



AGENCY FOR ELECTRONIC COMMUNICATIONS AND  
POSTAL SERVICES



# MOBILE BROADBAND IN MONTENEGRO - CURRENT STATUS AND PLANS FOR FUTURE

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## Overview of mobile networks in Montenegro

- Three MNOs: **Crnogorski Telekom**, Telenor and **Mtel**
- Five bands in use: **800 MHz, 900 MHz, 1800 MHz, 2 GHz and 2.6 GHz** (last spectrum auction: 2016)
- Technology
  - **2G (GSM/GPRS/EDGE)**
  - **3G (UMTS/HSPA+/DC-HSDPA)**
  - **4G (LTE/LTE-Advanced)**
    - **2x2 MIMO, 4x4 MIMO on few sites**
    - **2CA on many sites, 3CA on several sites**
    - **no VoLTE**
- **Voice traffic in cities: <5% by GSM, >95% by UMTS**
- **Data traffic in cities: <0.5% by UMTS, >99.5% by LTE**

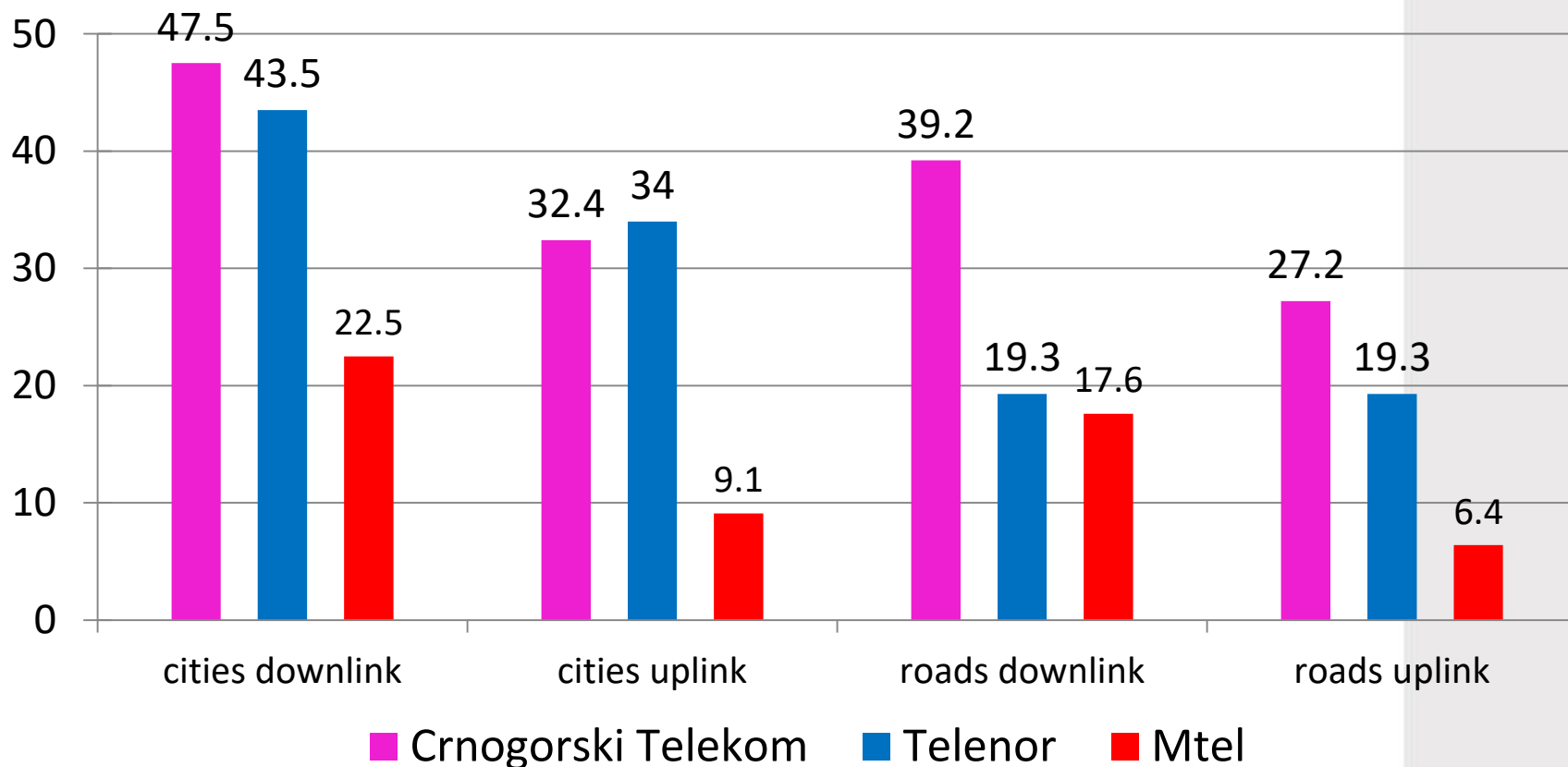


## Coverage after three years since Spectrum auction

- GSM: **98.4% of population**
- UMTS: **>97% of population**
- Composite GSM/UMTS coverage (Voice/SMS):  
**>98.5% of population**
- LTE basic coverage (RSRP  $\geq$  -120 dBm):  
**>97.5% of population**
- LTE (10 Mbps DL) coverage (RSRP  $\geq$  -112 dBm):  
**>97% of population**
- Special coverage obligation:  
**15 rural areas covered**



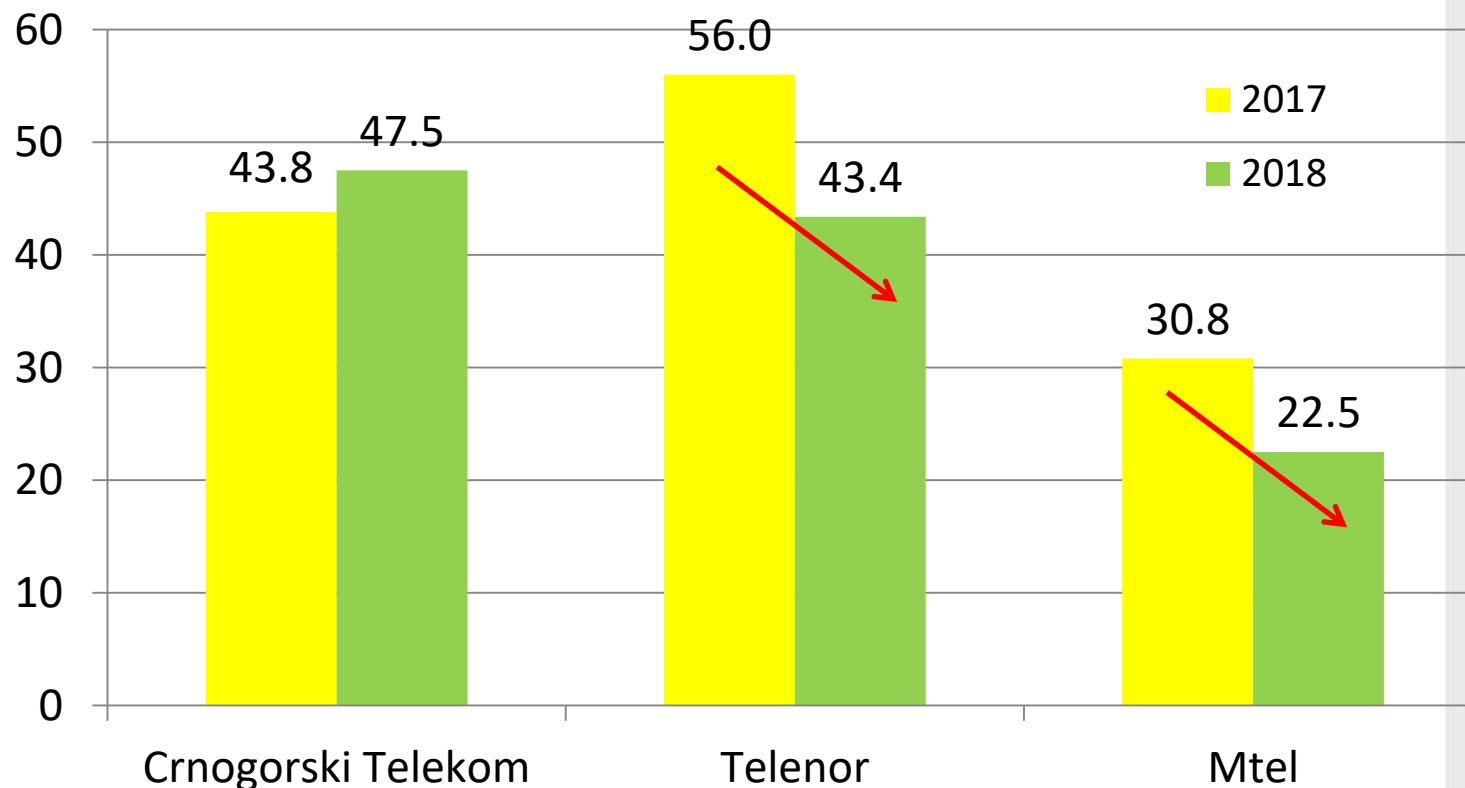
# Average data rate in Mb/s per FTP session (Measurements in Nov-Dec 2018)

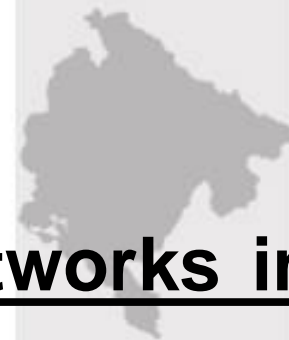




## Average data rate in Mb/s per FTP session in cities

(2017 vs 2018)





## Options for increase capacity of LTE networks in mid term

- **Base stations densification** – limited due to interference
- **Technology upgrade (4x4 MIMO, 256QAM, ...)** – limited due to antenna size
- **Implementation of LTE-A Pro: LTE-WLAN Aggregation (WiFi in unlicensed bands)** – limited due to complexity
- **Massive 3CA, 4CA or 5CA deployment** – more spectrum needed



## Available frequencies for LTE/LTE-A/LTE-A Pro in MNE

Band	Amount	Comment
900 MHz	up to 2x15 MHz FDD	Refarming. Potential use for LTE in case of GSM reduction and/or UMTS shot down.
1500 MHz	90 MHz SDL	Free. Potential use for LTE SDL.
1800 MHz	up to 2x15 MHz FDD	Refarming. Potential use for LTE in case of GSM shot down in this band.
2 GHz	up to 2x60 MHz FDD	Refarming. Potential use for LTE in case of UMTS reduction or shot down.
2.3 GHz	100 MHz TDD	Free. Potential use for LTE.
2.6 GHz	2x40 MHz FDD + 40 MHz TDD	Free. Potential use for LTE.
Unlicensed		5 GHz potential use for LTE-A Pro (LWA).





## **... or deployment of 5G network?**

- 5G is not only one more G in mobile network evolution (it is rather a revolution than an evolution)
- 5G is expected to create an ecosystem for technical and business innovation
- More oriented to “verticals” as businesses with connectivity requirements (energy, agriculture, automotive, city management, healthcare, manufacturing, etc)
- Requirements ranging from high reliability to ultra-low latency to high bandwidth and mobility (network slicing)



## **Some of issues regarding 5G are:**

- Are there real drivers for implementation of the new technology ("killer application") in this early phase? Are there real need for Gbps mobile connectivity at the moment?
- Are 5G vertical ecosystems ready for 5G? Are they aware of benefits of using 5G for their businesses?
- Is suitable RF spectrum for 5G networks available?
- How to manage EMF exposure risks?

**What regulators can/should to do to bring 5G to people and industry in their countries?**



## RF spectrum for initial 5G implementation

### Band 694-790 MHz

- suitable for mMTC, eMBB, URLLC
- wide area and deep indoor coverage
- enable operators to roll out 5G quickly and more cost-effectively
- up to 20 MHz FDD/TDD assignments

### In MNE:

- Band 700 MHz is free
- Usage for 5G is possible only in northern region due to DTV signals from ALB, ITA and CRO
- **Regional harmonisation** of deadline for release of the band 700 MHz for MFCN is of crucial importance



## **RF spectrum for initial 5G implementation**

### **Band 3400-3800 MHz**

- suitable for eMBB, URLLC, mMTC
- wide area but no deep indoor coverage
- the best compromise between capacity and coverage
- 100 MHz contiguous assignments

### **In MNE:**

- Part of the band 3400-3600 MHz is licenced to BWA until April 2022
- Whole band 3600-3800 MHz is free
- Usage for 5G possible now



## **RF spectrum for initial 5G implementation**

### **Band 24,25-27,5 GHz**

- suitable for eMBB
- addressing specific use cases requiring extremely high data rates
- 800 MHz contiguous assignments

### **In MNE:**

- Band 24,25-27,5 GHz to be identified for IMT in 2020
- Band 24,5-26,5 GHz currently is used for fixed links (gradual migration in other bands, depending of market demand for spectrum for 5G)
- Band 26,5-27,5 GHz (1 GHz) is free
- Usage for 5G possible after identification for IMT



## **EKIP plans regarding 5G**

- **Regulatory framework for spectrum – to be completed in 2020**
  - Adoption of new National frequency allocation plan
  - Adoption of channel arrangement and LRTC for bands 700 MHz, 3,5 GHz and 26 GHz
  - Cooperation with NRAs in ALB, ITA and CRO regarding deadline for release of the band 700 MHz for MFCN
- **Strategy for implementation of 5G mobile networks in Montenegro (doc) – to be completed in 2020**
- **Consultation with stakeholders on 5G pilot (mobile operators, public institution on state and local level, vertical industries, university...) - 2020**



## **Spectrum auction 2021 - activities**

- **Next spectrum auction is planned for 2021 – five years after previous**
- **Preliminary consultation with mobile operators (needs, timing, strategy, format, ...) – 2020**
- **Public procurement for consultancy service and auction software – 2020**
- **Information document – Q1 2021**
- **Auction process – Q3 2021**



## Spectrum to be auctioned

- **Renewal** until 01. 09. 2031 (in pre-auction or directly)
  - Band 900 MHz: 2x10 MHz
  - Band 1800 MHz: 2x20 MHz
  - Band 2 GHz: 2x15 MHz
  
- **Free spectrum for LTE** (until 01. 09. 2031 or 15 years)
  - Band 2 GHz: 2x5 MHz
  - Band 1500 MHz: 90 MHz
  - (?) Band 2300 MHz: 100 MHz
  - Band 2,6 GHz: 2x40 MHz FDD + 40 MHz TDD





## Spectrum to be auctioned for 5G

- Band 700 MHz: 2x30 MHz FDD + (?) up to 20 MHz TDD
  - Band 3400-3800 MHz: 400 MHz
  - Band 26 GHz: 1000 MHz
- Licence duration: 15 years (from mid 2022 (?))
  - Block size: 5 MHz or 10 MHz (700 MHz band) (?)  
20-100 MHz (3400-3800 MHz band) (?)  
200 MHz (26 GHz band) (?)
  - Auction format (CCA, SMRA, other (?))
  - Spectrum caps/floors (?)
  - Coverage requirements (?)
  - ... (?) - **to be defined...**



# Thank you.

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