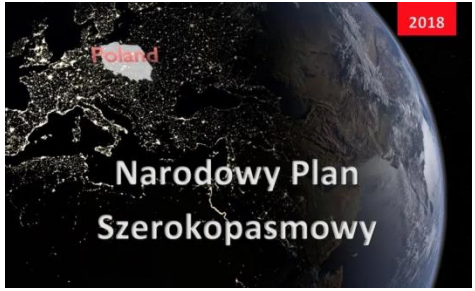
Coverage obligations

- First 6 months: 10 BTS in one city
- End of 2023: 250 base station in at least 9 voivodship cities and at least 20 communes (10+ BTS in each)
- End of 2025: 500 base station in at least 16 voivodship cities and at least 30 communes (10+ BTS in each)

5G - Critical factors I Challenges I Uncertainties



5G Critical factors: Infrastructure – network roll-out



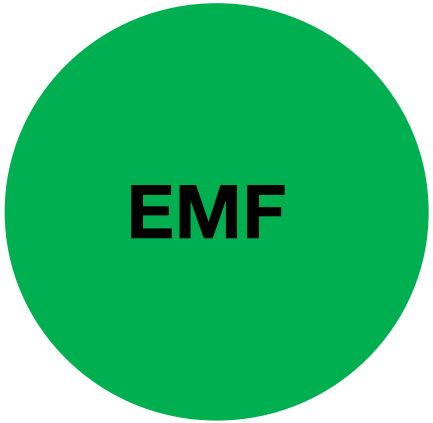
Cost of 5G network roll-out according to the Polish National Broadband Plan:

- PLN 11.35 to 20.3 billion (€2,65 to 4,74 billion) - estimated expenditures for 5G network in Poland (excluding the costs of spectrum).
- PLN 2.89 billion to PLN 11.85 billion (€0,67 to 2,76 billion) - estimated value of the financial gap (understood as the difference between the costs of building a 5G network and the financial potential of operators in 3 different scenarios (organic model, sharing model or public model).

Investment process:

- Length - the construction of the base station in Poland lasts at least 1 year (6 months in perfect conditions, while record length of construction - over 8 years)
- Legal uncertainties concerning administrative aspects of the process (numerous court proceedings)
- Protests delaying/blocking the construction process

5G - Critical factors I Challenges I Uncertainties



5G Critical factors: EMF as a barrier for 5G deployment

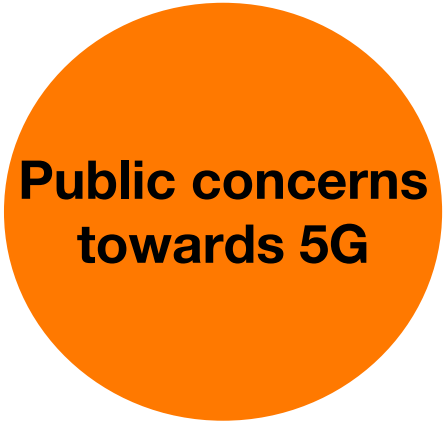
- ITU "The impact of RF-EMF exposure limits stricter than the ICNIRP or IEEE guidelines on 4G and 5G mobile network deployment" : *EMF exposure limits that are more strict than the ICNIRP or IEEE guidelines* ***negatively affect all potential levers to enhance the wireless infrastructure and deployment of 5G: spectrum, technology*** *(determining the spectral efficiency)* ***and network topology*** *(number of sites and sectors)*

- **EMF exposure limits in Poland are up to 100 times below ICNIRP guideliness – they are based on limits set in the 1980s**
- **It means no possibilities for expansion of existing networks in all types of areas (primarily metropolitan and urban, but also suburban and rural).**

Frequency [MHz]		800	900	1800	2100	2600
Electric field strenght [V/m]	Reference levels from Recommendation 1999/519/EC	38,9	41,3	58,3	61	61
	Polish regulations			7,0		
Equivalent plane wave power density [W/m^2]	Reference levels from Recommendation 1999/519/EC	4,0	4,5	9,0	10	10
	Polish regulations			0,1		

- **15/11/2019 - draft of a new regulation on permissible levels of EMF in the environment was sent for public consultation, which provides for harmonization with the values of Recommendation 1999/519/EC**

5G - Critical factors I Challenges I Uncertainties



5G critical factors: Public concerns towards 5G

- Public protests against 5G
- Main concerns voiced: 5G is a new type of electromagnetic weapon / 5G generates radiofrequency radiation that can damage DNA and leads to cancer/Electromagnetic hypersensitivity /5G allows mind control
- Myths and fake news proliferate
- Results:
  - blocked legislation allowing for small-area wireless access points
  - protests that lead to suspension/delay of network rollout
  - organized actions to damage telecommunications infrastructure
- This is not just a local problem (appeal to the EC to stop 5G; EU Council conclusions of 3 Dec. refer to EMF)
- Wide scientific research has been conducted on EMF in the last few decades. The conclusion of this research is that no reliable study has confirmed harmful effects of the EMF at levels which are compliant with the norms recommended by WHO.
- Responsible approach - concerns should not be ignored. Science-based communication and education is needed.

- Council Conclusions on the significance of 5G to the European Economy and the need to mitigate security risks linked to 5G (3 December 2019) (…) *RECOGNISES the need to raise public awareness about the possibilities of 5G and increase competences within developers and different user groups, and that the public sector has a role in encouraging the take up of 5G by leading by example, and encourages all relevant stakeholders to engage in the sharing of information and experience in support of the successful roll out of 5G, including questions related to the measurements of electromagnetic fields (EMF) limits.*

5G - Critical factors I Challenges I Uncertainties

5G Critical factors: 5G Security

General state of discussion:

- High temperature of political debate
- Focus on MNO's and vendors
- So far no single approach across EU
- 5G implementation is on-going

PL level

- Sept. 2019 US- Poland Joint Declaration on 5G (following *Prague proposals*)
- Dec. 2019 – expected draft of ordinance on the security and integrity of telecommunications networks incl. 5G

EU level

- March 2019 - EC's recommendations on 5G security
- July 2019 - country risk assessments
- Oct 2019 - EU coordinated risk assessment of the cybersecurity of 5G networks
- Nov 2019 - Threat Landscape of 5G Networks
- Dec 2019 – European Council Conlusions on 5G
- By end 2019 – publication of 5G security toolbox
- ??? - 5G certification scheme

Solutions under consideration:

- Ban for some vendors (white list/balck list)
- Suppliers diversification
- Network redundancy
- National roaming
- Additional security requirements regarding the network components and network design and operation

5G - Critical factors I Challenges I Uncertainties

5G Critical factors: General legal and regulatory environment

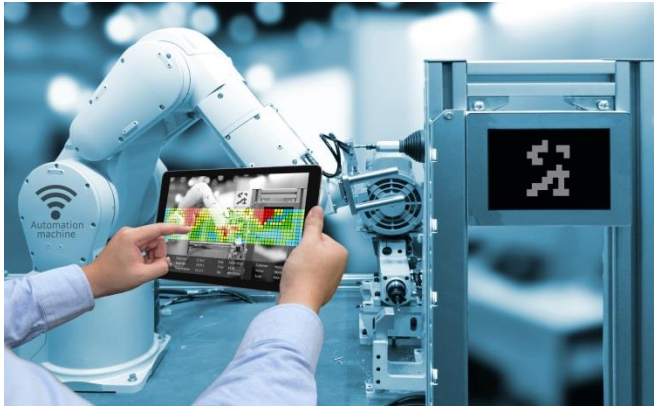
- **Very dynamic changes of overall legal environment in Poland (including new obligations for operators):**
  - **Parliament adopted 273 acts in 2018 (in 2017 - 212)**
  - **2 548 acts were published (2018) in the Journal of Laws (in 2017 - 2 509)**
- **Implementation of European Electronic Communications Code - draft of new Telco Act expected in Jan. 2020**

EECC 5G-related provisions

Spectrum	Duration of license	EMF limits	Small cells
Member States should release frequencies necessary to provide 5G: • 3.4 to 3.8 GHz – MS should reorganize and allow the use of sufficiently large blocks. • 24.25 to 27.5 GHz – allow to use at least 1 GHz, provided that there is a market demand	The **initial period** of frequency reservation is **at least 15 years** with the possibility of **extension** by another **5 years**	The notification procedure shall apply with respect to any draft measure by a MS that would impose on the deployment of small-area wireless access points different requirements with respect to electromagnetic fields than those provided for in Recommendation 1999/519/EC	Small cells can be deployed without special permits. **Physical and technical characteristics**, such as maximum size, weight, and where appropriate emission power of small-area wireless access points **will be determined by the EC by 30 June 2020**

Conclusions

- 5G is the next stage of the mobile evolution responding to the ever growing demand for network capacity and speed.
- 5G provides new opportunities for industry and business development and consequently a boost for economic growth and ever better consumer experience. While at the same time 5G implementation is a major investment challenge.
- Therefore, new and innovative means to monetise this investment must be found and they should not be impeded by any inadequate intervention.
- There are new challenges and sources of uncertainties which call for co-ordinated EU approach to avoid fragmentation and inconsistencies on the Single market.
- Education and coherent EU-wide evidence-based communication on 5G is needed to address concerns and fight fake news (eg. on EMF).
- 5G is still at an early phase and needs freedom to grow and market-based solutions and smart regulatory intervention only when hurdles for growth arise and need to be removed (eg. network roll-out procedures).
- Therefore, it is extremely important to ensure GROWTH-FRIENDLY policy approach, PREDICTIBLE and STABLE legal and regulatory environment that would indeed allow for progress.



Thank you