



Republic of North Macedonia

Broadband Competence Office

Report

Skopje, March 2021

Table of Contents

Introduction	2
Report on implementation of adopted strategic documents and plans for broadband development.....	3
Activities conducted by NBCO in NOBP implementation.....	3
Conducted activities of PE MB in the implementation of NOBP	4
Conducted AEC activities in the implementation of the NOBP	5
Undertaken activities for development of fixed broadband.....	5
Undertaken activities for introduction of 5G.....	5
Report and conclusions from the conducted mapping of existing and planned broadband networks of the operators, situation at the end of 2020.....	6
Mapping conducted at the end of 2018	6
Results from the conducted mapping in 2018.....	7
Mapping conducted at the end of 2020	7
Results from the mapping conducted at the end of 2020	8
Conclusions	9
Broadband Development Report in the country	11
Connectivity – indicators.....	12
Comparison with indicators of EU member states.....	13
1.Total incomes of telecom operators (in denars without VAT)	13
2. Broadband coverage.....	14
A. Fixed broadband access coverage	14
B. Mobile Broadband Access Coverage.....	15
3. Fixed broadband take-up (% of households)	16
4. Fast broadband take-up (% of households).....	17
5. Ultrafast broadband take-up (% of households).....	18
6. Fixed broadband take-up, market share by technology.....	18
7. Competition in the fixed broadband market	20
8. Mobile broadband distribution (subscribers per 100 inhabitants).....	21
9. 5G readiness	21
10. Internet (IP) traffic per capita	22
11. Broadband price index.....	23

Introduction

Pursuant to the amendments to the Law on Electronic Communications (July 2019), the National Broadband Competence Office (NBCO) shall act as an expert and advisory body to support investments in broadband networks. According to the law, NBCO is accountable for its work to the Minister of Information Society and Administration.

National Broadband Competence Office (NBCO) was established by the decision of the Minister of Information Society and Administration in October 2019, following the approval of amendments to the Law on Electronic Communications (Official Gazette of the Republic of North Macedonia, No. 153/2019) by the Assembly of the Republic of North Macedonia (RNM) in July 2019.

Pursuant to Article 71-a paragraph (2) of the Law on Electronic Communications ("Official Gazette of the Republic of Macedonia", No. 39/2014, 188/2014, 44/2015, 193/2015, 11/2018, 21/2018 and "Official Gazette of the Republic of Northern Macedonia, No. 98/2019 and 153/2019), the NBCO has the following competencies:

- Participates in the work of the Broadband Competence Offices Network both in the European Union and in the region,
- Gives opinions and suggestions for achieving faster development of electronic communications, and especially the broadband in the country,
- Cooperates with state authorities, state administration authorities, public enterprises, local self-government units, public institutions as well as legal entities with public authorizations and companies in full state ownership and provides support for drafting plans/projects/studies related to broadband networks, as well as provides support in their implementation,
- Gives opinions and suggestions on the use and necessary development of the optical infrastructure that has been built or will be built with public funding,
- Participates in determining the target areas in which state aid will be used for construction and development of broadband networks,
- Gives opinions and suggestions in the construction of broadband networks using state aid for: possible technical solutions, investment and business models, conditions for selection of operator, pricing policy and related issues,
- Participates, gives opinions and suggestions in the preparation of plans for promotion of the broadband in the country,
- Participates in public hearings and consultations related to the construction of broadband networks through the use of state help,
- Participates in determining the locations for providing free WI-FI internet access in the municipalities,
- Participates, gives opinions and suggestions in the preparation of future national strategic documents and development plans related to the development of the broadband,
- Monitors the implementation of the adopted national strategic documents and plans for the development of the broadband in the country, the fulfillment of the national broadband targets stipulated in them and gives opinions and proposals for their revision,
- At least twice a year, prepares a report to the Minister of Information Society and Administration on the development of the country's broadband market compared to the development of the broadband market in the European Union, in line with DESI (The Digital Economy and Society Index) and a report on the implementation of adopted strategic documents and plans for the development of the broadband in the country, the fulfillment of the national broadband targets set in them.

Report on implementation of adopted strategic documents and plans for broadband development

Activities conducted by NBCO in NOBP implementation

According to the Rules of Procedure of the National Broadband Competence Office (NBCO) in the event of an emergency, the NBCO sessions are held through electronic means of communication that enable the use of audio and video communication platforms.

Pursuant to Article 71-b of the Law on Electronic Communications, the NBCO consists of seven members, one of whom is the president of the NBCO. However, due to the resignations of two members, the NBCO currently has five members. Having this in mind, the NBCO considers that there is a need to fill the vacancies within the NBCO to the full number of members in accordance with the law.

In the period from October 2020 to April 1, 2021, the NBCO held a total of thirteen online sessions. Also, several meetings were held with relevant institutions in order to implement the National Operational Broadband Plan (NOBP).

One of the most important activities in this period, which is related to the implementation of the NOBP, is the cooperation with the Agency for Electronic Communications (AEC) for the processes of updating the white/gray/black zones and mapping the use of the Internet access service at the residential level (by speed and technology) throughout the country.

In that regard, during October 2020, it was agreed with AEC representatives to start these processes in order to complete them by the end of 2020. The implementation of these two processes will provide data that are necessary to start the preparation of the Feasibility Study of the National Transport Fiber Optic Network (NTOM). Based on the above, AEC submitted appropriate questionnaires to the operators, thus starting both processes. At the session held on October 26, 2020, the members of the NBCO approved Recommendations for providing free state Wi-Fi in open and public areas in accordance with the Government Work Program (2020-2024) and the National Operational Broadband Plan (NOBP).

In November 2020, the following activities were carried out by the NBCO:

- NBCO members met the representatives of the Agency for Real Estate Cadastre (AREC) to discuss the portal of the National Spatial Data Infrastructure (NSDI), regarding the implementation of the NOBP
- preparation of analysis of the received proposals for locations for free Wi-Fi points has been started by the local self-governments;
- regarding the submitted draft Study for BCOs in WB6 countries (prepared by a consulting company selected by the RCC (Regional Cooperation Council)), an opinion was prepared and submitted to the Minister and Deputy Minister of Information Society and Administration.

In December 2020, the latest National Operational Broadband Plan (NOBP) Implementation Support System of the Agency for Electronic Communications was presented to the members of the NBCO.

A representative of the Ministry of Education and Science (MES) also participated in the 20th session of the NBCO, during which a discussion was held in order to determine possible cooperation between the NBCO and the MES in the area of competencies of the NBCO, which are related to the current MES activities related to distance learning.

Also, a workgroup was established to prepare Recommendations for determining the data sets needed to support the planning and design processes of broadband networks, in accordance with the adopted national plans / strategies of the Government and privileges for access to them. Members of the NBCO took part in this working group, and it was agreed to invite representatives from AEC and PE

During January 2021, the NBCO through its nominated representative actively participated in the project of the RCC (Regional Cooperation Council) for the preparation of a Study to assess the degree of implementation of DESI (Digital Economy and Society Index) in the Western Balkans (WB6) . During this period, an online meeting was held with a representative of the consulting company hired by the RCC for the project and an answer was prepared to the questionnaire of the consultant that will be used in the preparation of the DESI Implementation Study in the countries of the region.

At the 21st session held in January 2021, the Work Program of the Government, ie the Ministry of Information Society and Administration (MISA) was reviewed. This is due to the fact that in accordance with the legal competencies, the NBCO should take in to account the planned initiatives of MISA, namely: the establishment of an Inter-ministerial group for harmonization of laws and by laws related to the construction of electronic communications networks, sewerage, the establishment of a workgroup to amend the Law on Electronic Communications, the adoption of Rules for setting up free state Wi-Fi,

Also, in this period, the NBCO reviewed the current situation with the two started processes that take place in cooperation with AEC (updating the zones and mapping the service using broadband at the inhabited places). It was concluded that the processes have been completed and a Report on the same should be approved, which will then be submitted to the Minister and Deputy Minister, AEC and PE.

During the month of February 2021, members of the NBCO continued with activities relevant to the implementation of the National Operational Broadband Plan (NOBP), such as the data processing processes obtained from the update of the white, gray and black zones, and in the direction of preparation of the Report.

Additionally, the first draft text of the Rules for establishing data sets needed to support the planning and design processes of broadband networks was prepared, in accordance with the adopted national plans / strategies of the Government and privileges for access to them. Representatives of AEC and PE were invited to the meeting where this proposal text was discussed with a request to comment on the proposal. At the same time, it should be emphasized that additional consultations will be needed, both with operators and with other public institutions regarding these Rules.

- Also, at the sessions held in this period, several activities were conducted and more discussions were opened, especially regarding with:
- the establishment of an Inter-Ministerial Workgroup by the Government for mutual harmonization and change of the laws and bylaws related to construction and electronic communications;
- - Initiation of the process of adoption of rules by the Government for installation of cable sewerage financed with public funds, as well as use of existing cable sewerage;
- - the need for the Government to adopt the Rules for determining the data sets needed to support the planning and design processes of broadband networks, in accordance with the adopted national plans / strategies of the Government and privileges for access to the same.

During March 2021, the NBCO unanimously adopted the Report and the conclusions from the conducted mapping of the existing and planned broadband networks of the operators (updating of the zones), as of the situation from the end of 2020. The adopted Report was officially submitted to the Minister and Deputy Minister of Information Society and Administration, AEC and PE Macedonian Broadcasting. The Report is an integral part of this Report.

Conducted activities of PE MB in the implementation of NOBP

Activities / processes undertaken:

- Initiating a change in the systematization of jobs in PE MB, where the broadband activity in Organizational set-up
Organogram of PE MB was added.
- Expansion / Updating of the internal team "Project Implementation Unit" in PE MB, which divides the responsibilities based on the experiences of the team members.

- Implementation of GIS platform and import of the latest data from the proposed locations of public institutions and locations for free state Wi-Fi.
- Meeting with AEC representatives, in order to provide access to their GIS platform intended for the implementation of the NBCO.
- Organizing meetings with public companies that have built optical infrastructure. PE MB is working at a high and structured pace, to finalize the mapping needed to start the Feasibility Study. The internal team is adapted to the specific needs required for the current situation and therefore it is expected that the mapping initiated by PE MB to be performed within the 2nd quarter of 2021.

Conducted AEC activities in the implementation of the NOBP

AEC actively cooperates with the NCBO and provides appropriate contribution from a professional point of view and technical resources in part of the operation of the NCBO.

AEC, more precisely the Telecommunications Department, procured a sophisticated Data Entry System related to the possibility of the operators of public electronic communications networks to provide services for broadband users. The project covered the Software part and the Hardware part.

At the same time, AEC upgraded the existing GIS system and the Single Information Point (ETI), which upgraded this system in its function to provide the opportunity to use all broadband information of JEKM operators.

An amendment to the Rulebook for construction of networks is also underway, by which the operators and institutions that would build or upgrade their telecommunication infrastructure, would receive relief in accordance with what AEC can help them in the construction, and in accordance with the Law On electronic communications.

Undertaken activities for development of fixed broadband

On the other hand, AEC performed appropriate updating of the data in the existing listed systems by updating the data from the operators of JEKM, as well as with some data from public institutions that have their own telecommunication infrastructure. This is extremely important because by updating the data and the new data from the state institutions, a clearer picture was obtained about the definition of white, gray and black zones of internet coverage.

AEC performed appropriate mapping of the institutions and operators of JEKM in the part of defining the mentioned white, gray and black zones of coverage throughout the country with internet and with the possibility to see and at what speeds for internet access a certain operator can have or public institution and to which settlement.

Undertaken activities for introduction of 5G

The situation with 5G-Pioneer bands is as follows:

- Band 700 MHz (703-733 и 758-788 MHz)

On February 1, 2020, the process of releasing this band ended, ie the DVB-T channels from this band were moved to lower frequencies. There are currently no radio frequency users in this band, ie all 60 MHz can be assigned. With the approval of the Plan for purpose of radio frequency bands in RS Macedonia ("Official Gazette of RNM", no. 50/2021) and the Plan for assignment and use of radio frequencies in RN Macedonia ("Official Gazette of RNM", no.60 / 2021) appropriate conditions for its use are prescribed.

- 3.6 GHz Band (3.400-3.800 MHz)

From this band it is planned to use 300 MHz for 5G. AEC has issued two temporary approvals for the use of radio frequencies for 5G testing. The approvals were issued to "A1 Macedonia" for the frequency band 3.7-3.8 GHz (100 MHz) with a validity period until 14.07.2020 and to "Makedonski Telekom" for the frequency band 3.6-

3.7 GHz (100 MHz) with a validity period up to 31.10.2020. Thus, 200 MHz out of the total available 300 MHz was assigned for testing.

- 26 GHz Band (24 250-27 500 MHz)

In RN Macedonia there is 1000 MHz available for assigning 5G operators. With the approval of the Plan for purpose of radio frequency bands in RN Macedonia ("Official Gazette of RNM", no. 50/2021) the conversion of the scope was performed, and with the approval of the Plan for allocation and use of radio frequencies in RN Macedonia ("Official Gazette "Gazette of RNM", no. 60/2021) appropriate conditions for its use are prescribed.

Preparations for the introduction of 5G

Preparations are underway for announcing the intention to conduct a public tender procedure with public bidding for granting approvals for use of radio frequencies in all three bands.

With bringing of the Plan for purpose of radio frequency bands in RN Macedonia ("Official Gazette of RNM", no. 50/2021) and the Plan for allocation and use of radio frequencies in RN Macedonia ("Official Gazette of RNM", no. 60 / 2021) enables 5G implementation in the frequency bands already assigned to the operators.

Report and conclusions from the conducted mapping of existing and planned broadband networks of the operators, situation at the end of 2020

Pursuant to paragraph (2) of Article 71-a of the Law on Electronic Communications ("Official Gazette of the Republic of Macedonia", No. 39/2014, 188/2014, 44/2015, 193/2015, 11/2018, 21/2018 and "Official Gazette of the Republic of North Macedonia", No. 98/2019 and 153/2019), the National Broadband Competence Office (NBCO) has the authority to monitor the conduction of strategic documents and plans for the development of broadband in the country. In order to monitor the implementation of the announced plans / investments of the commercial operators in the country, it is extremely important to establish a tool / mechanism for mapping the already built and planned for construction public electronic communication networks on the territory of the entire country.

Mapping conducted at the end of 2018

The first process of mapping the existing and planned coverage of the country with fixed access broadband networks of the operators have started in 2018 in order to prepare the National Operational Broadband Plan (NOBP) by a Workgroup established by the Ministry of Information Society and Administration in cooperation with the Agency for Electronic communications (AEC). All operators participated in the mapping process.

The mapping was conducted for existing and planned coverage:

- **fixed fast access broadband networks (provide download speeds between 30 and 100 Mbps) and**
- **fixed ultrafast access broadband networks (download speed greater than 100 Mbps).**

Based on the EU recommendations, the colors of the areas in the country were determined:

- **White zone - an area in the country where there is no fixed fast / ultra fast access broadband network, and no construction / development of such a network is planned in the next 3 years,**
- **Gray zone - an area where there is only one fast / ultrafast access broadband network (or it is planned to build such a network in the next 3 years), and there are no other plans to build such a network,**

- **Black zone** - an area in which there are at least two fast / ultrafast access broadband networks of different operators, or will be built in the next 3 years.

Results from the conducted mapping in 2018

Coverage of households in RNM in 2018 with fixed fast and ultra fast broadband networks:

- 78% of households (445,233) had access to fast broadband networks;
- 43.8% of households (249,979) had access to ultrafast broadband networks.

Comparison with the EU average for 2018:

- coverage of households with fast broadband networks (78%) was lower than the average in the European Union (83%),
- coverage of households with ultra-fast broadband networks (43.8%) was significantly lower than the EU average (60%).

Percentage of households located in white, gray and black zones (for fixed fast broadband networks):

- 15.06% of the households (85,958) were in white zones, ie. 85,958 households did not have access to the Internet with download speeds between 30 and 100 Mbps (nor was it planned by any operator in the next three years to build a network that would provide such an opportunity),
- 10.85% of households (61,931) were in gray zones,
- 74.09% of households (422,895) were in black zones.

Percentage of households in the white, gray, and black zones (for fixed ultrafast broadband networks):

- 30.53% of households (174,242) were located in white zones, or 174,242 households did not have access to the Internet with download speeds greater than 100 Mbps (nor was it planned by any operator in the next three years to build a network which will provide such an opportunity),
- 21.67% of households (or 123,684) were in gray areas,
- 47.80% of households (or 272,858) were in black zones.

Planned investments of the operators announced in 2018 for the next three years (until the end of 2021):

- Number of households that by the end of 2021 will be able to have access to fixed fast broadband networks: 484,826 households (84.94%), which means an increase from 78% to 84.94%.
- Number of households that by the end of 2021 will be able to access fixed ultra-fast broadband networks: 396,542 households (69.47%), which means a significant increase from 43.8% to 69.47%

It follows from the previous that in 2018 the operators announced investments mostly for the development of ultra-fast broadband networks.

Graphic display of white, gray and black zones according to the mapping in 2018 can be found at:

<http://app.gdi.mk/NGAPokrivanje/>

Mapping conducted at the end of 2020

Implementation of the "NOBP Implementation Support System"

During 2020, AEC implemented a "NOBP Implementation Support System", which is a sophisticated and reliable ICT system that will have at all times:

- up-to-date data on areas with existing and planned coverage with fast and ultra-fast access broadband networks,
- up-to-date data on the spatial distribution of white, gray and black zones throughout the country, and

- data for mapping the use of the Internet access service.

The NOBP implementation support system allows operators to independently delineate the areas of their existing and planned network coverage. All data is visualized on a map with different thematic layers that can be turned on / off according to the current needs of the user.

With the help of this "NOBP Implementation Support System" at the end of 2020, the process of mapping the existing and planned coverage of the country with broadband networks of the operators began.

The NOBP Implementation Support System is located at the following link: <https://e-agencija.aek.mk/nobp>.

Results from the mapping conducted at the end of 2020

Coverage of households in RNM in 2020 with fast and ultra-fast broadband networks:

- 82.84% of households (467,599) have access to fast broadband networks (download speed between 30 and 100 Mbps),
- 63.10% of households (356,212) have access to ultrafast broadband networks (download speed greater than 100 Mbps).

Comparison with the EU average:

- The coverage of households in RNM with fixed fast broadband networks in 2020 is 82.84% which is 3.16% lower than the coverage of households in the EU for 2019 (86%),
- The coverage of households in RNM with fixed ultra-fast broadband networks in 2020 is 63.1%, which is 3.1% higher than the coverage of households in the EU for 2018 (60%).

Percentage of households in white, gray and black zones (for fixed fast broadband networks):

- 12.81% of households (72,317) are located in white zones, or 72,317 households do not have access to the Internet with download speeds between 30 and 100 Mbps, nor is it planned by any operator in the next three years to build / develop such,
- 12.41% of households (or 70,041) are located in gray areas,
- 74.78% of households (or 422,129) are in black zone.

Percentage of households in white, gray and black zones (for fixed ultra-fast broadband networks):

- 24.93% of households (140,752) are located in white zones, or 140,752 households do not have the opportunity to access the Internet with a download speed greater than 100 Mbps, nor is it planned by any operator in the next three years to build / develop such a broadband network,
- 16.18% of households (or 91,367) are in gray zones,
- 58.89% of households (or 332,374) are in black zones.

Announced planned investments of operators in 2021 for the next three years (by the end of 2023):

- Number of households that by the end of 2023 will be able to access fast broadband networks: 492,170 households (87.19%), which means an increase from 82.84% to 87.19%.
- Number of households that by the end of 2023 will be able to access ultra-fast broadband networks: 423,741 households (75.06%), which means a significant increase from 63.10% to 75.06%. Similar to 2018, at the end of 2020 operators provided information on planned investments mostly for development of ultra fast broadband networks in the next three years reported announced.

Graphic display of white, gray and black zones according to the mapping in 2020 can be found at:

Table 1: Household coverage with fixed fast and ultra fast broadband networks, comparison with the EU and implementation of the announced investments by the operators

	WITH FIXED FAST BROADBAND NETWORKS (download between 30 and 100 Mbps)	WITH FIXED ULTRA FAST BROADBAND NETS (download faster than 100 Mbps)
HOUSEHOLD COVERAGE IN THE EU	In 2018: 83% In 2019: 86%	In 2018: 60%
HOUSEHOLD COVERAGE IN RNM	In 2018: 445.233 (78%) In 2020: 467.599 (82,84%)	In 2018 : 249.979 (43.8%) In 2020: 356.212 (63,10%)
INVESTMENTS ANNOUNCED BY HOUSEHOLD OPERATORS	Announced in 2018 for the end of 2021: 484.826 (84,94%) Announced in 2020 for the end of 2023: 492.170 (87,19%)	Announced in 2018 for the end of 2021: 396,542 (69,47%) Announced in 2020 for the end of 2023: 423,741 (75,06%)

Table 2: Households in RNM located in the so-called white, gray and black zones (for fixed fast broadband networks)

	IN WHITE ZONES	IN GRAY ZONES	IN BLACK ZONES
HOUSEHOLD NUMBER (PERCENTAGE)	In 2018: 85,958 (15,06%) In 2020: 72.317 (12,81%)	In 2018: 61.931 (10,85%) In 2020: 70.041 (12,41%)	In 2018: 422.895 (74,09%) In 2020: 422129 (74,78%)

Table 3: Households in RNM located in the so-called white, gray and black zones (for fixed ultrafast broadband networks)

	IN WHITE ZONES	IN GRAY ZONES	IN BLACK ZONES
HOUSEHOLD NUMBER (PERCENTAGE)	In 2018: 174242 (30,53%) In 2020: 140752 (24,93%)	In 2018: 123684 (21,67%) In 2020: 91367 (16,18%)	In 2018: 272858 (47,80%) In 2020: 332374 (58,89%)

Conclusions

1. The pandemic caused by the Covid-19 coronavirus did not stop the investments of the operators in the development of the fixed broadband networks, on the contrary, the requirements for providing faster internet access for distance learning and work from home have contributed to accelerating the development of fixed fast and ultra fast networks.

2. The operators have implemented the announced investments in accordance with the data for planned investments from 2018, which can be seen from the following:

- Of the announced 484,826 households (84.94%) that by the end of 2021 were planned to have access to fixed fast broadband networks at the end of 2020, access to fixed fast broadband networks was provided to 467,599 households (82.84%), which is an average annual increase of 2.42%.
- From the announced 396,542 households (69.47%) which by the end of 2021 were planned to have access to fixed ultrafast broadband networks, at the end of 2020 access to fixed ultrafast broadband networks is provided for 356,212 households (63.10 %), which is an average annual increase of 9.65%.

3. If the trend of construction of fixed fast networks from the previous two years is maintained, it is realistic to expect by the end of 2023 to reach the planned number of 492,170 households (87.19%) that will have access to fast broadband networks

4. If the trend of construction of fixed ultra-fast networks from the previous two years is maintained, the planned number of 423,741 households (75.06%) that by the end of 2023 should have access to fixed ultra-fast networks, could be achieved earlier.

5. In relation to conclusions 3 and 4, however, the expectation is that the trend of building new networks will decline at the moment when the operators will cover the areas in which there is minimal economic interest for investments, after which the number of concluded contracts as a result of sales campaigns that operators would undertake to take advantage of already built networks.

6. It should be noted that the above data were obtained using data from the 2002 Census of Population, Households and Dwellings and as such may not reflect the real situation on the ground. For more relevant data for households that have access to fixed high-speed and ultra-fast internet, and especially for data for white, gray and black zones, it is necessary to conduct mapping with the latest data after the end of the 2021 Census of Population, Households and Dwellings.

7. With the help of the implemented "NOBP Implementation Support System", the mapping of the existing and planned fixed broadband networks in the country becomes a continuous process and an important tool for monitoring the implementation of the adopted national strategic documents and plans for the development of the broadband in the country.

Broadband Development Report in the country

According to the Law on Electronic Communications, the NBCO “prepares a report at least twice a year to the Minister of Information Society and Administration on the development of the broadband market in the country regarding the development of the broadband market in the European Union, according to DESI (The Digital Economy and Society Index) report on the implementation of the adopted strategic documents and plans for the development of the broadband in the country, the fulfillment of the national broadband targets set in them.

In order to fulfill this obligation, in February 2020, the NBCO adopted the "Methodology for determining the Index of Digital Economy and Society in the Republic of North Macedonia" and a Form for the form and content to be contained in the Broadband Market Development Report according to DESI (www.bco.mioa.gov.mk).

The methodology is based on the EU DESI methodology and according to this Methodology, the NBCO is responsible for monitoring only the "Connectivity" dimension.

At the session held on 22.06.2020, NBCO adopted amendments to the Form for the form and content that should be contained in the Broadband Market Development Report according to DESI, in order to reorganize the data in order to simplify the comparison "Coverage" indicator for RNM with the corresponding EU countries.

The preparation of this Report is in accordance with the adopted Form for the form and content that the Broadband Market Development Report should contain in accordance with DESI (consolidated text) (www.bco.mioa.gov.mk).

In preparing this Broadband Market Development Report in the "Connectivity" dimension, the NBCO, as a data source for certain sub-dimensions and indicators, used data from:

- Agency for Electronic Communications, for the most part,
- State Statistical Office,
- National Bank,
- Information on the achieved progress of RNM for the needs of the Subcommittee on Innovation, Information Society and Social Policy (March 2020).

Note:

This Report compares the RNM indicators with the "DESI 2020 Report" published by the European Commission (EC) on 11.06.2020.

Connectivity – indicators

The "Connectivity" dimension indicators for RNM are shown in Table 4.

Table 4. Indicators for the "Connectivity" dimension (March 2021)

Indicator	Description	Unit	Value / Reference date	Value / Reference date	Value / Reference date
1a1 Fixed Broadband Coverage	% of households covered by broadband: xDSL, cable (basic and NGA), FTTP, WiMax or LTE networks	% of households	97.87% (Q1/2019)	97.87% (Q1/2019)	99,08% (Q4/2020)
1a2 Fixed Broadband take-up	% of households that are broadband subscribers: xDSL, cable (basic and NGA), FTTP, WiMax or LTE networks	% of households	70.91% (Q3/2019)	72.95% (Q1/2020)	73,58% (Q3/2020)
1b1 4G coverage	% of settlements with 4G coverage: measured as average coverage of telecommunications operators in each country	% of households	99.365% (Q4/2019)	99.38% (Q2/2020)	99,395% (Q4/2020)
1b2 Mobile Broadband take-up	Number of mobile internet subscribers per 100 inhabitants	Subscribers per 100 inhabitants	70.06% ¹ (Q3/2019)	64.83% (Q1/2020)	64,95% (Q3/2020)
1b3 5G readiness	Part of the spectrum intended and allocated for 5G use until the end of 2020 in the so-called 5G pioneering bands. These bands are 700 MHz (703-733 MHz and 758-788 MHz), 3.6 GHz (3400-3800 MHz) and 26 GHz (1000 MHz at 24250-27500 MHz). All three frequency bands have equal weight	% of harmonized spectrum	0%	22.2% ² (14.07.2020)	22.2%
1c1 Fast Broadband Coverage	% of households covered by a broadband of at least 30 Mbps download. The technologies involved are FTTH, FTTB, cable Docsis 3.0 and VDSL	% of households	78% (Q1/2019)	78% (Q1/2019)	82,84% (Q4/2020)
1c2 Fast Broadband take-up	% of household broadband subscribers with at least 30 Mbps	% of households	21.03% (Q3/2019)	27.43% (Q1/2020)	28,27% (Q3/2020)
1d1 Ultrafast Broadband Coverage (NGA)	% of households covered by a broadband of at least 100 Mbps download. The technologies involved are FTTH, FTTB and Docsis 3.0 cable	% of households	43,8% (Q1/2019)	43,8% (Q1/2019)	63.10% (Q4/2020)
1d2 Ultrafast broadband	% of household broadband	% of	0.98%	1.74%	1,81%

¹ A correction of the indicator "Mobile Broadband Prevalence" was made from the previous report of the NBCO

² Authorizations to use radio frequencies for 5G testing

take-up	subscribers with at least 100 Mbps	households	(Q3/2019)	(Q1/2020)	(Q3/2020)
1e1 Broadband Price Index	Broadband price index	Scale (0-100)			

Comparison with indicators of EU member states

1.Total incomes of telecom operators (in denars without VAT)

The data on the total incomes of the operators refer to 2019 and are shown in Table 5.

Table 5. Incomes from telecommunication services

Service	Incomes in 2018 (mkd)	Incomes in 2019(mkd)
Landline	2,131,578,000.00	2,026,590,000.00
Fixed internet access	3,990,676,000.00	4,126,204,000.00
Mobile telephone line	6,823,893,000.00	7,076,195,000.00
Mobile internet access	1,468,488,000.00	1,628,726,000.00
Bussiness internet users	555,277,292.00	489,512,212.00

Source: Agency for Electronic Communications

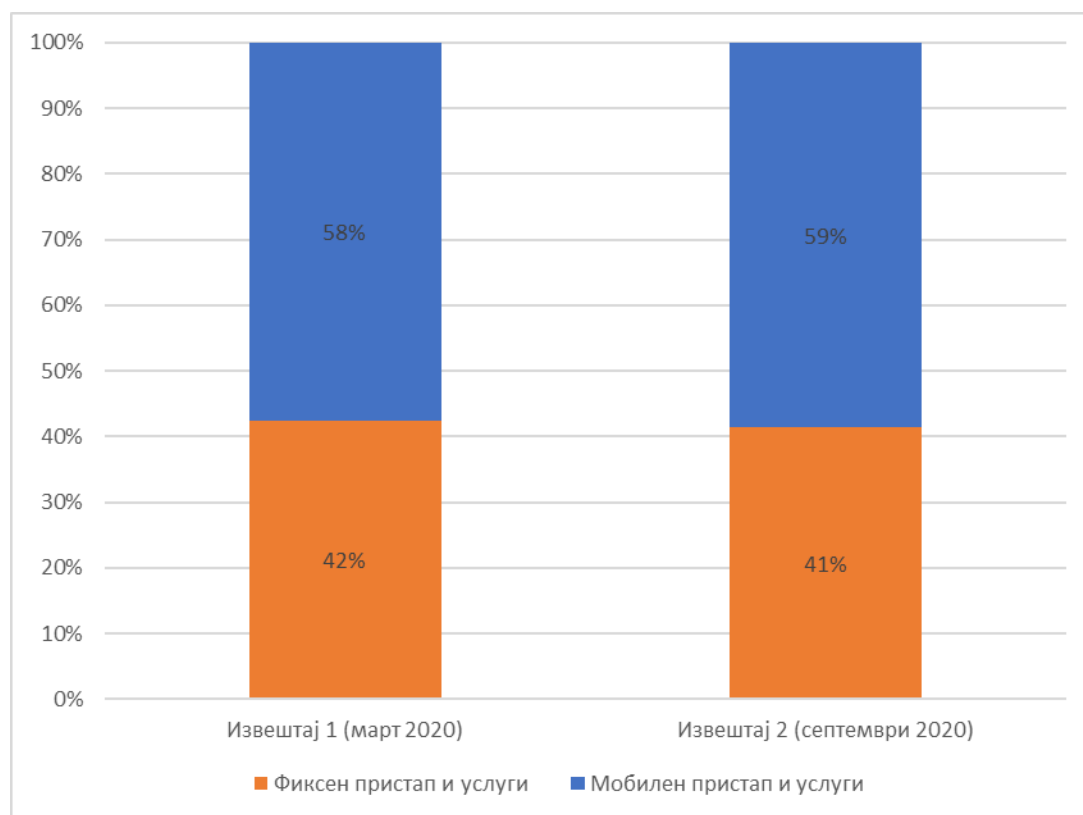


Figure 1: Share of incomes from telecommunication services (Source: AEC)

2. Broadband coverage

A. Fixed broadband access coverage

Fixed broadband coverage is covered by 558,568 households or 99.08% of the total number of households in RNM.

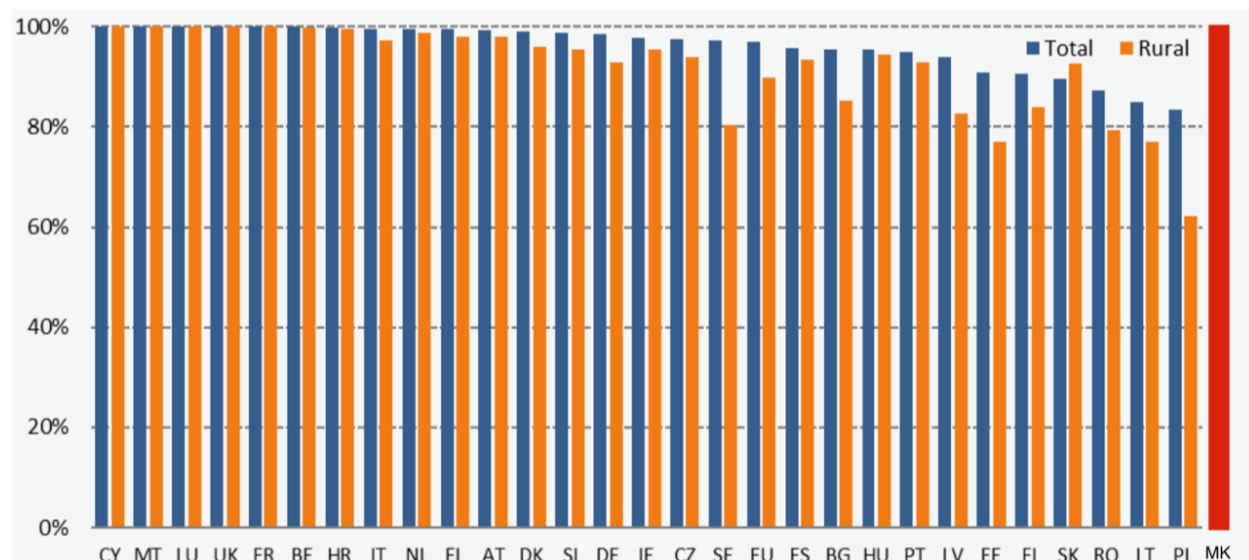


Figure 2: Fixed broadband coverage (% of households) (Source: EC (mid-2019), AEC (Q4 / 2020))

Fixed fast broadband coverage (download with speed of at least 30 Mbps and not more than 100 Mbps) has 467,599 households or 82.84% of the total number of households in RNM.

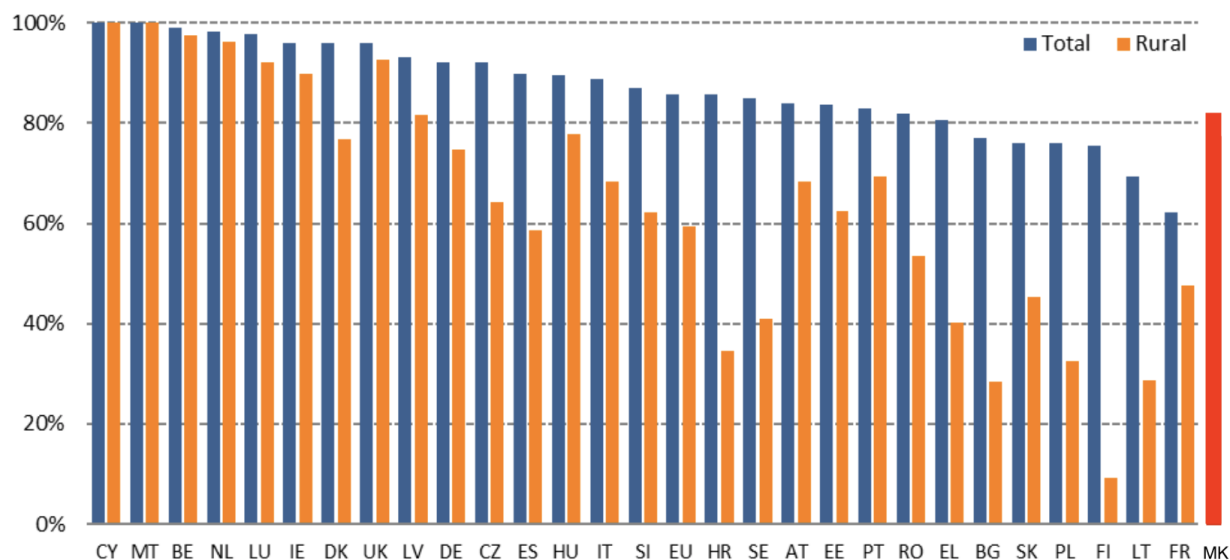


Figure 3: Coverage with fast broadband networks (% of households)
(Source: EC (mid-2019), AEC (Q4 / 2020))

356,212 households or 63.10% of the total number of households in RNM have coverage with fixed ultra-fast broadband (download with a speed of at least 100 Mbps).

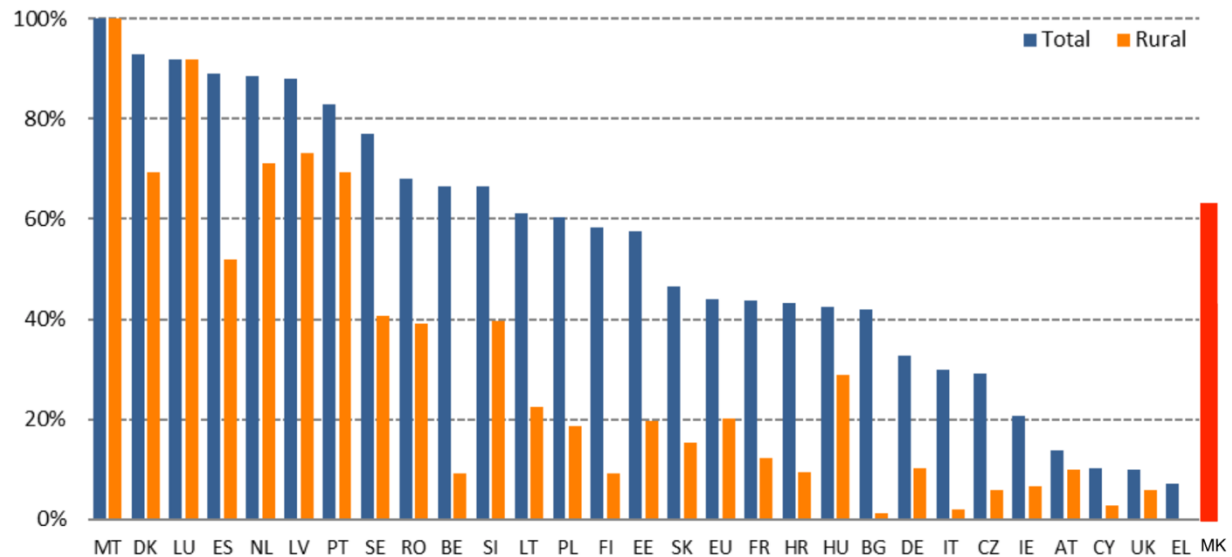


Figure 4: Coverage with ultra-fast broadband networks (% of households)
(Source: EC (mid-2019), AEC (Q4 / 2020))

B. Mobile Broadband Access Coverage

In RNM, 99.58% of the population is covered by 4G (LTE) network (by at least one mobile operator). The average availability of 4G (as an average value of the coverage of the two mobile operators) is 99.395% of the population in RNM.



Figure 5: 4G coverage, in percentage of population (Source: EC (mid-2019), AEC (Q4 / 2020))

3. Fixed broadband take-up (% of households)

The take-up of fixed broadband is 73.58%, ie 415,253 households in RNM have a subscriber agreement for fixed broadband. (Source: Agency for Electronic Communications)

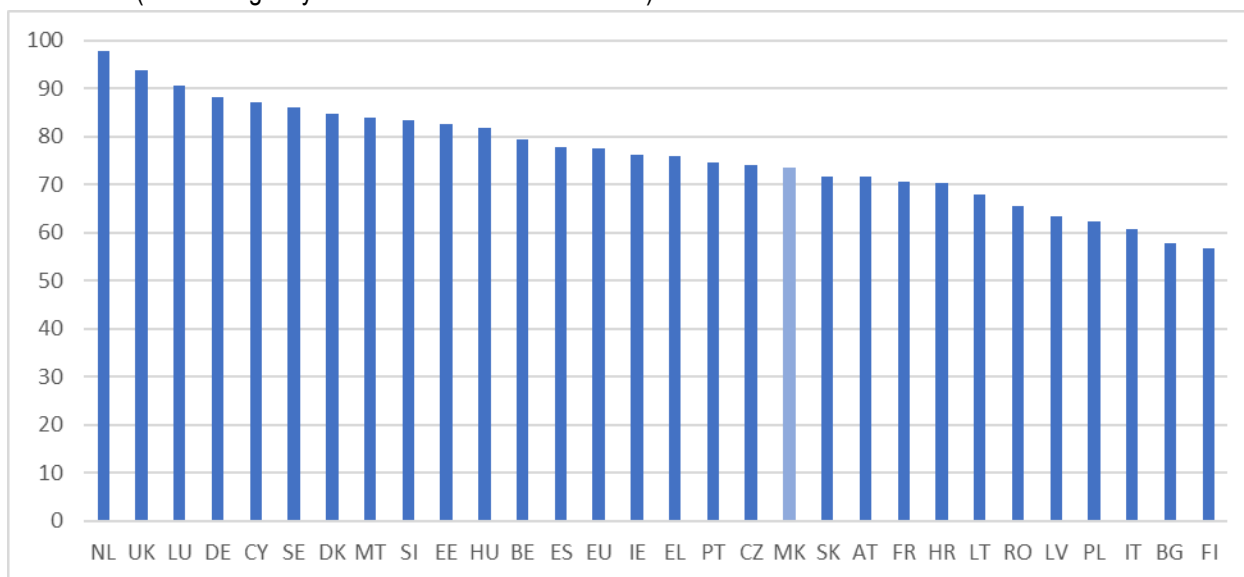


Figure 6: Households with fixed broadband subscriptions (Source: Eurostat (2019), AEC (Q3 / 2020))

The take-up of fixed broadband in the period from the first NBCO report from March / 2020 to this NBCO report, March / 2021 records the following increase, as shown in Figure 7.

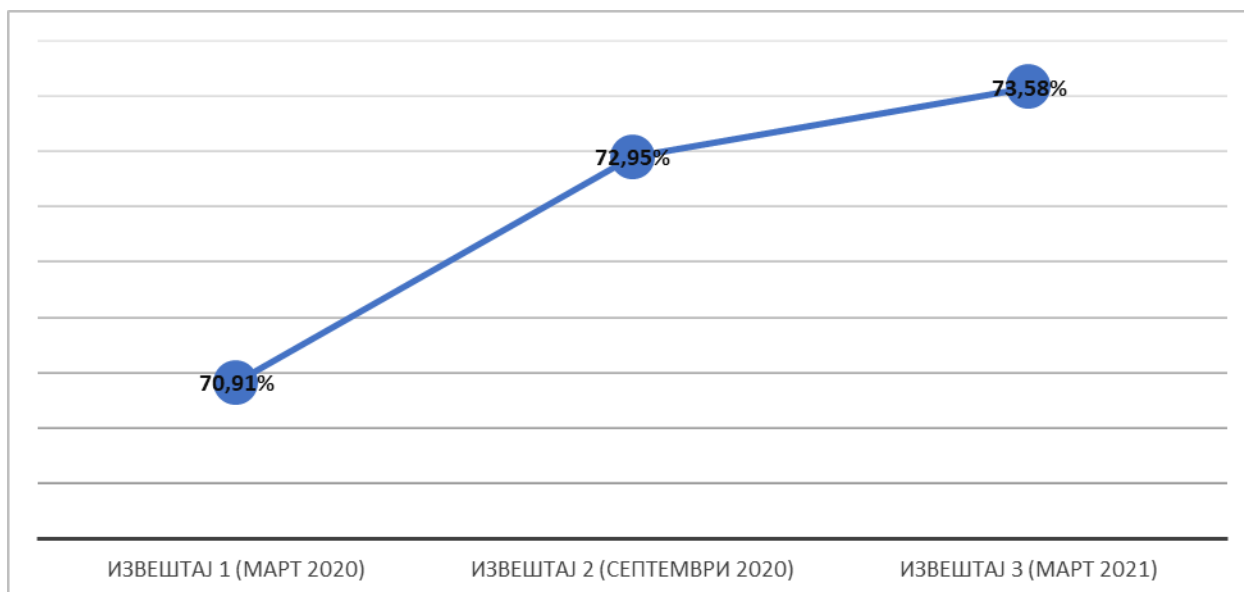


Figure 7: Change in the number of household subscriptions of fixed broadband in RNM (Source AEC)

4. Fast broadband take-up (% of households)

The distribution of fast broadband for Q3 / 2020 is 28.27%, ie 159,553 households have a subscriber agreement for fixed broadband with a download speed of at least 30 Mbps and less than 100Mbps. (Source: Agency for Electronic Communications).

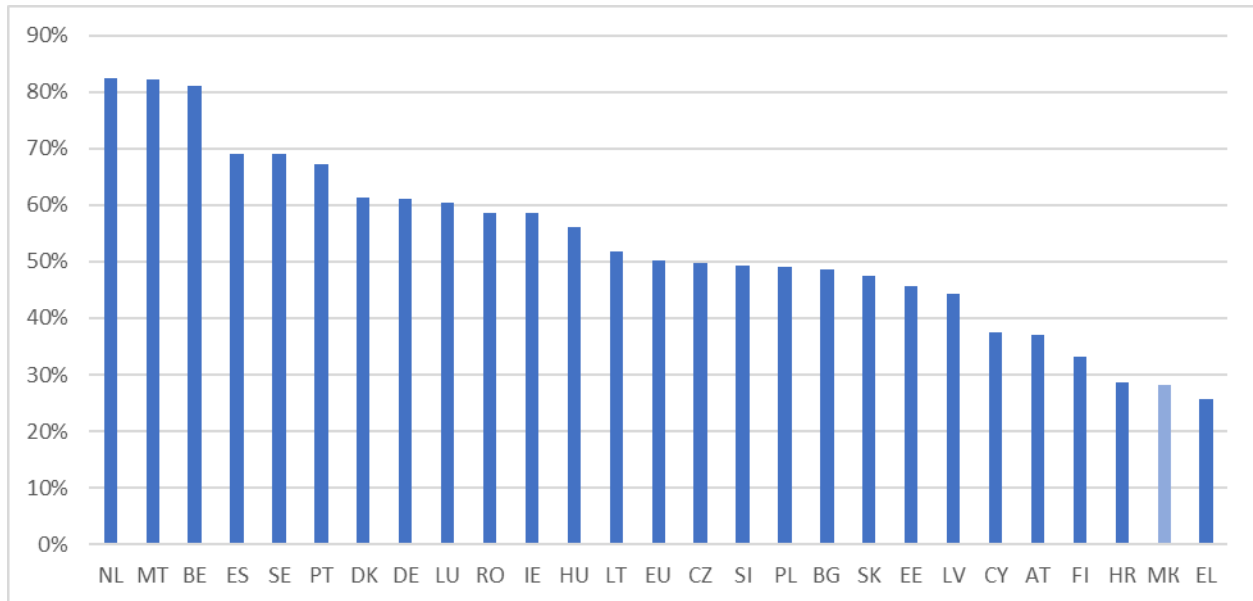


Figure 8: Households subscriptions with fixed fast broadband
(Sources: Digital Agenda for Europe (2019), AEC (Q3 / 2020))

Distribution of fixed fast broadband in the period from the first NBCO report from March / 2020 to this NBCO report, March / 2021 shows the following increase, as shown in Figure 9.

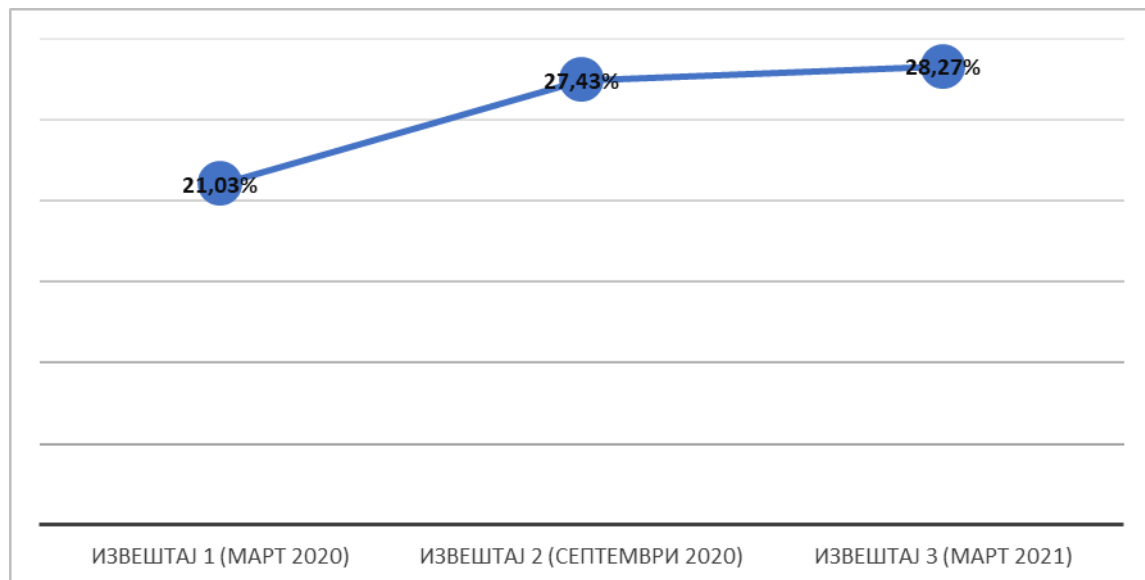


Figure 9: Change in the number of household subscribers of fixed fast broadband in RNM (Source: AEC)

5. Ultrafast broadband take-up (% of households)

Take-up of ultra fast broadband for Q3 / 2020 is 1.81%, ie 10,221 households have a subscriber agreement for fixed broadband with a download speed of at least 100 Mbps. (Source: Agency for Electronic Communications).

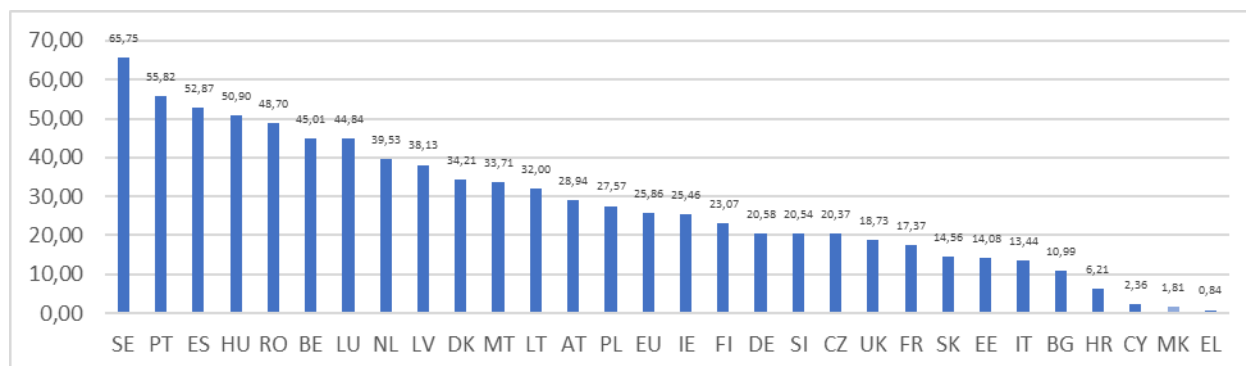


Figure 10: Households subscriptions of fixed ultra fast broadband (Source: EK (2019), AEC (Q3 / 2020))

The distribution of fixed ultra-fast broadband in the period from the first NBCO report from March / 2020 to this NBCO report, March / 2021 marks the following increase, as shown in Figure 11.

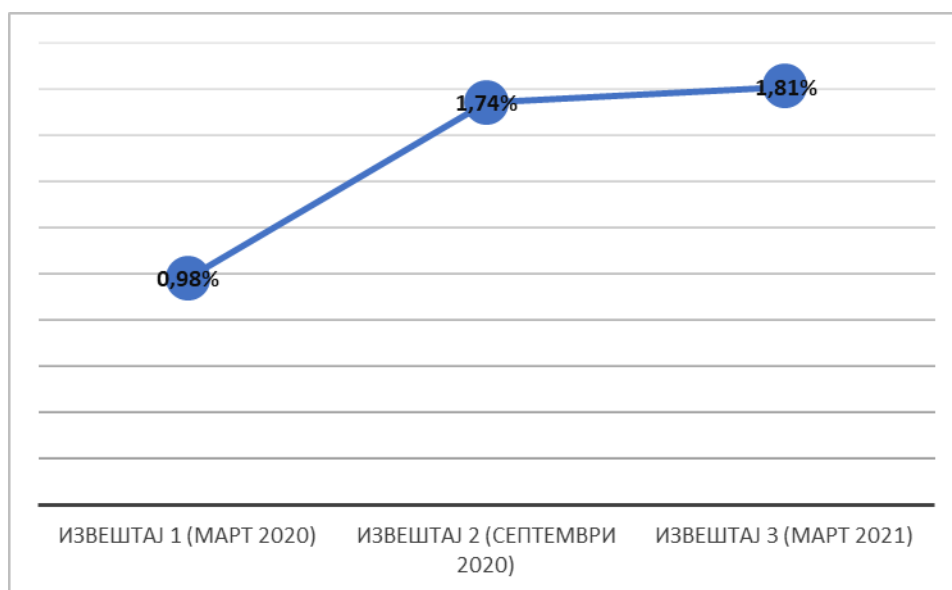


Figure 11: Change in the number of household subscribers of fixed ultra fast broadband in RNM (Source: AEC)

6. Fixed broadband take-up, market share by technology

Table 6 shows the percentage of fixed broadband technology used:

Table 6. Market share of fixed broadband by technology

Technology	Market share (%) (March2020)	Market share (%) (September 2020)	Market share (%) (March 2021)
DSL (VDSL included)	30.75	29.14	28,22
Cable (with Docsis 3.0 included)	34.29	33.29	31,99
FTTH+B	13.87	15.45	17,04
Other (LL-Leased Lines, LAN, Fix LTE)	21.09	22.12	22,75

Source: Agency for Electronic Communications

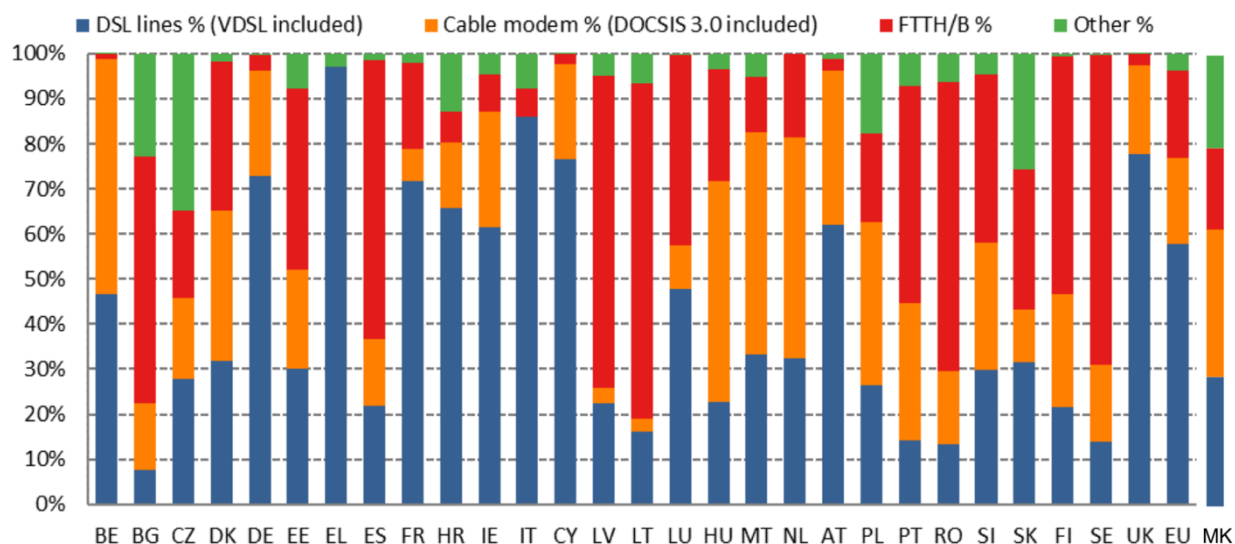


Figure 12: Fixed security technologies used
Sources: Eurostat (July / 2019), AEC (Q3 / 2020))

The share of optical access (FTTH + B) in the total number of fixed broadband subscribers in RNM with 17.04% is at a comparable level with the average value of the share of optical access in the 28 EU member states which is 19%. Although at the level of the EU average the dominant technology is xDSL on which the main competing technology is cable with Docsis 3.0, in RNM the cable technology Docsis 3.0 according to the share has surpassed xDSL technology.

In RNM, the percentage of NGA subscriber agreements (download speed of at least 30 Mbps) in relation to the total number of subscriber agreements for fixed broadband in the country is 39.27% and the same in the period from the first report of NBCO, March / 2020 to this report of NBCO, March / 2021 records a continuous increase.

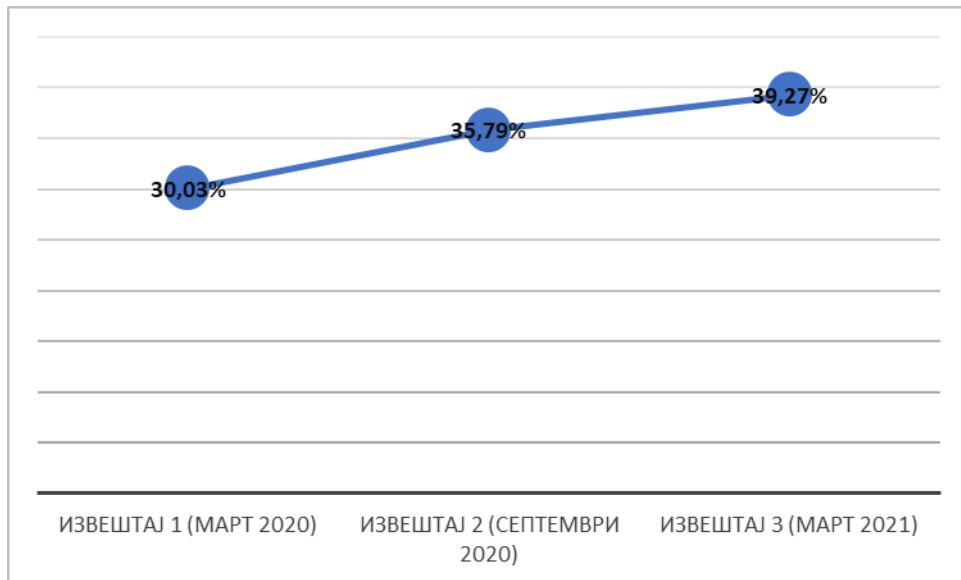


Figure 13: Change of the share of NGA subscriber agreements in RNM (Source: AEC)

7. Competition in the fixed broadband market³

In RNM, the share of the traditional (incumbent) operator "Makedonski Telekom" on the fixed broadband market in Q3 / 2020 according to the total number of subscribers (residential and business) according to all fixed broadband access technologies is 40.58%, while the share of new coming operators on the fixed broadband market is 59.42%. (Source: Agency for Electronic Communications)

This ratio according to the market share between the traditional and the new comer operators in RNM is similar to the average of the 28 EU member states, where the traditional telecom operators still control 40% of the subscribers.

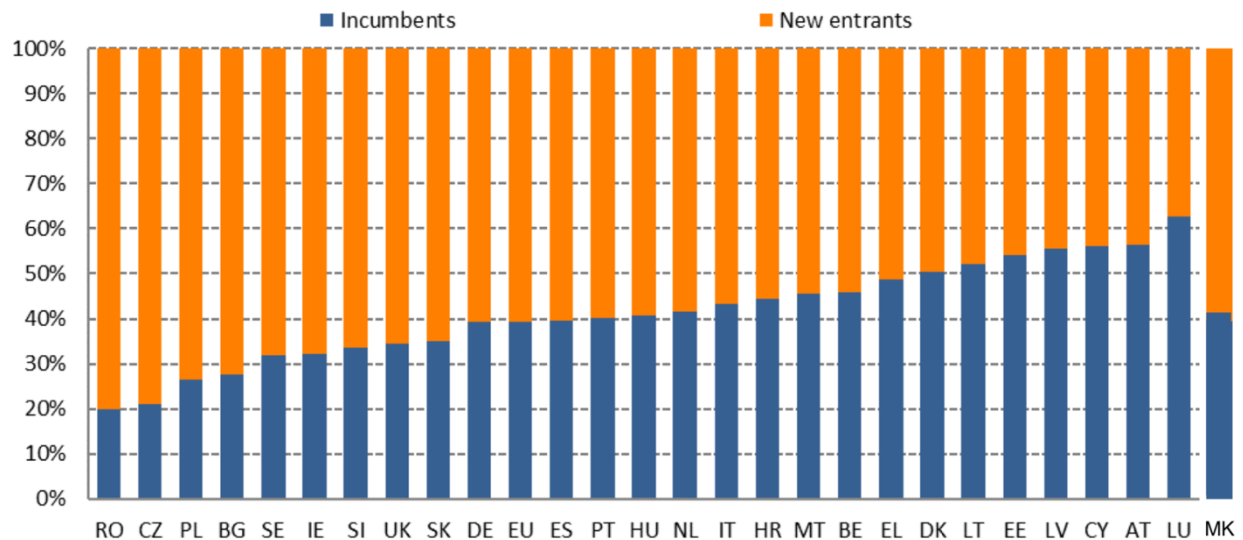


Figure 14: Fixed broadband market share by number of subscribers
(Sources: EC (July / 2019), AEC (Q3 / 2020))

Shows the share of the fixed broadband market on a national level for the traditional (incumbent) operator and new entrants, according to the number of users.

As one of the regulatory measures for reducing the dominance of the traditional (incumbent) operator on the market is unbundled access to the local loop, ie xDSL technologies.

Therefore, the participation of the traditional (incumbent) operator in the market for fixed broadband according to technology is shown, as follows: total and separate for NGA, DSL, VDSL, cable, FTTH / B.

8. Mobile broadband distribution (subscribers per 100 inhabitants)

The mobile broadband take-up for Q3 / 2020 is 64.95%, ie the total number of subscribers who use mobile broadband is 1,348,663 (Source: Agency for Electronic Communications).

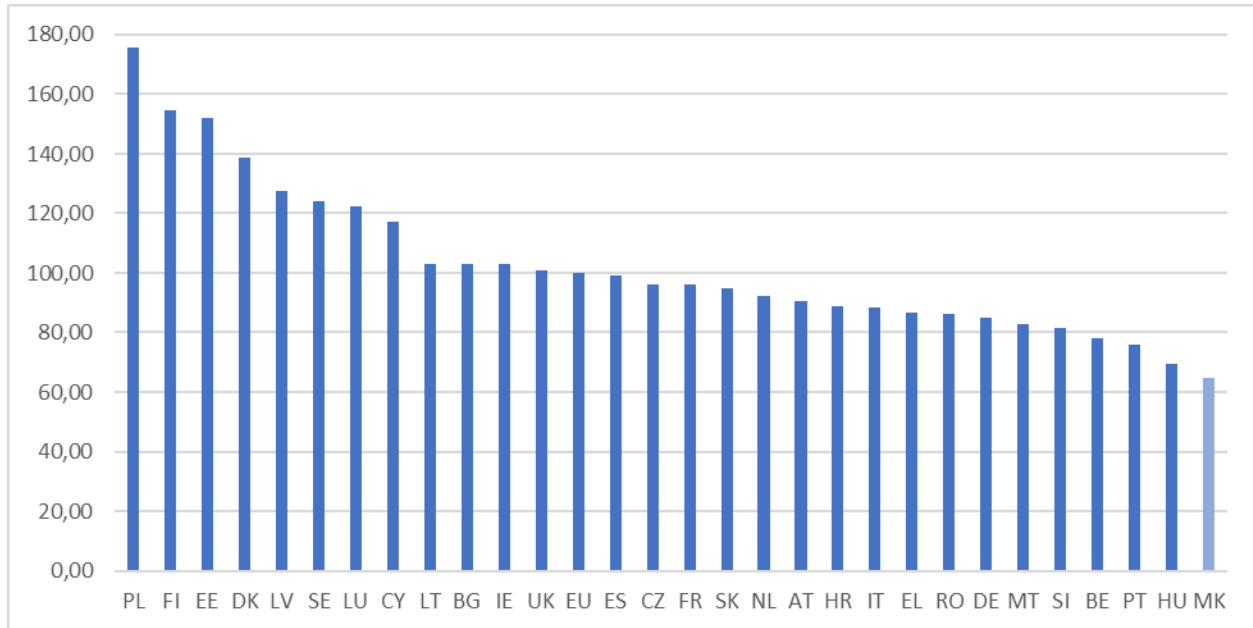


Figure 15: Mobile Broadband take-up (Sources: EC (July / 2019), AEC (Q3 / 2020))

9. 5G readiness

The "5G Readiness" indicator shows the portion of the spectrum allocated for 5G targets in the country in terms of 5G pioneer bands.

The Agency for Electronic Communications submitted a notification that the situation with the 5G pioneer bands in the Republic of North Macedonia is as follows:

- 700 MHz band (703-733 and 758-788 MHz):

On February 1, 2020, the process of releasing this band ended, ie the DVB-T channels from this band were moved to lower frequencies. There are currently no radio frequency users in this band, ie all 60 MHz can be assigned. With the approval of the Plan for purpose of radio frequency bands in RNM ("Official Gazette of RNM", No. 50/2021) and the Plan for assignment and use of radio frequencies in RNM ("Official Gazette of RNM", No. 60/2021) appropriate conditions for its use are prescribed. There are currently no 5G frequencies assigned to this band.

- 3.6 GHz band (3,400-3,800 MHz)

From this band it is planned to use 300 MHz for 5G. AEC has issued two temporary approvals for the use of radio frequencies for 5G testing. The approvals were issued to "A1 Macedonia" for the frequency scope 3.7-3.8 GHz (100 MHz) with a validity period until 14.07.2020 and to "Makedonski Telekom" for the frequency band 3.6-3.7 GHz (100 MHz).

MHz) with a validity period up to 31.10.2020. Thus, 200 MHz out of the total available 300 MHz was allocated for testing.

There are currently no 5G frequencies assigned to this band.

- 26 GHz band (24 250-27 500 MHz):

In the Republic of North Macedonia there is 1000 MHz available for assigning 5G operators. With bringing of the Plan for purpose of radio frequency bands in RNM ("Official Gazette of RNM", no. 50/2021) the conversion of the scope was performed, and with the adoption of the Plan for assignment and use of radio frequencies in RNM ("Official Gazette of RNM", No. 60/2021) appropriate conditions for its use are prescribed.

There are currently no 5G frequencies assigned to this band.

10. Internet (IP) traffic per capita

- Fixed broadband internet traffic per household during a month is 123 GB. (Source: Agency for Electronic Communications)

The average fixed broadband internet traffic per household during one month in the period from the first NBCO report from March / 2020 to this NBCO report, March / 2021 recorded the following increase, as shown in Figure 16.

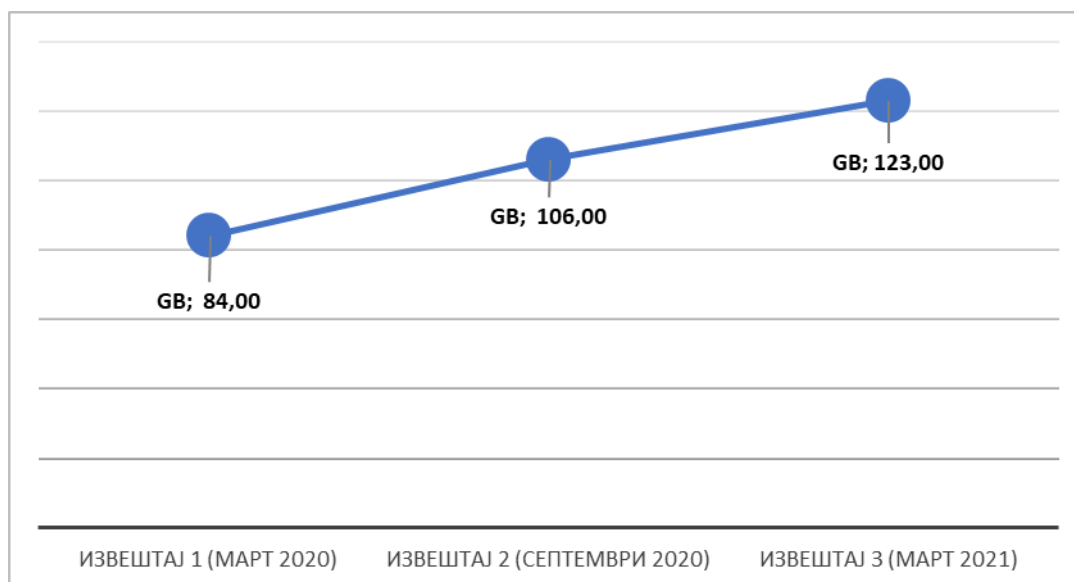


Figure 16: Change of fixed broadband internet traffic per household in RNM (Source: AEC)

- Mobile broadband internet traffic per subscriber who uses mobile internet during a month is 4.1 GB. (Source: Agency for Electronic Communications)

The average mobile broadband internet traffic per subscriber during one month in the period from the first report of the NCBC from March / 2020 to this report of the NCBC, March / 2021 records the following increase, as shown in Figure 17.

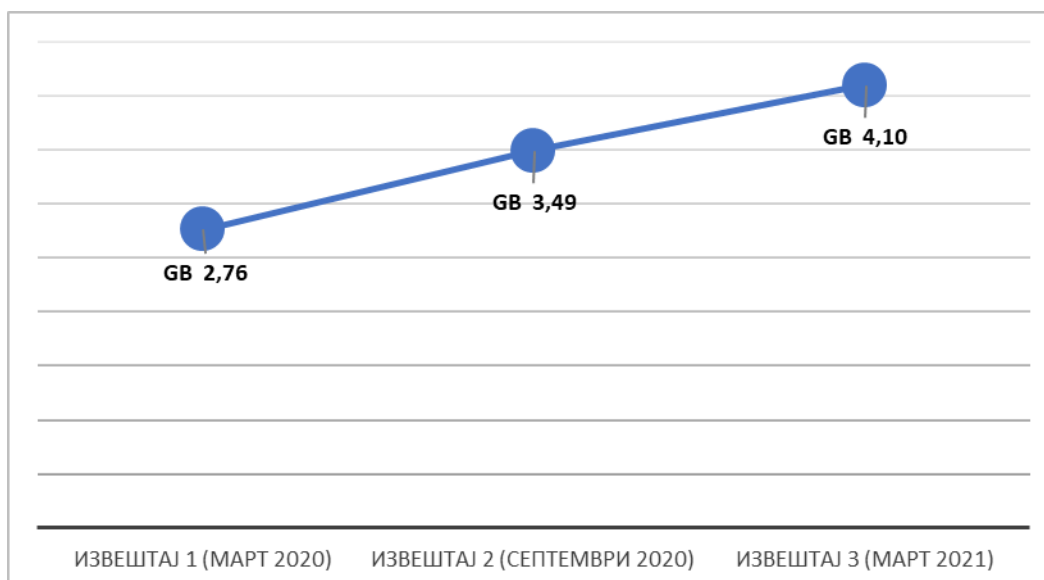


Figure 17: Change of mobile broadband internet traffic per subscriber in RNM (Source: AEC)

11. Broadband price index

In the analysis of the retail prices offered on the market of fixed broadband services in RNM, the OECD methodology "Revised OECD telecommunication price baskets" from December 2017 was used, according to which the retail offers of the three first ranked operators are analyzed according to the market share by the number of customers, whose common total market share is at least 70

The analysis of the retail prices on the market of fixed broadband services in this report included the retail offers of the operators: "Makedonski Telekom", "A1 Macedonia" and "TRD ROBI - Telekabel", which together in Q3 / 2020 have a 94.3% share in the fixed broadband market according to the number of subscribers.

The value of 1 Euro = 61,695 MKD (Source: National Bank)

The value for PPP (Purchasing Power Parity) for RNM is calculated according to the data of the International Monetary Fund at 2.759428476.

Category	Internet		Internet and landline		Internet + TV+ landline	
	Offer	The lowest price	Offer	The lowest price	offer	The lowest price
12-30 Mbps	Cable internet Lightspeed 30/1	500 Mkd 8.1 Eur 22.36 (PPR)	A1 Net Neon 15/1	599 Mkd 9.70 Eur 26.79 (PPP)	A1 Combo Neon up to 15/1 Mbps	799 Mkd 13.00 Eur 35.74 (PPP)
30-100 Mbps	Optical, package Optic 40 40/40	1000 Mkd 16.2 Eur 44.73 (PPP)	A1 Net Neo S until 50/3 Mbps	799 Mkd 13.00 Eur 35.74 (PPP)	A1 Combo Neo 4M 50/3 Mbps	1199 Mkd 19.43 Eur 53.63 (PPP)
>100 Mbps	Optical package Max Optic 1 Gbps/1 Gbps	3500 Mkd 56.70 Eur 156.54 (PPP)	Makedonski telekom package XL	2999 Mkd 48.61 Eur 134.14 (PPP)	Makedonski telekom package XL, up to 300 Mbps / 300 Mbps + Max TV XL	3508 Mkd 56.90 Eur 156.90 (PPP)

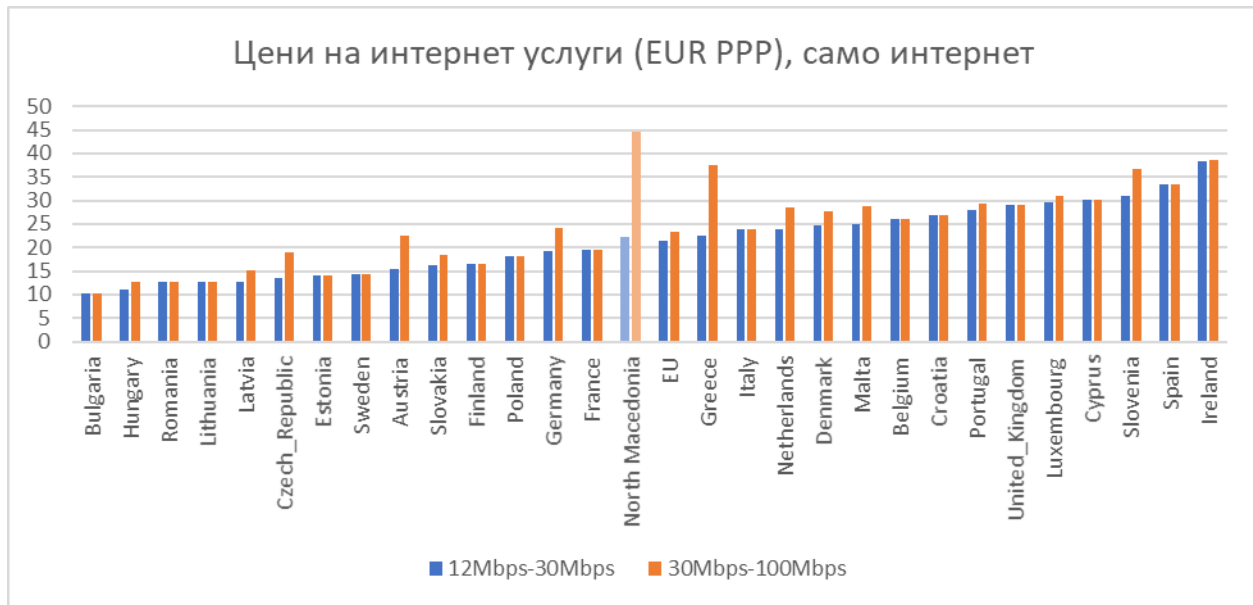


Figure 18: Prices for Internet only services (EUR PPP), Internet only
 (Sources: Empirica (end / 2019), operators in MK (March / 2021))

In the EU member states, the offers of the commercial operators for internet with speed higher than 100 Mbps decreased by 30% compared to 2014, so that in 2019 the average price of the offers for internet with speed higher than 100 Mbps was 35 EUR (PPP). The lowest offer of the commercial operators in RN Macedonia in March / 2021 for internet only with speed higher than 100 Mbps is 156.54 EUR (PPP) and refers to the optical package "Max Optic" with speed (upload / download) of 1 Gbps / 1 Gbps.