

5G COUNTRY PROFILE



REPUBLIC OF NORTH MACEDONIA

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Version 1.1

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Note: Version 1.1 of this document is an advanced draft for possible additional inputs, comments, feedback. The final version of the document is planned to be released after the ITU Regional Forum for Europe.

1. ICT background and current status of broadband

The Republic of North Macedonia is one of the fastest-growing ICT markets in the Western Balkan region with a robust telecom infrastructure. In 2018, ICT sector valued about 862 million EUR, contributing about 4% to the country's GDP.¹ North Macedonia experienced quick development of the electronic communications market as a result of the opening up of the telecommunications sector to competition,² attracting investments from foreign actors in telecommunications and IT due to the country's low corporate tax and free economic zones.³ In the 2017 ITU ICT Development Index (IDI), North Macedonia ranks 69th out of 176 countries.⁴

Broadband is on the rise as the government continues to promote digital infrastructure developments. With a less developed fixed network, mobile plays an important role in the country with penetration rates being relatively high and likely continue increasing for mobile-cellular and for mobile-broadband services.⁵ 3G licenses were first awarded in 2008 to MakTel and Vip (now named A1 Macedonia). At the end of 2013, LTE services were launched commercially. Currently, North Macedonia benefits from substantial 2G, 3G, and 4G infrastructure that covers more than 98% of the population.⁶ The mobile market revenue in 2018 totalled 136 million EUR.⁷

Building upon the previous ICT-related policy frameworks of the National Strategy for the Development of Electronic Communications with Information Technologies and the National Strategy for Information Society Development and Action Plan, the government adopted in 2019 the National Operational Broadband Plan for 2019-2029 (NOBP). Among other things, this new plan relied on information from the national broadband mapping as well on the expected investments by telecom operators in the near future. Aligned with the strategic objectives of the Digital Agenda for Europe and the EU's Gigabit Society, the NOBP articulates a 5G roadmap with the following targets:⁸

- By the end of 2023, at least one larger city to be covered with 5G signal;
- By the end of 2025, the main corridors in accordance with the Treaty establishing the Transport Community on the basic and comprehensive road network in the country should be covered with an uninterrupted 5G signal;
- By the end of 2027, all towns in the country are covered with uninterrupted 5G signal;
- By the end of 2029, anyone can have the opportunity to access the internet through 5G with a minimum speed of internet access of at least 100 Mbps;

¹ See: ITU Report, *Investing in the North Macedonia Mobile Communications Market, 2020*, p. 4.

² See: <http://documents1.worldbank.org/curated/en/348431571341516627/pdf/Concept-Project-Information-Documents-PID-North-Macedonia-Digital-Economy-NODE-P170993.pdf>

³ See: <http://ukrexport.gov.ua/i/imgsupload/file/ICT%20web.pdf>

⁴ See: <https://www.itu.int/net4/ITU-D/idi/2017/index.html>

⁵ See: https://www.itu.int/en/ITU-D/LDCs/Documents/2017/Country%20Profiles/Country%20Profile_Republic-of-North-Macedonia.pdf

⁶ See: ITU Report, *Investing in the North Macedonia Mobile Communications Market, 2020*, p. 20.

⁷ See: ITU Report, *Investing in the North Macedonia Mobile Communications Market, 2020*, p. 9.

⁸ See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

- By the end of 2029, at least 50% of the total number of household subscriber contracts across the country are for internet access of at least 100 Mbps;
- By the end of 2029, all households will have affordable opportunity to access a network that allows for a download speed of at least 100 Mbps, with a possibility for an upgrade to Gigabit speed; and
- By the end of 2029, all public institutions (schools, universities, research centres and other educational institutions, healthcare facilities, ministries, courts, local self-governments and other state authorities and bodies) have symmetrical internet access with a speed of at least 1Gbps.

There are four pillars in place to support the measures and activities in achieving the targets in the NOBP: I) Use of state aid; II) Additional measures for encouraging the use of access to ultrafast Internet; III) Improved legal framework and regulation; and IV) 5G introduction and development plan.

While broadband services continue to expand in the country, a 2018 domestic mapping of current commercial networks and operators' future plans indicate that 30% of households are located in "white zones." These white zones correspond to areas that lack capacities for access to super/ultra-fast Internet (with download speed higher than 100Mbps), and that there are no plans to invest in such networks in the foreseeable future.⁹

To tackle this issue, and in alignment with the NOBP, the Ministry of Information Society and Administration announced a collaboration with the World Bank to develop a National Transport Fibre Network. The government expects such network to access these "white zones," as well as fibre network within these specific areas, that would be available for operators to use so to provide services to the citizens. The only condition for this plan is that retail prices for super-fast internet access for households should not exceed 2% of the average monthly income in a respective planning region.¹⁰

2. Broadband and mobile telecommunication sectors data

ITU data shows that 79.17% of individuals in the Republic North Macedonia had access to the Internet in 2018.¹¹ In 2010, the ITU data estimate for the country was 51.90% and, in 2000, 2.49%. In 2019, the number of fixed-broadband subscriptions per 100 inhabitants was 21.33.¹² Moreover, according to the latest Broadband competence office Report¹³ on the country's broadband development, the Republic of North Macedonia reports the following indicators, not covered by:

- Fixed broadband coverage (% of households) is 97,87%;
- Fixed broadband take-up (% of households) is 72,95%;
- 4G coverage (% of households) is 99,38%;

⁹ See: <https://mioa.gov.mk/?q=en/node/2624>

¹⁰ See: <https://mioa.gov.mk/?q=en/node/2624>

¹¹ See: ITU World Telecommunication/ICT Indicators Database online (2020): <http://handle.itu.int/11.1002/pub/81550f97-en> (indicator "i99H")

¹² See: ITU World Telecommunication/ICT Indicators Database online (2020): <http://handle.itu.int/11.1002/pub/81550f97-en> (indicator "i992b")

¹³ See: <http://bco.mioa.gov.mk/wp-content/uploads/2020/10/Извештај-на-НКБК-бр.2-усвоен-на-29.9.2020-eng.pdf>

- Preparedness for 5G (% of harmonized spectrum) is 22,2% (14.07.2020);
- Fast broadband (NGA) coverage (% of households) is 78%;
- Fast broadband take-up (% of households) is 27,43%;
- Ultra-fast broadband (NGA) coverage (% of households) is 43,8%;
- Ultra-fast broadband take-up (% of households) is 1,74%.

Information detailed in the NOBP shows that coverage with fast broadband networks is roughly the same as the average in the European Union. However, the existing coverage with ultra-fast broadband networks (43.8%) is lower than the EU average (58%).¹⁴ For enterprises (with 10 or more employees) in 2019, 85.8% of them had fixed broadband connection, an increase of 4.3 percentage points compared to the previous year.¹⁵ Additionally, the wholesale broadband market in North Macedonia is highly concentrated with few providers, and the high wholesale broadband prices prevent investments, especially among the smaller or regional operators.¹⁶ From the regional perspective, Europe's average fixed-broadband basket cost was 1.5 percent of the GNI per capita in 2019, while North Macedonia's corresponded to 3.8% of the GNI per capita in 2019 for a 50 Gb Internet data cap.¹⁷

In regards to the mobile sector, the number of active mobile-cellular subscriptions is 98.65 per 100 inhabitants, while the mobile-broadband subscriptions per was equivalent to 69.85 in 2019.¹⁸ Moreover, according to ITU data 3G population coverage in North Macedonia is 99.88% while 4G/LTE coverage is 99.53%.¹⁹ In terms of prices, the country's mobile-data basket cost corresponded to 1.9% of the GNI per capita in 2019 for a monthly allowance of 1.5 a Gb,²⁰ while the European region's average was 0.8 per cent for the same year. In 2019, alone, the mobile-broadband Internet traffic within North Macedonia was equivalent to 0.045 exabytes.²¹

3. Spectrum assignment for 5G & market development

The 2019 NOBP recognizes the that one of the preconditions for the promotion of 5G networks is providing a sufficient and adequate radio frequency spectrum as early as possible to stimulate investments, innovation, and competition in the development of 5G services.

¹⁴ See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

¹⁵ See: <http://www.stat.gov.mk/publikacii/2020/Macedonia%20in%20figures-2020-web.pdf>

¹⁶ See: <http://documents1.worldbank.org/curated/en/348431571341516627/pdf/Concept-Project-Information-Document-PID-North-Macedonia-Digital-Economy-NODE-P170993.pdf>

¹⁷ See: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/prices2019/ITU_ICTpriceTrends_2019.pdf

¹⁸ See: ITU World Telecommunication/ICT Indicators Database online (2020): <http://handle.itu.int/11.1002/pub/81550f97-en> (indicator "i911mw")

¹⁹ See: ITU World Telecommunication/ICT Indicators Database online (2020): <http://handle.itu.int/11.1002/pub/81550f97-en> (indicator "i271G and i271GA")

²⁰ See: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/prices2019/ITU_ICTpriceTrends_2019.pdf

²¹ See: ITU World Telecommunication/ICT Indicators Database online (2020): <http://handle.itu.int/11.1002/pub/81550f97-en> (indicator "i136mwi")

The Agency for Electronic Communications (AEK) expects to assign 5G spectrum in the second half of 2020, with plans to initially award 5G-suitable spectrum in the 700MHz and 3.6GHz bands.²² To facilitate this process, AEK launched a public consultation in February 2020 so that interested parties could provide their input regarding terms and conditions of the spectrum auction, demand for spectrum, optimal way of allocating the airwaves, and deadline aligned with the operator's return on investments.²³

From February 2020 700 MHz band is freed up from digital video broadcasting-terrestrial (DVB-T) and will enable nationwide and indoor 5G coverage.²⁴ Due to favourable propagation conditions, AEK states that the 700 MHz frequencies will provide the opportunity for network operators to develop comprehensive 5G coverage early, based on their existing network infrastructure.²⁵

Furthermore, the AEK expects to award 2x10MHz of spectrum in the 700 MHz band per operator, while it plans to distribute 300 MHz in the 3.6GHz band (100 MHz per operator) nationally and 68.5MHz regionally.²⁶ Some of the conditions proposed by AEK for the allocation of these two bands deals with both territorial and population coverage. One condition determines that at least one North Macedonian city needs to have uninterrupted 5G coverage by the end of 2023, and all remaining cities by 2027, while the second condition expects that all citizens must be provided with 5G access with a minimum downlink of 100Mbps by 2029.²⁷

Additionally, the AEK plans to reserve 2x10MHz in the 700MHz band and 100MHz in the 3.6GHz bands for a new network operator, with a lower one-time fee and coverage obligations. For the 24.25-26.5 GHz radio frequency band, if needed, AEK may conduct re-planning by 2023 and allocate it for land mobile services.

4. Current progress on 5G: consultations and national strategies

As part of the NOBP, operators are expected to invest in two critical areas in the country to facilitate 5G development:²⁸

- **Infrastructure investments:** Mainly to build a denser fibre optic network infrastructure, thus ensuring 5G connectivity of base stations by funding their installation. The next generation of 5G wireless networks will support applications requiring high speeds. One of the solutions, in this case, is to allow higher density of base stations by deploying small cells.

²² See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

²³ See: <https://aek.mk/javen-povik-za-mislenje-za-izdavanje-odobrenija-5g/>

²⁴ See: http://signal.aek.mk/irc2018/irc2018_s3_03.pdf

²⁵ See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

²⁶ See: https://aek.mk/wp-content/uploads/2020/02/20200205_Javna_rasprava_5G.pdf

²⁷ See: https://aek.mk/wp-content/uploads/2020/02/20200205_Javna_rasprava_5G.pdf

²⁸ See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

- Investments in service innovation: Mainly to stimulate the emergence of new 5G services. Such a focus on innovation includes the financing of pilot projects through which the potential 5G features will be demonstrated and tested, thus allowing the development of new services.

Moreover, according to NOBP, the new government should establish inter-ministerial working groups for mutual harmonization and amendment of the laws and bylaws related to construction and electronic communications, taking into account the proposals submitted by operators and the measures outlined in the national broadband plan. Representatives of ministries, regulatory bodies, operators, universities, chambers of commerce, equipment manufacturers, independent experts, civil society associations, private companies, and others, participated in the working group.²⁹

As a result, a dedicated website page has been created to host relevant information on 5G development as well as proposals by stakeholders.³⁰ Moreover, according to NOBP, the government representatives should engage discussions with stakeholders to ensure:³¹

- Joint use of the existing physical infrastructure;
- Intensifying the coordination of construction works;
- Use of free optical fibre for aggregation linking to the development of 5G. Procedures that will enable quick and simple acquisition of approvals for construction of electronic communication networks, and in particular for deploying fibre optic infrastructure and base stations for the new 5G network;
- Deployment of 5G equipment on existing lighting poles, at bus stops, transmission line towers, etc; and
- Deployment of small-size and low output equipment for mobile networks should be in accordance with the regulations for the installation of urban equipment (without an approval/decision), and via very simple and quick procedure.³²

The document articulates that the 5G implementation in North Macedonia should guarantee the building of a nation-wide ecosystem for wireless connectivity with a focus on quality of user experience not only within the context of increased speed, reliability, and reduced communication latency but also in the context of significantly expanding the number of offered services and improving the overall quality of life.

Accordingly, one of the central government's strategy in achieving these 5G-related targets focuses on maximizing the benefits of 5G implementation for financial return through governmental support. Such a strategy includes the development of a thriving economic market through support and advancement of

²⁹ See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

³⁰ All relevant documents and stakeholder proposals can be found here: <https://mioa.gov.mk/?q=mk/node/1552>

³¹ See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

³² Ibid.

new services in various vertical market segments that may be offered to end-users through a diverse niche of possible industries and services.

To accomplish that, according to the NOBP, government representatives should engage in discussions with vertical sectors, industry and the telecommunication operators³³ to the following end:

- Sign a Memorandum of Understanding for 5G development and digital transformation in all spheres of the society through the use of 5G technology;
- Possible financing of pilot projects through which the potential 5G features will be demonstrated and tested, thus allowing development of new services;
- Raising the level of the digital skills within the industry, as well as among the citizens.

5. Electromagnetic field levels and the implementation dynamics

As, AEC issued temporary licences to both MNO for testing 5G on a period of 12 months in the frequency band 3.6 GHz band, AEC conducted measurements of non-ionizing radiation in order to see the contribution of the new 5G NR technology from the test network of Makedonski Telekom. During the measurements, two base stations were active, one from the building of Makedonski Telekom and the other from the building of TK Centar. The measuring point is in front of the AEC building, 160 meters from the first base station. Limit values for the EMF are taken from the recommendations of International Commission for Non-ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) (1998), whose recommendations are implemented in the European legislation given in CEPT Recommendation ECC REC(02)04-Measuring non ionizing electromagnetic radiation (9 KHz-300 GHz). According to these recommendations, basic limit values and reference limit values are defined.

The whole Report from the measurement is published on 18/12/2019 on the official web page of AEC.³⁴ A final result of the measurement is that the contribution of 5G as a part of all the other technologies is 32% whereas, for example, LTE is at 49 % from the maximum allowed value. 5G's contribution in the total density of electromagnetic energy is 38 % instead of LTE which is 47 %. Another important remark of this Report is the fact that this measurements and calculation were done in the worst-case scenario when 5G sites were active 100 % and the whole beams were towards the measurement equipment.

6. 5G commercial launches: announcements, trail cities, and digital cross-border corridors

As of August 2020, there is no commercial availability of 5G products, although commercial pre-release and tests have occurred.

In September 2018, Makedonski Telekom, which has the largest share of the broadband market in North Macedonia, informed that it performed the first 5G demo in the country, claiming the tests results of the tests reached the highest Internet speed registered. On that occasion, the operator also claimed that the

³³ See:

https://mioa.gov.mk/sites/default/files/pbl_files/documents/reports/north_macedonia_national_operational_broadband_plan_final_en.pdf

³⁴ See: https://aek.mk/wp-content/uploads/2020/06/lzvestaj_od_merenje_na_nejoniziracko_zracenje-AEK-5G-NR.pdf

provider had planned investments in the next two years in order to meet all prerequisites for the commercial launch of 5G.³⁵

In May 2019, Makedonski Telekom and Faculty of Electrical Engineering and Information Technologies (FEEIT) of the “Ss. Cyril and Metodius” University, being also ITU Centre of Excellence, announced a partnership for testing 5G network. The press release informed that the 5G-related tests would occur in the FEEIT’s “5G Evolution Laboratory” within the Wireless and Mobile Networks Lab at the institution based in Skopje, which is equipped with a 5G core network emulation and virtual wireless access. The provider announced that the partnership’s plan included furthering the engagement with researchers in performing real scenario tests while conducting experiments.³⁶

In July 2019, Agency for Electronic Communications issued two temporary frequency authorizations for testing 5G network. Frequency authorizations are issued to A1 Makedonija for frequency band 3.7-3.8 GHz (100 MHz) with validity date till 14.07.2020 and to Makedonski Telekom for frequency band 3.6-3.7 GHz (100 MHz) with validity date till 31.10.2020

In November 2019, Makedonski Telekom has set up a trial 5G network in the centre of Skopje, with tests scheduled to be carried out during 2020 before a full commercial launch. The provider said that it was aiming to test the 5G performance in real-time, thus enabling new services for users. These services included the following: super-fast fixed-wireless internet, virtual reality (VR) 3600 live video, VR gaming in real time and ultra-HD multi-video streaming.³⁷

³⁵ See: https://www.telekom.mk/ns-newsarticle-Makedonski_Telekom_performs_the_first_5G_demo_in_Macedonia.nsp

³⁶ See: <https://www.telekom.mk/ns-newsarticle-5G-Technology-testing-Makedonski-Telekom-and-FEEIT-partnership.nsp>

³⁷ See: <https://www.telekom.mk/ns-newsarticle-makedonskitelekom-set-up-the-first-test-5g-network-in-the-center-of-skopje.nsp>