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REPUBLIC OF SERBIA
REPUBLIC AGENCY FOR
ELECTRONIC COMMUNICATIONS

OVERVIEW

OF TELECOM MARKET IN THE REPUBLIC OF SERBIA IN 2011

Republic of Serbia
RATEL
Republic Agency for Electronic Communications

AN OVERVIEW OF TELECOM MARKET IN THE REPUBLIC OF SERBIA IN 2011

Belgrade, 2012.


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An Overview of Telecom Market in the Republic of Serbia in 2011

Authors:
dr Milan Janković, mr Vesna Tintor, Sanja Vukčević-Vajs, Aleksandar Utješinović, Zorana Vujović, Dragan Lukić, Duško Kostić, Aleksandar Mitrović, Dejan Vakanjac, Snežana Jovičić, Milosav Grubović, Vesna Krzman, Tomislav Ranđić, Aleksandra Stefanović, Zorana Nedić

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Višnjićeva 8, 11000 Belgrade
Telephone: +381 11 3242-673
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A WORD OF INTRODUCTION

The Republic Agency for Electronic Communications has been regulating the telecom market in the Republic of Serbia for seven years, since it was established in May 2005 as the Republic Agency for Telecommunications (RATEL), pursuant to the 2003 Law on Telecommunications. In July 2010 the Law on Electronic Communications was passed, based on the 2002 EU Regulatory Framework and, partly on 2007 EU regulation. According to the new law, the Agency changed the name in the Republic Agency for Electronic Communications, keeping the same short name RATEL.

The Law sets out the following tasks:

- ensure the conditions for the further development of the electronic communication by using the advanced ICSs and a balanced development throughout the territory of the Republic of Serbia,
- create conditions for level-playing field for all market players, both in terms of network neutrality and in terms of market economy,
- ensure further development of the electronic communication market by applying ex-ante mechanisms such as to stimulate competition, and, where necessary, also by applying ex-post market regulation,
- provide a comprehensive protection of the interest of all market participants, end-users in particular, leading to the provision of new, more affordable services, of higher quality,
- ensure optimal and rational usage of all national resources: frequencies and numbering.

RATEL's 2011 Activity Plan envisaged the following specific activities:

- preparation of bylaws in order to implement the Law on Electronic Communications,
- measures for efficient implementation of the Government policy and strategy for

electronic communications,

- regulatory activities and measures for the enhancement and development of the electronic communication market,
- activities related to the enhancement and development of the Agency,
- cooperation with other institutions and organizations.

By the end of 2011, RATEL published 16 bylaws in the *Official Gazette of the Republic of Serbia*, envisaged by the Law on Electronic Communications. The procedure of preparing the bylaws in RATEL's competence consists of drafting, public consultation and adoption of the act by the Agency Managing Board, followed by requesting the opinion of the relevant ministry on the compliance of the act with the Constitution and the Law, whereupon the final text is prepared and published in the *Official Gazette of the Republic of Serbia*. The Agency also prepared and submitted to the responsible ministry 7 proposals of the bylaws to be passed by the ministry at the proposal of the Agency.

Pursuant to the Law on Electronic Communications, and implementing the relevant EU recommendations on the markets susceptible to *ex-ante* regulation, the Agency designated and analyzed 9 relevant markets, identified SMP operators in each market and passed the relevant decisions. The decisions stipulate the conditions under which the SMP operators are to provide their services.

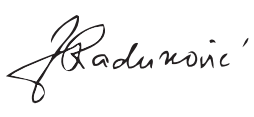
In 2011 the Agency signed the memoranda on understanding and cooperation with the NRAs from Macedonia (AEK), Bulgaria (CRC), Greece (EETT) and Croatia (HAKOM). As for the national institutions, RATEL also signed the memorandum of cooperation with the Competition Commission of the Republic of Serbia, and has a continual cooperation with the consumer protection association.

The Agency participated in the meetings of the Enhanced Permanent Dialogue (EPD) between EU and the Republic of Serbia and the dialogue Belgrade – Priština, held in Brussels. Furthermore, RATEL took active part in the conferences organized by the NRAs in the region. In accordance with their obligations, RATEL presented to the public a number of analysis and reports concerning the

developments in the telecommunications market of the Republic of Serbia, and participates in the meetings organized by Cullen International.

An Overview of Telecom Market in the Republic of Serbia in 2010 was published in June 2011 in printed and electronic form, in both Serbian and English language. The hardcopies were distributed to state institutions, operators and media, whereas the electronic version is available at the Agency website along with the overviews from the previous years.

Chair of the Managing Board



Professor Jovan Radunović

1. RATEL's ACTIVITIES IN 2011

The year 2011 was marked by dynamic activities related to the implementation of the Law on electronic communications (*Official Gazette of RS*, no. 44/10, hereinafter: the Law). The Law is harmonized with the EU 2002 Regulatory Framework and thus enables the following:

- greater transparency and legal certainty in the electronic communication sector, in order to stimulate the investments in the sector;
- continuity in the work of the regulatory authority, the Republic Agency for Electronic Communications, as the legal successor of the Republic Telecommunication Agency;
- introduction of the "general authorization" to the end of further liberalization of the electronic communication sector;
- conditions and parameters for identifying markets susceptible to ex-ante regulation, along with the criteria for designating operators with significant market power and imposing regulatory obligations on an SMP operator;
- guaranteed quality in the provision of publicly available electronic communication services by stipulating the QoS parameters in greater detail and by setting the minimum QoS, along with the manner in which the information on the offered QoS is to be provided;
- electronic communication networks and services user protection;
- non-discriminatory assignment procedure for addresses, numbering and radio frequencies, as scarce resources;
- introduction of technological neutrality policy, to the end of further development of the electronic communication sector in the Republic of Serbia.

The Republic Agency for Electronic Communications (RATEL) is an autonomous organization - an independent regulatory authority founded by the Law, and, pursuant to Art. 141 of the Law, it is the legal successor of the Republic Telecommunication Agency.

The process of liberalization and opening of the telecom market in the Republic of Serbia continued in 2011, mainly through creation of a stable and predictable regulatory environment, in order to stimulate the sector development, investments, innovative services, new market entrants, promotion of competition and protection of users' interests.

In keeping with the competencies stipulated under the Law, the principles and objectives of the market regulation, as well as in the strategic documents and provisions regulating the sector, in 2011 RATEL focused its activities on the adoption of bylaws, relevant market analysis and the adoption of decisions significant for the market regulation and electronic communications sector development, all to the end of ensuring the conditions for a balanced and stable development of the electronic communications within the territory of the Republic of Serbia, business predictability and equal treatment of the operators, as well as the maximum benefit for the users of electronic communications services, in terms of choice, price and quality of the services offered.

In 2011, just like the previous years, RATEL published the annual publication "An Overview of Telecom Market in the Republic of Serbia in 2010", with the intention of making available the data that reflect the situation in the telecom sector of the Republic of Serbia, providing necessary information to the operators, relevant public authorities, scientific institutions, investors and users, as well as the national regulatory authorities in charge of the electronic communications in the region and in the EU.

RATEL's activities accomplished in the period from 1 January to 31 December 2011, which were the result of activities and tasks defined under the regulations pertinent to the telecom or electronic communications sector and under the 2011 Framework Business Plan, are presented below.

REGULATORY ACTIVITY

In performing its regulatory activity, in 2011 RATEL worked intensively on adopting the bylaws within its competence, since the provision of Art. 143 of the Law stipulates special obligations for RATEL regarding the transition period, upon the entry into force of the Law, and the adoption of general acts. In particular, Art. 143, paragraphs 5 and 6 of the Law stipulates that the Agency shall adopt general acts based on the competences under the Law within one year upon the entry into force thereof, whereas in the meantime the general acts adopted based on the Law on Telecommunications will remain in force, except for those provisions of the acts that are incompatible with the Law.

Since the Law entered into force on 8 July 2010, the deadline referred to in Art. 143, para. 5 of the Law expired on 8 July 2011.

In the first half of 2011, before the set deadline, RATEL adopted a series of bylaws, as part of its competence set out under the Law:

- Rules on application forms for the issuance of individual licence for the use of radio-frequencies (Official Gazette of RS, no. 08/11)
- Rules on application form for the issuance of licence for the use of numbering (Official Gazette of RS, no. 32/11)
- Numbering Plan (Official Gazette of RS, nos. 32/11 and 35/12)
- Rules on general terms and conditions for performing electronic communication activities under general authorization regime (Official Gazette of RS, no. 38/11)
- Rules on number portability on public telephone networks at a fixed location (Official Gazette of RS, no. 52/11)
- Rules on the application of the cost-accounting principle, separate accounts and reporting of an operator with significant market power in the electronic communications

sector (Official Gazette of RS, no. 52/11)

- Rules on manner of amateur radio station usage (Official Gazette of RS, no. 52/11)
- Decision on designating relevant markets susceptible to ex-ante regulation (Official Gazette of RS, no. 59/11)
- Rules on the manner of monitoring the radio frequency spectrum usage, technical inspection procedure and protection from harmful interference (Official Gazette of RS, no. 60/11)
- Rules on the manner of radio stations usage on the national and foreign aircrafts, locomotives, ships and other vessels (Official Gazette of RS, no. 60/11)
- Rules on the amount of annual fee for the use of numbering (Official Gazette of RS, no. 67/11)
- Rules on the scope and content of the minimum set of leased lines (Official Gazette of RS, no. 70/11)
- Rules on the minimum content, level of detail and manner of publication of standard offers (Official Gazette of RS, no. 70/11)
- Rules on quality parameters for publicly available electronic communication services and monitoring of electronic communication activity (Official Gazette of RS, no. 73/11)
- Rules on obligations of value added services provider (Official Gazette of RS, no. 76/11)
- Rules on the terms and conditions for access to and usage of the data from a public directory (Official Gazette of RS, no. 84/11)

Also, within the deadline set under the Law, the Managing Board adopted the text of the Rules on the amount of fees for the provision of services within the competence of the Republic Agency for Electronic Communications and submitted it to the responsible ministry, in compliance with the procedure set out under Art. 23 of the Law and the obligations of the holders of state authority with regard to adoption of regulation, as stipulated under the Law on State Administration (*Official Gazette of RS*, nos. 79/05, 101/07 and 95/10).

Pursuant to the Law, a number of bylaws are adopted by the responsible ministry at RATEL's proposal, hence, during 2011, RATEL also prepared the proposals of bylaws in the area of electronic communications to be adopted by the responsible ministry, as follows:

- Rules on radio equipment and telecommunications terminal equipment,
- Rules on the manner and conditions for the determination of the zone of the electronic communications infrastructure and associated facilities, protected areas and obligations of investors during the construction of buildings and premises,
- Rules on the conditions for ensuring electromagnetic compatibility for electronic communication network, associated facilities, electronic communication equipment and terminal equipment,
- Rules on Universal Service
- Rulebook on analogue to digital switchover in TV broadcasting and access to multiplex in terrestrial digital broadcasting
- Rulebook on requirements in terms of staff, equipment and premises of an undertaking, company or other legal entity authorized for measuring and testing the operation of electronic communications networks and services, associated facilities, electronic communications equipment and terminal equipment
- Rules on technical conditions for electronic communication equipment of business and residential buildings.

Also, in accordance with its competences, in 2011 RATEL prepared the proposal for the Radio Frequency Allocation Plan and the proposal for the Frequency/Location Allotment Plan for Broadcasting Service, carried out the public consultation procedure and submitted the proposals for both Plans to the responsible ministry for adoption.

A series of separate acts were also adopted, within the competencies stipulated under the law, with the purpose of electronic communication market regulation.

ELECTRONIC COMMUNICATIONS NETWORKS AND SERVICES

During 2011, RATEL continued with the activities aimed at creation of a free and open market, ensuring equal treatment for all participants. In keeping with the adopted regulations and procedures for the introduction of new technologies and services, which were finalized in the previous period, RATEL undertook a series of activities concerning the regulation of the particular area, in order to stimulate competition in those market segments that had been closed so far.

In view of the fact that the necessary provisions regulating the mobile telephony sector had been adopted and appropriate licences had been issued, thereby enabling the introduction of competition, in 2011 RATEL continued monitoring the compliance of the three mobile operators with the terms and conditions stipulated in the licences, while this market was subject to relevant market analysis and the decisions adopted thereupon.

The same applies to the licences for public fixed wireless access (FWA) telecommunications network in the frequency band 411.875-418.125/421.875-428.125 MHz and voice services, data package transmission and simultaneous voice and data transmission granted in mid June 2009 to the Telecommunications Company Telekom Srbija, Joint Stock Co. (hereinafter: Telekom Srbija, Joint Stock Co.) and Orion telekom, Ltd. Both operators began with the commercial service provision in 2010, within the set timeframe, thereby fulfilling the condition from the licence. During the previous year, RATEL continued monitoring the compliance with the terms and conditions stipulated under the licence.

In order to enable further liberalization of the telecom or electronic communication sector in the Republic of Serbia, on 22 January 2010 RATEL's Managing Board passed the decision on granting a licence for public fixed telecommunications network and services for the territory of the Republic

of Serbia to the company Telenor Ltd. In 2011 Telenor Ltd. began with the commercial service provision, within the set timeframe.

During 2011, RATEL adopted a number of individual decisions regulating mutual relations between operators, on equal terms. In this way conditions were created for a tariff rebalance to be carried out in fixed telephony and for charges of termination on the fixed network of Telekom Srbija, Joint Stock Co to be set according to the 2010 cost-based model. A single termination charge was set for all fixed networks in the Republic of Serbia, a price of leased line was set for all cable duct operators, as well as the charge of termination on IN platform of Telekom Srbija's fixed network. Upon the market analysis procedure and the identification of SMP operators, RATEL adopted the decisions designating the SMP operators and imposing on them the obligations in the relevant markets, pursuant to the Law and the Decision on relevant markets susceptible to *ex-ante* regulation (*Official Gazette of RS*, no. 59/11). Following the requests of the operators, 18 decisions on numbering usage were adopted, in accordance with the Law.

Analysis of the 2010 regulatory reports on cost-accounting principle application for Telekom Srbija Joint Stock Co. and SBB Ltd., the analysis of the regulatory report for the first six months of 2011 for SBB Ltd. and the analysis concerning the problems caused by interconnection charges for VoIP providers call origination were carried out. Code 0800 for international traffic origination of Telekom Srbija users was introduced and relevant service costs were analysed. Also, analysis and opinion were provided concerning bundled services provision by Telekom Srbija Joint Stock Co. Following the analysis of the request received from SBB Ltd., approval was given to modify prices for radio and TV programme distribution. Furthermore, a continuous update of the information on price modification for cable distribution services of all providers and a list of roaming tariffs of the national mobile operators with 50 selected countries were also provided.

Since the Law stipulates the obligation of RATEL to keep appropriate registers of the operators, in February 2011, the Managing Board passed the decision on the manner in which the registers, records, data bases and other information within the competence of the Republic Agency for Electronic Communications are to be kept and published on the Agency website. In addition to

updating the existing registers and creating new ones, in 2011 there were 69 new entries in the register of providers performing electronic communications activity, as follows:

- 8 for media contents distribution services
- 8 for electronic communications networks
- 8 for VoIP service
- 31 for broadband service
- 2 for VPN service
- 2 for data transmission service
- 3 for leased lines service
- 3 for capacity leasing
- 3 for infrastructure leasing
- 1 for dark fiber leasing.

During 2011, 24 authorizations for international interconnection with the telecommunications network operators in the neighbouring countries were issued.

Also, 7371 technical permits – certificates and 1792 approvals for the import of goods were issued.

In 2011, RATEL continued to monitor the quality of the delivered services, in particular the control of compliance with the terms and conditions stipulated under the issued licences and authorizations, with the aim of undertaking measures against entities providing telecommunications services without the adequate permit.

However, under the new Law, RATEL's monitoring role is somewhat different, hence, pursuant to Art. 131. of the Law, RATEL's competencies include the monitoring of the operators under the obligation to perform electronic communications activities in accordance with the prescribed

general requirements for performing such activities, special obligations designated for operators with SMP, conditions stipulated under licences for the use of numbering, individual licences for the use of radio-frequencies, and other obligations stipulated under the Law and bylaws adopted in accordance with it. Furthermore, RATEL is authorised to perform measurements and to test the operation of electronic communication equipment and terminal equipment. In case an operator is not working in compliance with the obligations, RATEL informs the operators thereof and gives a deadline for the operator to make a statement and/or remove the irregularities. If RATEL finds that the operator failed to remove the irregularities before the given deadline, the case will be reported to the inspection of the responsible ministry.

RADIOCOMMUNICATIONS

The activities related to the joint work of the Ministry of Culture, Media and Information Society, the Republic Broadcasting Agency (RRA) and RATEL on the creation of conditions necessary for analogue to digital switchover in radio and television programme broadcasting, continued in 2011.

In addition, during 2011, the following activates related to RF spectrum management were took place:

- as part of the broadcasting activities, the data from 25 BRIFICs (***BR International Frequency Information Circular***) of the International Telecommunication Union, of relevance for the broadcasting service of the Republic of Serbia, were analyzed. Answers were prepared for all cases where the new frequency assignments affects our broadcasting service, and they were delivered to the Radiocommunication Bureau in timely manner;
- a large number of compatibility analyses were carried out related to requests for new frequency assignments, using the appropriate software;
- the proposal for amendments to the Allotment Plan for terrestrial analogue broadcasting service was prepared based on the compatibility analysis;

- a large number of coordination requests for new frequency assignments or modification of the existing, made by the neighbouring or other administrations, were solved;
- more than 20 meetings were held with the representatives of the Serbian Army, Ministry of Interior of the Republic of Serbia and the Serbia and Montenegro Air Traffic Service Agency, as part of the preparation of the proposal for the Radio-Frequency Allocation Plan and all relevant international and national regulations were taken into consideration (agreements, recommendations, decisions, standards, rulebooks, etc.)
- preparations for the World Radiocommunication Conference held from 23 January – 17 February 2012, in terms of studying the material and contributions of other administrations, as well as the preparation of the contributions of RATEL's representatives.

Also, RATEL prepared a range of information and analyses pertaining to RF spectrum management and user information.

In addition, RF spectrum management also included the following activities related to the issuance of radio station licences, radio frequency coordination and notification and RF spectrum monitoring:

- 7122 individual permits for radio frequency usage were issued at operators' requests according to provision of Art. 86 of the Law, 32 individual permits for radio-stations on aircrafts, 69 of individual permits for radio-frequency usage for radio-stations on board of ships or other vessels, 304 individual permits for radio-frequency usage to diplomatic-consular offices and foreign legal entities in accordance with the provisions of Arts. 87 and 88 of the Law, as well as 128 amateur radio-station permits were also issued. Two approvals for international interconnection via microwave links were also issued;

- 354 decisions on revoking the assigned radio-frequencies were adopted, according to Art. 95 of the Law;
- a large number of coordination requests for new frequency assignments or modification of the existing , made by neighbouring or other administrations, were solved.

Also, during 2011, there was a continuous monitoring RF spectrum, consisting of:

- daily signal monitoring of FM and TV broadcasting from the Monitoring Centres „Beograd" and „Niš", and periodic measuring throughout the territory of the Republic of Serbia,
- over 210 field controls of radio signal,
- 742 reports on RF spectrum control,
- 31 solved cases regarding RF spectrum harmful interferences,
- 7 reports on measuring deviation,
- 4450 radio-station technical inspections
- a detailed register of radio-stations operating without permission, together with the activities on preventing the operation of those radio-stations.

Furthermore, measuring related to interferences cased by CDMA systems, measuring related to the uneven volume of TV station broadcasters with national coverage, and control of locations with a large number of transmitters were performed. Also, our experts were present at the demonstration of experimental work of mobile operators using LTE technology.

In regard to the radio-stations which had been using radio frequencies without permit, in 2011, 458 cases were reported to the Broadcasting Agency and 187 to the Ministry of Culture, Media and Information Society and 86 offence proceedings were instigated.

USER PROTECTION

Just like in the previous years, RATEL continued with the user support services with the aim of resolving the problem of complaints concerning the work of some operators, which involved the analysis of the number of user complaints according to the type of services, preparation of specific enactments and daily communication with the users by e-mail and telephone. In 2011, 694 user complaints were received. Operators responded to 617 complaints, of which 252 complaints were resolved with the positive outcome for the users.

Upon the entry into force of the Law, the activities related to the universal service (US) continued. In the previous period RATEL carried out the analysis of the US provision, including the geographic coverage and the development level of the public communication networks and the availability of public electronic communication services in the republic of Serbia. Based on the analysis, the following two groups of inhabited locations were identified:

- locations with no mobile telephony signal and no fixed telecommunications network or with an insufficient number of fixed lines (there are 43 such locations) and
- locations where the number of lines per 100 inhabitants is less than 10 or where there are no fixed lines and the mobile network signal coverage is inadequate (there are 712 such locations).

At RATEL's initiative, the operators designated for US provision in terms of ensuring the coverage of a larger number of inhabited locations have reached the agreement whereby Telekom Srbija Joint Stock Co. is required to provide US in 311, Telenor Ltd. in 302 and Vip mobile Ltd. in 99 inhabited locations. The basic criterion was the market share of each operator. The coverage of the affected locations, where the number of lines per 100 inhabitants is less than 10, is expected to be reached during 2012.

MONITORING AND ANALYSIS OF THE MARKETS SUSCEPTIBLE TO EX-ANTE REGULATION

In accordance with the 2011 Framework Plan, RATEL carried on with the intensive work concerning the analysis and regulation of the electronic communication market. According to the Law, RATEL is required to carry out market analysis, collect and publish the statistic data and provide the information on the situation in the electronic communication market of the Republic of Serbia to the National Assembly of the Republic of Serbia in form of the annual report. As a result of these tasks, in 2011 RATEL published the annual publication:

- **An Overview of Telecom Market in the Republic of Serbia in 2010.**

Furthermore, information was collected and submitted to the International Telecommunication Union (ITU) in form of the questionnaire with indicators, reports on the annual analysis of the telecommunication traffic were prepared and quarterly data were submitted to the Statistical Office of the Republic of Serbia, and also information on telecommunications market, service prices and regulatory measures was provided to the Cullen International for the purpose of the annual report.

The Law stipulates for RATEL to carry out, at least once every three years, the analysis of the relevant and, if necessary, additional markets, applying the relevant EU recommendations on the market analysis and identification of single and/or joint significant market power.

Pursuant to the Law and in line with the Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation and the Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, C (2007) 5046, 2007/879/EC, RATEL's Managing Board adopted the Decision on relevant markets susceptible to ex-ante regulation (*Official Gazette of RS*, no. 59/11). This decision identifies 9

relevant markets susceptible to *ex-ante* regulation in the Republic of Serbia and their geographic dimension, as follows:

- Retail access to the public telephone network at a fixed location
- Wholesale call origination on the public telephone network at a fixed location
- Wholesale call termination on the public telephone network
- Wholesale (physical) access to network elements and associated facilities (including shared and full unbounded access to the local loop)
- Wholesale broadband access
- Wholesale terminating segments of leased lines
- Wholesale call termination on mobile telephone network
- Retail media content distribution
- Retail publicly available telephone services provided at a fixed location

During 2011, analysis of the relevant markets susceptible to ex-ante regulation was carried out through joint work of several RATEL's organization units.

The data used for the analysis had been collected through the questionnaire concerning the relevant markets, covering the period from 2007 to 2009 and the first six months of 2010.

The purpose of the analysis procedure was to determine the level of competition in a specific relevant market, pursuant to Art. 59, para. 1 of the Law, i.e. to determine whether there are operators with significant market power in the specific relevant market.

In the analysis procedure, relevant markets were identified in the production and geographic dimension, the criteria for determining significant market power were analysed and, upon the completed procedure, SMP operators were designated together with the obligations in the relevant market (individually or jointly with other operators).

The analysis entails data collection from over 300 operators (mobile, fixed, Internet, CDS, VoIP, CDMA), storing, processing, comparison and presentation of the relevant data in the annual publication. The data are also used for the annual report submitted to the ITU, and biannual reports sent to Cullen International. Special efforts are dedicated to the analysis of causes and consequences of particular market trends, especially to the strategic issues concerning the evaluation of the future electronic communication market development.

Pursuant to the Law, the Rules on the cost accounting principle, separate accounts and reporting by SMP operators in electronic communication market (*Official Gazette RS*, no. 52/11) which introduces the current cost accounting model for SMP operators from 2012.

A comparative overview of the number of users and the penetration rate in the public fixed communications network, public mobile communications network, Internet and cable systems for 2009, 2010 and 2011 is given in Table 1 below.

Table 1. Comparative overview for last 3 years — Source: RATEL

	2009		2010		2011	
	Number (thousands)	Penetration (%)	Number (thousands)	Penetration (%)	Number (thousands)	Penetration (%)
Fixed - lines	3 105.7	41.42	3 110.3	41.48	3 030.4	42.56
Mobile - users	9 912.3	132.20	9 915.3	132.24	10 182.0	142.99
Internet - subscribers	1 705.7	22.75	2 407.4	32.11	3 828.7	53.00
Cable - subscribers	1 080.9	14.42	1 247.2	16.63	1 331.3	18.70

RATEL'S ORGANIZATION AND DEVELOPMENT

RATEL was founded pursuant to the Law, as an autonomous organization with the status of a legal entity which exercises public authorities in order to effectively implement the established electronic communications policy, promote competition in the sphere of electronic communications networks and services, enhance their capacity and/or quality, contribute to the development of

electronic communications market and protect the interests of users of electronic communications services, in accordance with the Law and the bylaws adopted pursuant to this Law.

RATEL is functionally and financially independent of government authorities, organizations and entities engaged in the electronic communications sector.

The Agency operates pursuant to the provisions pertinent to public agencies, and the responsible ministry supervises the lawfulness and appropriateness of functioning of the Agency in performing the entrusted duties.

All decisions in RATEL's competence are adopted by the Managing Board and director. The members of the Managing Board are appointed and relieved from office by the National Assembly of the Republic of Serbia at the proposal of the Government, on the basis of the public call for appointment of MB members. Among the five members of the Managing Board one is the Chairperson and one is the Deputy Chairperson, while the term in office is five years. The Managing Board, pursuant with the Law, passes RATEL's annual business plan and other bylaws stipulated by the Law and performs other tasks which do not fall within the competence of the director.

At the proposal of the Government, the National Assembly of the Republic of Serbia appointed the Chairperson, Deputy Chairperson and the members of the Managing Board of the Republic Agency for Electronic Communications (Official Gazette of RS, no. 23/11) on 31 March 2011. Prof. Dr Jovan Radunović was appointed the Chairperson, Dr Zdravko Stanimirović was appointed Deputy Chairperson, while Prof. Dr Miroslav Dukić, Prof. Dr Vlade Milićević and Vuk Vujović, MBA were appointed members of the Managing Board.

The Director is responsible for the lawfulness of RATEL's work, and represents and acts on behalf of the Agency, manages the activities and business operations of the Agency, decides on the rights, obligations and responsibilities of the Agency's employees, prepares and implements decisions of the MB, ensures the transparency of RATEL's work and performs other tasks specified in the Law and in the Statutes of the Agency. The director is appointed and removed from office

by the Managing Board, on the basis of a public call for the appointment, pursuant with the Law. The term in the office of the director is five years and he/she can be reappointed. The director is a full time employee with RATEL, he/she is responsible for their work to the MB and submits annual and periodical reports to the MB.

The following organization units were formed for performing the work within RATEL's competence:

- **Regulation Sector** (with the following departments: Bylaws Department, Technical Regulations Department and Radiocommunications Department),
- **Economic Affairs and Market Analysis Sector** (with the following departments: Market Analysis and Cost-Accounting Department, Accounting and Finance Department and Procurement Division),
- **Logistics Sector** with the following departments: General Affairs Department, e-RATEL Department and Monitoring Department).

The financial assets are provided by RATEL's revenues from the numbering fees, radio-frequency fees, fees for performing electronic communication activities, and revenues from the provision of services within RATEL's competence.

RATEL's annual financial report is approved by the Managing Board and revised by an independent chartered auditor.

The difference between the revenues and expenditures laid down in RATEL's annual financial report is paid into public revenues account of the Treasury of the Republic of Serbia and used by the responsible ministry for the promotion and development of electronic communications and information society. A part of these revenues, proportional to the revenues made by the electronic communication network and services operators in the territory of the Autonomous Province of Vojvodina, is paid into the account of the Province Treasury and used by the province authority in

charge of electronic communication for the promotion and development of electronic communication and information society in the territory of AP Vojvodina.

During 2010, RATEL's total revenues amounted to approximately 1 330 million dinars, with the total expenditures of 734 million dinars. Pursuant to Article 27, paragraph 86 of the Law, once the financial reports had been audited, the surplus of 601 million dinars was paid into the Treasury of the Republic of Serbia and the Autonomous Province of Vojvodina, in the amount of 587 million dinars and 14 million dinars, respectively.

On 31 December 2011, RATEL had 105 employees. RATEL is located in rented business premises in Višnjićeva 8 in Belgrade. The spectrum monitoring centres are located in Dobanovci and Niš.

Further upgrade of the existing ICT systems within RATEL continued in 2011:

- **Central base of the ported mobile numbers began with operation in two redundant locations, and it is available at: www.prenesibroj.rs**
- **The internal document management system was upgraded and the work with electronic documents and electronic signature was enabled**
- **New Agency register was implemented on the Agency website and the communication with the Agency via electronic forms was enabled. In this way, over thousand forms and submissions were received by the Agency and several hundred thousand data stored and processed in short time.**

Once the central base of the ported mobile numbers had been tested and put into operation by RATEL and the three mobile operators had carried out the required activities, the conditions were met for the mobile users to keep their numbers when changing the operator. Thus the practical implementation of the Rules on the number portability in the public mobile telecommunications networks (*Official Gazette of RS*, no. 5/10) began, promoting the rights of end-users and further

liberalization in the electronic communication sector. The number portability removes the obstacle of being tied to an operator through the telephone number, due to which the users were reluctant to change the operator even when they are not satisfied with the service. With the number portability, it is easier for users to change the operator, which stimulates the competition among operators and provides better service conditions and choice for the end-user.

During 2011, 17 sessions of the Managing Board were held. They involved the preparation of 118 items of the agenda and the adoption of 12 decisions of the Managing Board, 16 bylaws (rules) and 7 proposals of bylaws to be adopted by the responsible ministry. The director of the Agency passed 1600 separate legal acts (decisions, conclusions, approvals, certificates, criminal charges and acts related to public procurement procedures) and more than one hundred separate acts concerning legal labour status of the employees. Furthermore, a large number of memorandums were addressed to the Government of Republic of Serbia, the responsible ministries, operators and many other institutions and organizations, both in the country and abroad.

In 2011, RATEL published two issues of the professional-scientific magazine *Telekomunikacije*. The seventh issue was printed and published in June and the eight in November of 2011.

Observing the principles of transparency in the work and provision of information to all participants of the telecom market, two regular press conferences were held in RATEL's premises:

- ***Presentation of the annual publication - Overview of the Telecom Market in the Republic of Serbia 2010***, held on 10 May 2011, on the occasion of RATEL's yearly publication issuance
- ***Presentation of the publication The Future Built on Broadband*** held on 27 May 2011. RATEL translated and published the publication The Future Built on Broadband by the members of the Broadband Commission and Digital Development of the ITU and UNESCO.

With the purpose of providing transparency in RATEL's work and offering an opportunity to the public to take part in the process of decision-making in the telecommunications sector, in 2011, pursuant to the provision Art. 34-36 of the Law and the Instructions on the Public Consultations Procedure, RATEL organized 18 public consultations prior to the adoption of all general bylaws by the Managing Board. Pursuant to the Law, the decisions on SMP operators and their obligations in relevant market, as well as the Reports on the relevant market analysis that were integral part of these decisions, were also subject of public consultations.

COOPERATION WITH OTHER ORGANIZATIONS AND INSTITUTIONS

In performing its main role under the Law to create the necessary conditions for an unhindered development of the electronic communication market in the Republic of Serbia, RATEL has established close cooperation with the relevant state and judicial authorities and other entities.

The open and direct cooperation between RATEL and the Ministry of Culture, Media and Information Society, as well as with the Digital Agenda Administration established in March 2011 as a body within the Ministry of Culture, Media and Information Society, resulted in the efficient performance of the regulatory activity. Pursuant to the Law, the cooperation also involved a joint work on the creation of bylaws adopted by the responsible ministry at RATEL's proposal.

With the aim of ensuring an efficient radio frequency spectrum management and the protection of operation of priority radio services, RATEL has established the cooperation with the Ministry of Culture, Media and Information Society, the Republic Broadcasting Agency, the Ministry of Defence, Serbian Armed Forces, the Ministry of Interior and Serbian and Serbia and Montenegro Air Traffic Service Agency.

During 2011, RATEL participated in the following work groups, commissions and activities:

- National Programme for Integration of the Republic of Serbia in the EU (NPI), the preparation of answers to the European Commission Questionnaire followed by the meetings with the EC representatives, along with the input of RATEL's bylaws in the joint database and data collecting for the electronic communication section of the EC annual Progress Report.
- cooperation with the Competition Commission,
- accession of the Republic of Serbia to the World Trade Organization,
- sector meetings between the European Commission and the Republic of Serbia,
- preparation of the materials for the European Communication Monitoring Report 3 - Serbia and Cullen International.

We would like to point out RATEL's participation in drafting the National Programme for Integration of the Republic of Serbia in the European Union (NPI), through its activities within Information Society and Media Sub-group 10, and also Competition Sub-group 8, the Free Movement of Goods Sub-group 1 and Foreign Economic Relations Sub-group 30. In 2011, the activities were mainly related to the National Programme for Integration of the Republic of Serbia in the EU. NPI is a comprehensive document including a plan for a gradual harmonization of the national legislation with *acquis communautaire*, envisaged by the Stabilisation and Accession Agreement (SAA). Since NPI provides a detailed overview of reforms and activities to be carried out in the years ahead, it is of great importance for the work of the state institutions, and also for the future business plans of the private sector.

Having in mind RATEL's responsibilities, under the Law, regarding the relevant market analysis susceptible to *ex-ante* regulation and designating SMP operators, and the good cooperation with the Competition Commission, in May 2011 the two institutions signed the Protocol of Cooperation, as independent and autonomous institutions performing public duties in line with the Law and the Law on Competition Protection. In 2011, the cooperation with the Competition Commission was related to the competition issues in the media content distribution market concerning the assessment of possible violation of competition in the wholesale broadband market.

The dynamic development of ICTs, i.e. services and equipment, requires continuous monitoring and introduction of new regulations. This requires intensive and direct international cooperation with the national regulatory authorities (NRAs) and other international institutions in the region and in the EU. For the purposes of the harmonization of regulations, technical provisions, and standards, in 2011 RATEL's experts took an active part in the meetings of several international organizations:

- participation in the international meetings organized by the ITU – preliminary meeting for the World Radiocommunication Conference, CPM-11-2, and the meetings of SG5 and SG6,
- participation in CEPT meetings – Radio Frequency Spectrum Management World Group (WGFM) and Spectrum Engineering Work Group (WGSE)
- participation in the COMMITTEE RAINWAT meetings
- participation in the European Communications Office (ECO) meetings –WGRA meetings and seminar on SRD.

Constant contacts with all participants in the market were maintained through the official institutional participation of RATEL in the meetings and roundtables:

- 10th International TELSIKS Conference, 5-8 October 2011, Niš: RATEL, TELSIKS and the regional Chamber of Commerce of Niš organized a roundtable „**ICT in the EU and the Republic of Serbia: current situation and future steps**"
- Telecommunications Forum TELFOR 2011, 20-22 November 2011, Belgrade: TELFOR and RATEL organized a roundtable "**National Broadband Network in Serbia (NBN-S)**"
- a large number of roundtables upon invitation, presentation and publication of papers in the national and international conferences and magazines.

RATEL's employees participated in several international and national conferences:

- Telecommunication ducts cadastre project – visit to the German NRA, April 2011,
- EuroDIG Conference – 2011, Belgrade,
- Infofest Jahorina, March 2011, BiH,
- roundtables and meeting on consumer protection (the most important being the participation in the European project "Enhancement of Consumer Protection in the Republic of Serbia"),
- seminars on the implementation of the new Law on Litigation Procedure, The Law on The Execution of Penalties and Security Measures and the Law on Consumer Protection,
- XVII Legal Days in Budva,
- Infofest and IX Conference of the NRAs "Regulatory Activity in the Electronic Communication Sector", October 2011, Budva,
- Kopaonik School of Natural Law "Right and Responsibility", December 2011, Kopaonik.

In May 2011 Mr Brahima Sanou, Director of the ITU Telecommunication Development Bureau-TDB visited Belgrade. Mr Sanou was present at the opening of the 4th Conference on Internet Governance - EuroDig 2011, held on 30 and 31 May 2011 in Centre "Sava".

RATEL cooperates with the other NRAs in Europe, in particular with those in the region. In 2011 RATEL signed the memoranda of understanding with the Croatian Agency for Post and Electronic Communications (HAKOM), Regulatory Commission for Telecommunications of the Republic of Bulgaria (CRC), Regulatory Commission for Telecommunications of the Republic of Greece (EETT) and the Agency for Electronic Communications of the Republic of Macedonia (AEK). The cooperation defined by the memoranda provides for a regular exchange of information concerning the electronic communications policy and strategy making and expert meetings with the purpose of studying and comparing technical, legal, economic and other aspects of the regulatory activities in this sector.

The representatives of RATEL and the Agency for Electronic Communication and Post of the Republic of Montenegro (EKIP) signed the following two technical agreements on coordination in border areas

- technical agreements on coordination in border areas for IMT/UMTS systems in frequency bands 880-915/925-960 MHz (GSM900) and 1710-1785/1805-1880 MHz (GSM1800) and
- technical agreements on coordination in border areas for IMT/UMTS systems in frequency bands 1900-1980/2010-2025/2110-2170 MHz.

In its work, RATEL continues the cooperation with all participants in the telecom market: operators, providers, distributers, industry, research and educational institutions as well as with consumer associations.

Director

Dr Milan Janković

2. ELECTRONIC COMMUNICATIONS MARKET ANALYSIS

In line with the competencies under the Law, the Agency carried out the analysis of the relevant electronic communication markets in the Republic of Serbia in 2011. Pursuant to Art. 59 of the Law and the Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation[1], in the Decision no. 1-02-3400-11/11 of 7 July 2011 the Agency designated relevant markets in the territory of the Republic of Serbia susceptible to ex-ante regulation, as follows:

1. Retail access to the public telephone network at a fixed location
2. Wholesale call origination on the public telephone network at a fixed location
3. Wholesale call termination on the public telephone network
4. Wholesale (physical) access to network elements and associated facilities (including shared and full unbounded access to the local loop)
5. Wholesale broadband access
6. Wholesale leased lines
7. Wholesale call termination on mobile telephone network
8. Retail media content distribution
9. Retail publicly available telephone services provided at a fixed location

Since the markets with structural, regulatory or other lasting barriers, such as to prevent new entrants to become competitive in the given market, are susceptible to ex-ante regulation and since these

[1] Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to *ex-ante* regulation, in line with the Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, C (2007) 5046, 2007/879/EC.

shortcomings can only be removed by applying ex-ante regulation, the Agency carried out the relevant market analysis followed by the decisions on designating SMP operator(s) in each of the analyzed relevant markets. The data used for this purpose had been collected in the period 2007-2010 (the first six months). in this way Agency was able to designate SMP operators by analyzing the relevant market and by considering the criteria for determining significant market power. Upon the completed analysis, taking into account the current level of the competition in the market and the identification of the potential barriers to the development of market competition, the obligations were imposed on the SMP operators with the purpose to contribute to an even development of the competition in the relevant market with regard to the type and nature of the identified shortcomings, previous and future investments and the possibility for a reasonable rate of return on the investments.

With the decisions of the Agency (for each relevant market individually) from November 2011, the following obligations were imposed on the SMP operators for wholesale markets:

1. Publication of relevant data – reference offer,
2. Non-discriminatory actions,
3. Accounting separation,
4. Provision of access and use of parts of the network infrastructure and associated facilities,
5. Price control and cost-based accounting,
6. Provision of minimum set of leased lines,

and the following obligations were imposed on the SMP operators for retail markets:

1. Prohibition of excessive pricing,
2. Prohibition of barriers to entry or excessive pricing or underpricing such as to limit the competition,

3 Prohibition of preferential treatment of an end-user,

4 Retail price control,

5 Obligation to obtain a formal approval from NRA for price formulation and price changes for bundled services

6 Individual tariff control measures,

7 Cost-oriented prices or benchmarked prices.

Table 2. SMP Operators in Each Relevant Market

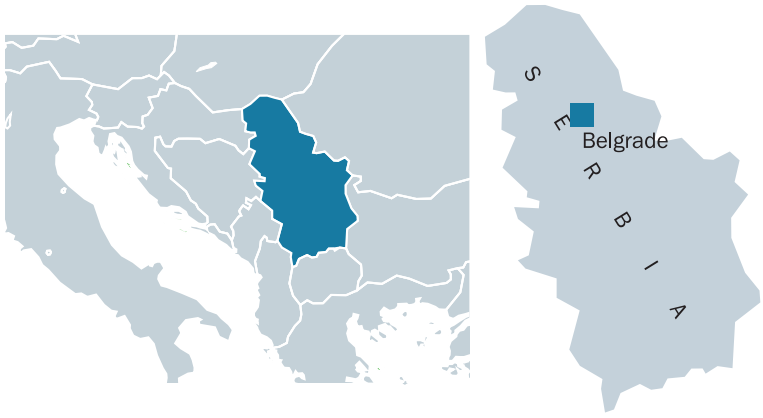
Market		SMP operator
M1	Retail access to the public telephone network at a fixed location	Telekom Srbija Joint Stock Co.
M2	Wholesale call origination on the public telephone network at a fixed location	Telekom Srbija Joint Stock Co.
M3	Wholesale call termination on the public telephone network	Telekom Srbija Joint Stock Co. Orion telekom Ltd.
M4	Wholesale (physical) access to network elements and associated facilities (including shared and full unbounded access to the local loop)	Telekom Srbija Joint Stock Co.
M5	Wholesale broadband access	Telekom Srbija Joint Stock Co.
M6	Wholesale leased lines	Telekom Srbija Joint Stock Co.
M7	Wholesale call termination on mobile telephone network	Telekom Srbija Joint Stock Co. Telenor Ltd. Vip mobile Ltd.
M8	Retail media content distribution	Serbia broadband – Srpske kablovske mreže Ltd.
M9	Retail publicly available telephone services provided at a fixed location	Telekom Srbija Joint Stock Co.

SMP operators are required to fulfil the imposed obligations under terms and condition set out under the relevant market analysis.

All above-mentioned market analyses and the relevant decisions were published at the Agency website www.ratel.rs/регулатива/анализе_тржишта.538.html

2.1. BASIC CHARACTERISTICS OF THE TELECOM MARKET IN THE REPUBLIC OF SERBIA

Figure 1. Republic of Serbia – Basic Facts



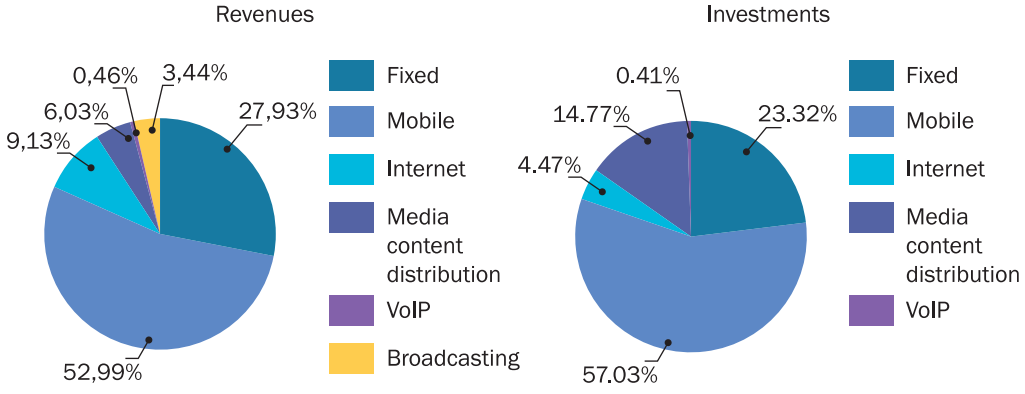
Basic data	Source: Statistical Office of the Republic of Serbia and RATEL
Name	Republic of Serbia
Capital	Belgrade
Area	88.361 km2
Population (without AP Kosovo and Metohija), 2012 data.	7 120 666
Country code:	+381
Internet domain:	.rs
GDP for 2011	RSD 2 882.64
Average net income in 2011	RSD 43 887.00 (€430)
Fixed penetration:	42.56
Mobile penetration:	142.99
ISPs:	232
Network digitalization rate:	98.54%

According to RATEL's data collected from the telecom operators, the revenues from telecom services in 2011 in the Republic of Serbia amounted to 1.6 billion euros, which is approximately 10% more than the previous year. Such growth is in keeping with the compound annual growth rate (CAGR) of the telecom sector revenues in the period from 2005 to 2011 of 9.52%. The share of telecom sector revenues in GDP was around 5.66% (cf. 5,29% in 2010). The total investments in the telecom sector in 2011 amounted to 243 million euros.

The data utilized for the telecom market analysis in the Republic of Serbia were retrieved from the reports submitted by the telecom market participants and refer to the territory of the Republic of Serbia without the Autonomous Province of Kosovo and Metohija which is under UN administration pursuant to 1244 Security Council Resolution temporarily regulating, *inter alia*, the competencies of the international civil mission in this territory.

In terms of different services in the Serbian electronic communication market there were no significant changes in the total revenues in 2011. The revenues from the mobile services amounted to 847 million euros and accounted for the largest share in the total revenues of almost 53%. Also, the investments in the mobile telephony in 2011 accounted for over a half of the total investments in the electronic communications market in the Republic of Serbia, with 57%. The structure of the revenues and investments in the telecommunications sector is given below (Figure 2).

Figure 2. Structure and investments by services in 2011 Source: RATEL



Tables 3 and 4 illustrate telecom service baskets representing monthly expenditure per subscriber of telecom services in Serbia in 2011 compared with the data retrieved in 2009 and 2010. The low usage basket shows the average monthly expenditure for basic telecom services, which include terrestrial television (RTV subscription), fixed and mobile telephone services, whereas

Table 3. Low Usage Basket (RSD) Source: RATEL

LOW USAGE BASKET	2009		2010		2011	
	Average bill	% of the monthly salary	Average bill	% of the monthly salary	Average bill	% of the monthly salary
Fixed	877.30	2.30%	1,004.30	2.60%	988.99	2.25%
Mobile (prepaid)	349.90	0.90%	331.30	0.90%	249.24	0.57%
TV (national TV subscription)	387.00	1.00%	500.00	1.30%	500.00	1.14%
Total	**1,614.20**	**4.20%**	**1,835.60**	**4.80%**	**1,738.23**	**3.96%**
Average net salary (in December)	*36,789.00*		*39,580.00*		*43,887.00*	

Table 4. High Usage Basket (RSD) Source: RATEL

HIGH USAGE BASKET	2009		2010		2011	
	Average bill	% of the monthly salary	Average bill	% of the monthly salary	Average bill	% of the monthly salary
Fixed	877.30	2.30%	1,004.30	2.60%	988.99	2.25%
Mobile (postpaid)	1,107.90	2.90%	1,948.70	5.00%	1,715.07	3.91%
TV (national TV subscription)	387.00	1.00%	500.00	1.30%	500.00	1.14%
Internet	1,021.60	2.60%	1,165.00	3.00%	1,289.84	2.94%
CATV	456.30	1.20%	559.00	1.40%	593.06	1.35%
Total	**3,850.20**	**10.00%**	**5,177.00**	**13.40%**	**5,086.96**	**11.59%**
Average net salary (in December)	*36,789.00*		*39,580.00*		*43,887.00*	

the high usage basket shows how much the population spends monthly using the Internet and CATV in addition to the basic package. In 2011, the cost of the basic package equalled 4% of the net average monthly salary in December, and that of the extended package amounted to approximately 11.6%. Within the basic package, the largest amount goes to fixed-line services - 2.25% of the average salary in December 2011, whereas in the extended package, the biggest expenditure is the mobile (postpaid) service – 3.91% of the average salary in December 2011.

2.2. COMPARATIVE ANALYSIS WITH THE SEE COUNTRIES

Same as the previous years, a comparative analysis of South East Europe countries was carried out in 2011. SEE countries include three EU candidate countries – Turkey, Croatia and Macedonia, and also four Stabilization and Accession Agreement (SAA) signatory countries – Serbia, Montenegro, Bosnia and Herzegovina and Albania. Since the analysis for each year is carried out in the following year, it should be pointed out that, in the meantime, on 1 March 2012, the Republic of Serbia was granted the status of an official candidate country to the EU by the European Council.

The value of VAT in these countries remained approximately the same as in 2010. The highest VAT rate was again recorded in Croatia (23%) and Albania (20%), followed by Turkey, Macedonia and Serbia (18%) and finally Bosnia and Herzegovina and Montenegro with the lowest rate (17%).

As shown in Figure 3 below, Croatia has the biggest GDP per capita, whereas Serbia recorded a considerable growth in GDP per capita year-on-year (10.43%), followed by Montenegro (9.12%), Macedonia (7.66%) and Albania (3.25%). There were no significant changes in this indicator for Croatia, whereas for Turkey there was a slight drop compared with 2010,

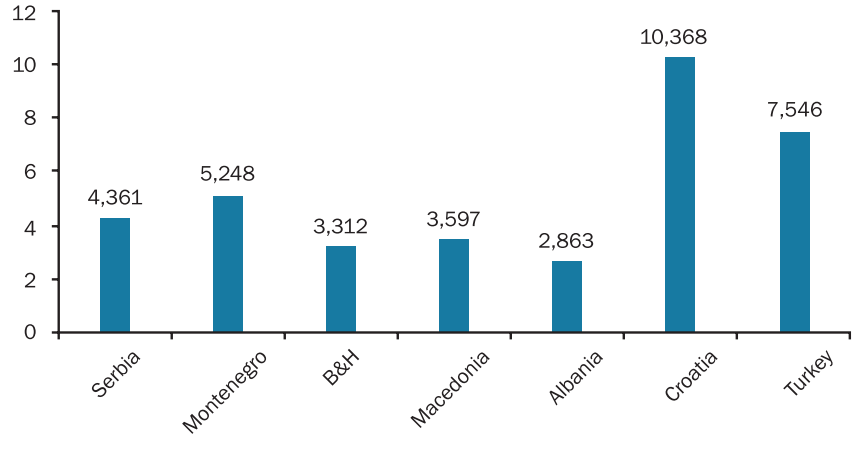
Serbia had the largest growth in GDP of 10.65% year-on-year, followed by Macedonia (7.71%), Montenegro (7.26%), Albania (3.72%) and Bosnia and Herzegovina (1.42%). In GDP for Croatia and Turkey there were only slight changes.

The total telecommunications market value in these countries is estimated to 15.8 billion euros, which is a slight increase compared with 2010, when a minor decrease had been perceived. A

Table 5. Population and GDP in 2011
Source: International Monetary Fund (IMF) – World Economic Outlook Database, April 2012.

Country	Population (mn)	GDP (€ bn)
Albania	3.218	9.21
Bosnia & Herzegovina	3.890	12.88
Montenegro	0.620	3.25
Croatia	4.416	45.79
Macedonia	2.059	7.40
Serbia	7.411	32.32
Turkey	73.950	558.05

Figure 3. GDP Per Capita
Source: International Monetary Fund (IMF)-World Economic Outlook Database, April 2012.



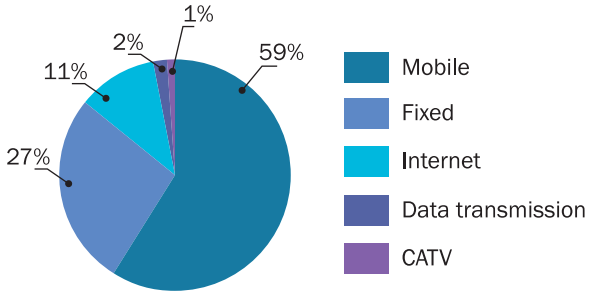
particular increase was observed within the market segments of CATV (23.8%) and the Internet (13.3%), whereas the data transmission segment showed a drop (-20.8%). There was a slight increase in mobile and fixed telephony compared with the previous year, when a decrease had been perceived (Table 6.).

Table 6. SEE Electronic Communication Market
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)

	2007	2008	2009	2010	Sector growth 2009-2010
Fixed-line telephony	5,411,329,200	4,565,475,200	4,183,524,600	4,196,561,600	0.30%
Internet services	965,443,300	1,272,911,900	1,531,031,400	1,734,473,600	13.30%
Mobile telephony	9,013,465,400	9,964,334,200	9,126,823,000	9.329,789.300	2.20%
Data transmission	384,632,700	440,934,500	448,902,100	355,580,100	-20.80%
CATV (cable Internet services excluded)	113.333,300	144,899,500	181,364,900	224,519,400	23.80%
Total	**15,888,203,900**	**16,388,555,300**	**15,471,646,000**	**15,840,924,000**	**2.40%**

In line with the trend of the previous year, the largest share, as much as 58.9% of the total telecom market revenues, goes to revenues from mobile telephony, followed by revenues from fixed telephony, 26.5% and the Internet, 10.9%, which is a slight increase year-on-year. There was a slight drop in the share of data transmission, whereas the share of the Internet was increased by 1%.

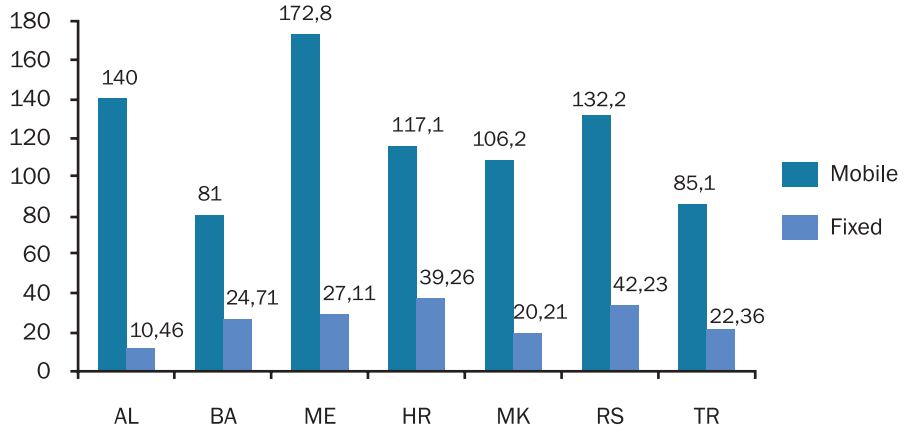
Figure 4. Market Share of Electronic Communication Services in 2011
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)



The comparative overview showed that mobile and fixed penetration (Figure 5) showed that while in some countries there was a growth, in other there was a decline in this segment. The biggest change was seen in Albania, where fixed penetration dropped by 8% whereas mobile penetration increased by

24%. A similar situation was perceived in Macedonia, where fixed penetration dropped by 1.8% whereas mobile penetration increased by 11.8%. In Croatia, a slight increase was seen in fixed penetration, whereas mobile penetration rate dropped by 13.9%. In Montenegro there was a decrease in both fixed and mobile penetration rate, by 4.6% and 17.3% respectively. In Serbia, Turkey and Bosnia and Herzegovina, there were no significant changes in either fixed or mobile penetration rate compared with 2010.

Figure 5. Mobilne and Fixed Penetraion Rate (countries in the region)
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)



The prices of specific fixed network services provided by the operators in the region and in the EU, as well as the leased line services are given in Figures 6, 7, 8 and 9. The monthly subscription charge is lowest in Albania and highest Turkey and Croatia (Figure 6) whereas the local and national call tariff is still by far the lowest in the Republic of Serbia (Figure 7). The highest annual charges for 2km of 2Mb/s leased lines are observed in Macedonia (€ 12 099), whereas charges for 34Mb/s leased lines are the lowest in Turkey (€12 358).

The number of broadband users in Serbia continued to grow in 2011, amounting to 3 828 721, which is an increase of 68% compared with 2 275 900 users in 2010. Due to the ongoing telecommunications development and broadband Internet access, the number of broadband users is growing whereas the number of dial-up users is dropping, which is a trend recorded in both the EU countries and countries in the region.

Figure 6. Standard Monthly Subscription for Residential Users (€) (VAT included)
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)

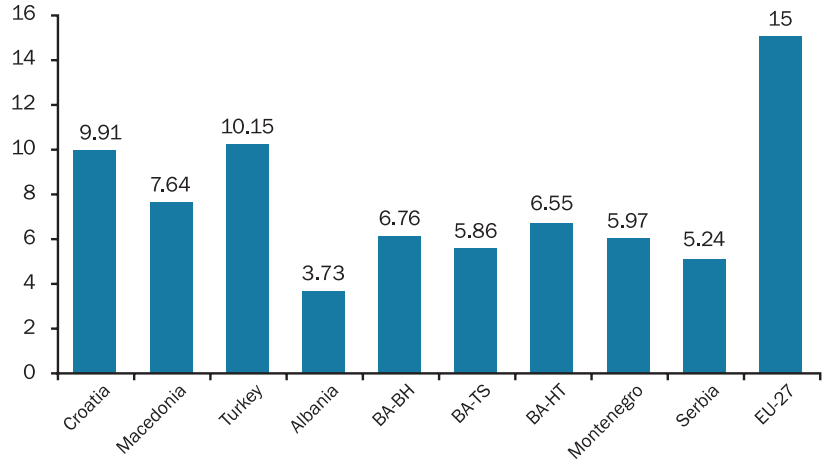


Figure 7. Price of a 10-minute Local and National Call (€) (VAT included)
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)

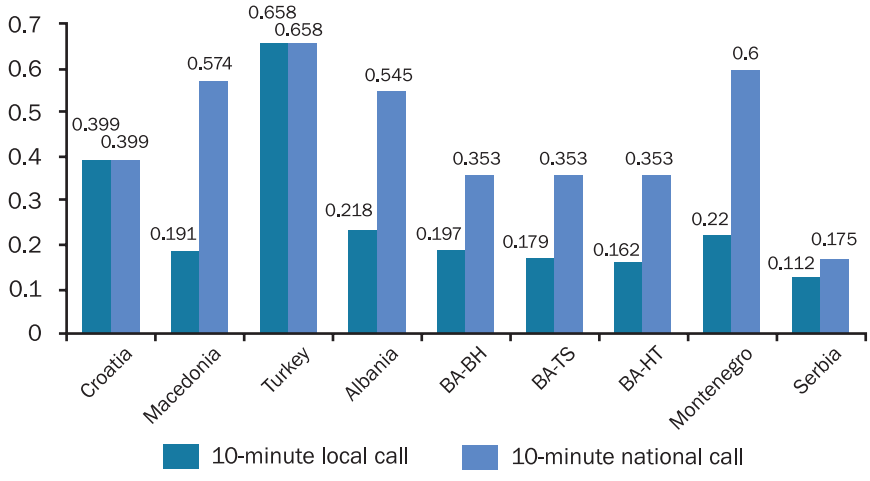


Figure 8. Annual Charges for 2 Mbit/s 2 km National Leased Lines (€)
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)

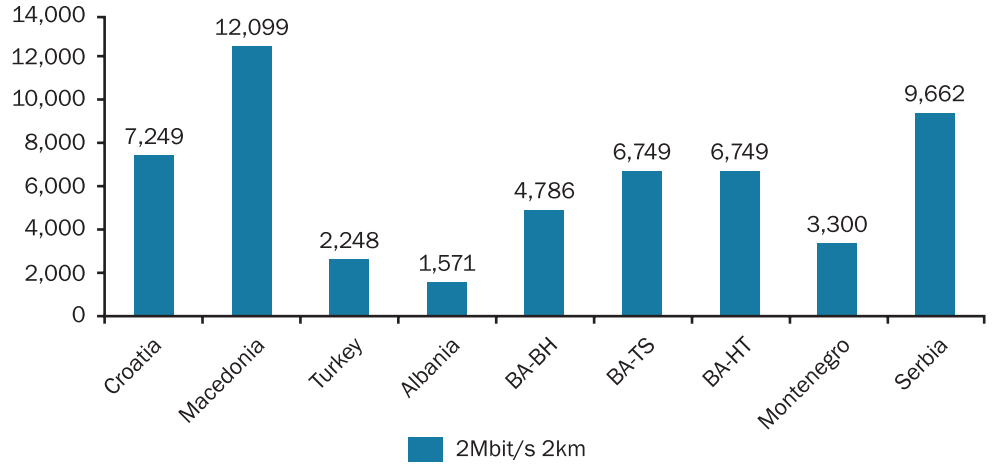


Figure 9. Annual Charges for 34 Mbit/s 2 km National Leased Lines (€)
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)

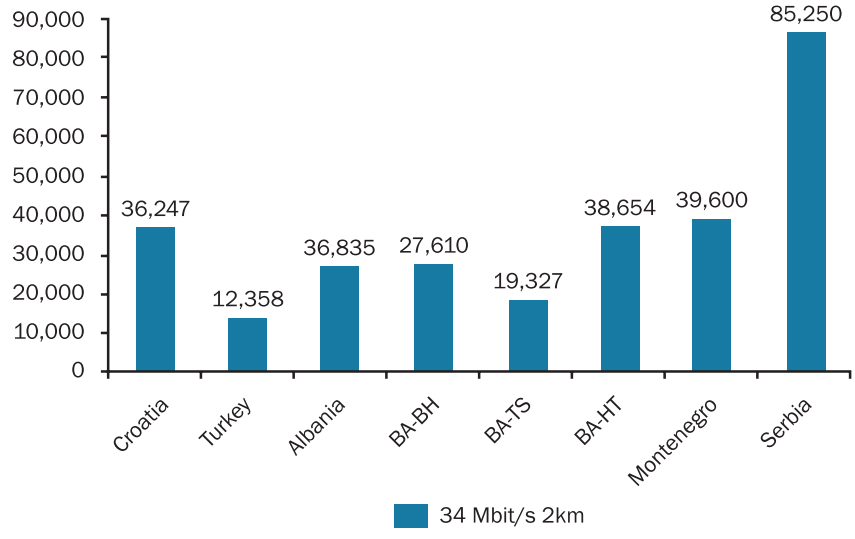


Figure 10. Fixed Broadband Penetration Rate
Source: Enlargement countries monitoring report 1 – Annex I – November 2011 (Cullen International)

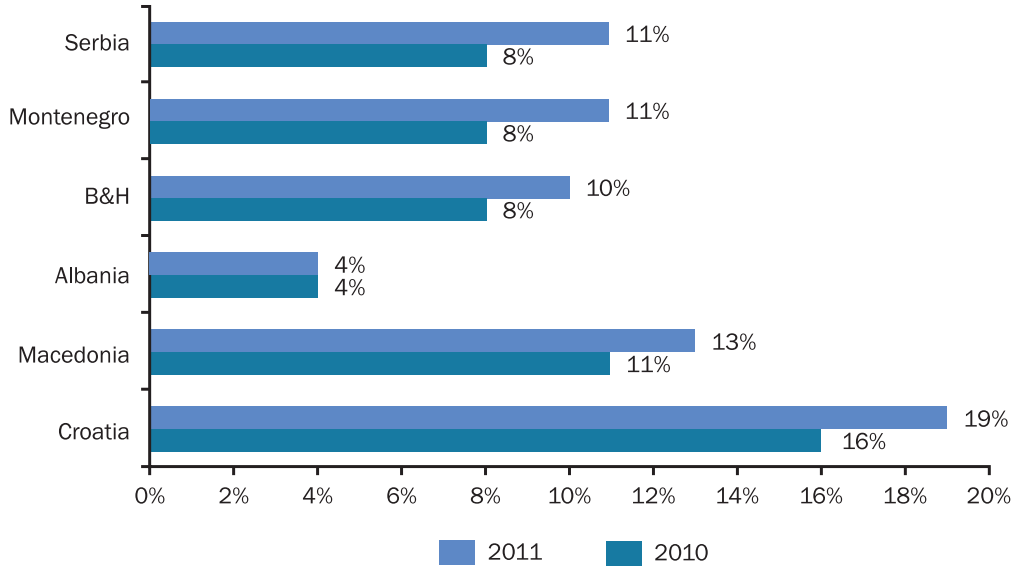
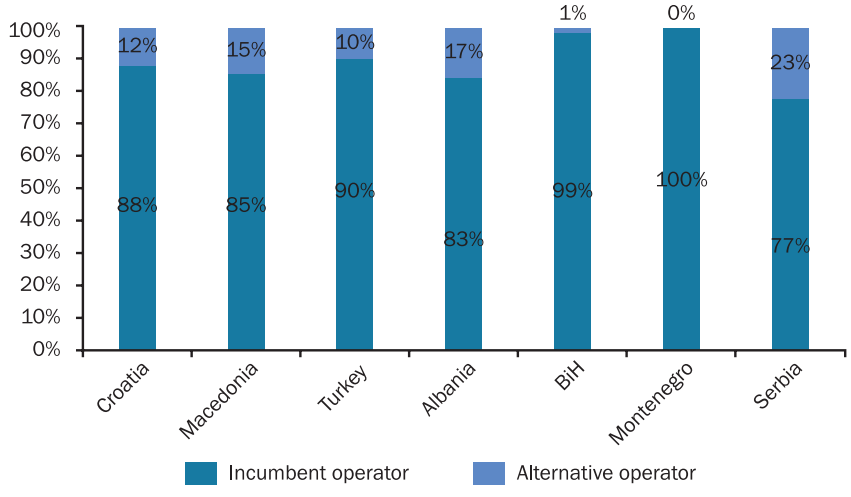


Figure 11 illustrates competition on the retail ADSL market between incumbent operators and other (alternative) operators. As clearly shown, the incumbent operator had absolute ADSL access market share (100%) only in Montenegro, followed by the incumbent operators in Bosnia and Herzegovina with 99% and Turkey with 90.4% of shares. The incumbent operator had the least share in Serbia (76.9%) and Albania (82.8%).

2.3 ICT DEVELOPMENT INDEX

With the aim of measuring and monitoring the development of information society and determining the digital divide among UN Member States, the International Telecommunication Union (ITU) publishes the indicators of ICT development on a regular basis. In comparison with the previous methodology, when data was usually obtained from the undertakings present in the ICT industry, recent approaches of data collection focus on obtaining relevant indicators on the basis of a rep-

Figure 11. Konkurencija u maloprodaji ADSL pristupa
Source: Enlargement Country Monitoring Report 4 Annex (Cullen International)



resentative sample of the telecommunications services users. The following indicators are presented according to the ITU Manual for Measuring ICT Access and Use by Households and Individuals, published in 2009, which provides a description of the core indicators and methodology for data collection and analysis. The list of the core indicators on the use of ICTs by households and individuals is given below. The list comprises 12 core indicators, HH1 – HH12, with relevant values for the Republic of Serbia in 2011, and an additional, reference indicator HHR1. RATEL obtained the following results, in cooperation with the Statistical Office of the Republic of Serbia:

Table 7. ICT Development Indicators
Source: Statistical Office of the Republic of Serbia Srbije

	Indicator	Definitions and notes	2011.
HH1	Proportion of households with a radio	The *proportion of households with a radio* is calculated by dividing the number of in-scope households with a radio by the total number of in-scope households. A *radio* is a device capable of receiving broadcast radio signals, using popular frequencies, such as FM, AM, LW and SW. It includes a radio set integrated in a car or an alarm clock but excludes radios integrated with a mobile phone, a digital audio player (MP3 player) or in a computer.	72 %

HH2	Proportion of households with a TV	*The proportion of households with* a TV is calculated by dividing the number of in-scope households with a TV by the total number of in-scope households. A *TV* (television) is a stand-alone device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable and satellite. It excludes TV functionality integrated with another device, such as a computer or a mobile phone.	98.9 %
HH3	Proportion of households with telephone	The *proportion of households with telephone* (fixed or mobile) is calculated by dividing the number of in-scope households with a telephone (fixed or mobile) by the total number of in-scope households.	
	Proportion of households with fixed telephone	The *proportion of households with fixed telephone only* is calculated by dividing the number of in-scope households with a fixed telephone only by the total number of in-scope households. A *fixed telephone line* refers to a telephone line connecting a customer's terminal equipment (e.g. telephone set, facsimile machine) to the public switched telephone network (PSTN) and which has a dedicated port on a telephone exchange. It may not be the same as an access line or a subscriber.	86.9 %
	Proportion of households with mobile cellular telephone	The *proportion of households with mobile cellular telephone* only is calculated by dividing the number of in-scope households with a mobile cellular telephone only by the total number of in-scope households. A *mobile cellular telephone* refers to a portable telephone subscribing to a public mobile telephone service using cellular technology, which provides access to the PSTN. This includes analogue and digital cellular systems, as well as IMT-2000 (3G). Users of both post-paid subscriptions and pre-paid accounts are included.	82.5 %
	Proportion of households with both fixed and mobile cellular telephone		
HH4	Proportion of households with a computer	The *proportion of households with a computer* is calculated by dividing the number of in-scope households with a computer by the total number of in-scope households. A *computer* refers to a desktop or a laptop computer. It does not include equipment with some embedded computing abilities such as mobile cellular phones, personal digital assistants (PDAs) or TV sets.	52.1 %
HH5	Proportion of individuals who used a computer (from any location) in the last 12 months	*The proportion of individuals who used a computer* is calculated by dividing the total number of in-scope individuals who used a computer from any location in the last 12 months by the total number of in-scope individuals. A *computer* refers to a desktop or a laptop computer. It does not include equipment with some embedded computing abilities such as mobile cellular phones, personal digital assistants or TV sets.	56.6 %

HH6	Proportion of households with Internet access at home	The *proportion of households with Internet access* at home is calculated by dividing the number of in-scope households with Internet access by the total number of in-scope households. The *Internet* is a world-wide public computer network. It provides access to a number of communication services including the World Wide Web and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only via a computer – it may also be by mobile phone, PDA, games machine, digital TV etc.). Access can be via a fixed or mobile network.	41.2 %
HH7	Proportion of individuals who used the Internet (from any location) in the last 12 months	The *proportion of individuals who used the Internet* is calculated by dividing the total number of in-scope individuals who used the Internet (from any location) in the last 12 months by the total number of in-scope individuals. The *Internet* is a world-wide public computer network. It provides access to a number of communication services including the World Wide Web and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only via a computer – it may also be by mobile phone, PDA, games machine, digital TV etc.). Access can be via a fixed or mobile network	44.4%
HH8	Location of individual use of the Internet in the last 12 months	The proportion of individuals who used the Internet at each location can be calculated as either: the proportion of in-scope individuals or the proportion of Internet users, using the Internet at each location. Access to the Internet is not assumed to be only via a computer – it may also be by mobile phone, PDA, games machine, digital TV etc. Individuals should be asked about all locations of Internet use (that is, the survey question used by countries should specify multiple responses). Note that, except for mobile access, the locations are associated with the equipment used e.g. a PC installed at work or at an Internet café.	
	Home		86.4 %
	Work	Where a person's workplace is located at his/her home, then he/she would answer yes to the home category only.	26.2 %
	Place of education	For students. Teachers (and others who work at a place of education) would report 'work' as the place of Internet use.	10 %
	Another person's home	The home of a friend, relative or neighbour.	19.6 %
	Community Internet access facility	Internet use at community facilities such as public libraries, publicly provided Internet kiosks, non-commercial telecentres, digital community centres, post offices and other government agencies; access is typically free and is available to the general public.	1.2 %
	Commercial Internet access facility	Internet use at publicly available commercial facilities such as Internet or cyber cafés, hotels, airports etc, where access is typically paid (i.e. not free of charge).	9.3 %

	Any place via a mobile cellular telephone	Use of the Internet at any location via a mobile cellular telephone (including handheld devices with mobile phone functionality).	29.2%
	Any place via other mobile/wireless access devices	Use of the Internet at any location via other mobile access devices, e.g. a laptop computer or handheld device that uses wireless access (at a WiFi 'hotspot') or a laptop computer connected to a mobile telecommunications network.	10.2 %
HH9	Internet activities undertaken by individuals in the last 12 months	The proportion of individuals who undertook each activity can be calculated as either: the proportion of in-scope individuals or the proportion of Internet users who undertook each activity.	
	Getting information about goods or services		58.5%
	Getting information related to health or health services	Includes information on injury, disease, nutrition and improving health generally.	56.4%
	Getting information from general government organizations	*General government organizations* should be consistent with the SNA93 (2008 revision) concept of general government. According to the SNA "... the principal functions of government are to assume responsibility for the provision of goods and services to the community or to individual households and to finance their provision out of taxation or other incomes; to redistribute income and wealth by means of transfers; and to engage in non-market production." (General) government organizations include central, state and local government units.	78.1 %
	Interacting with general government organizations	Includes downloading/requesting forms, completing/lodging forms on line, making on-line payments and purchasing from government organizations. It excludes getting information from government organizations. *General government organizations* should be consistent with the SNA93 (2008 revision) concept of general government. According to the SNA "... the principal functions of government are to assume responsibility for the provision of goods and services to the community or to individual households and to finance their provision out of taxation or other incomes; to redistribute income and wealth by means of transfers; and to engage in non-market production." (General) government organizations include central, state and local government units.	46.5 %
	Sending or receiving e-mail		68.6 %
	Telephoning over the Internet/VoIP	The use of Skype, iTalk, etc. Includes video calls (via webcam).	64.0 %
	Posting information or instant messaging	Posting messages or other information to chat sites, blogs, newsgroups, on-line discussion forums and similar; use of instant messaging.	69.8 %

	Purchasing or ordering goods or services	Refers to purchase orders placed via the Internet whether or not payment was made on line. Orders that were cancelled or not completed are excluded. Includes purchasing of products such as music, travel and accommodation via the Internet.	59.2 %
	Internet banking	Includes electronic transactions with a bank for payment, transfers, etc. or for looking up account information. Excludes electronic transactions via the Internet for other types of financial services such as share purchases, financial services and insurance.	63.2 %
	Education or learning activities	Refers to formal learning activities such as study associated with school or tertiary education courses as well as distance education involving on-line activities. (A more narrow interpretation is likely to be less meaningful as it could include a range of activities such as using the Internet to search for information.)	65.4 %
	Playing or downloading video games of computer games	Includes file sharing games and playing games on line, either paid or free of charge.	N/A
	Downloading movies, images, music, watching TV or video, or listening to radio or music	Includes file sharing and using web radio or web television, either paid or free of charge.	N/A
	Downloading software	Includes the downloading of patches and upgrades, either paid or free of charge.	26.2 %
	Reading or downloading on-line newspapers or magazines, electronic books	Includes accessing news websites, either paid or free of charge. Includes subscriptions to on-line news services.	63.7 %
HH10	Proportion of individuals who use a mobile cellular telephone	The *proportion of individuals with use of a mobile cellular telephone* is calculated by dividing the total number of in-scope individuals with use of a mobile cellular telephone by the total number of in scope individuals. A *mobile cellular telephone* refers to a portable telephone subscribing to a public mobile telephone service using cellular technology, which provides access to the PSTN. This includes analogue and digital cellular systems, as well as IMT-2000 (3G). Users of both post-paid subscriptions and pre-paid accounts are included. *Use of a mobile cellular telephone* does not mean that the telephone is owned or paid for by the person but should be reasonably available through work, a friend or family member, etc. It excludes occasional use, for instance, borrowing a mobile phone to make a call.	85.3 %

HH11	Proportion of households with access to the Internet by type of access (narrowband, broadband (fixed, mobile))	This indicator should be calculated as the proportion of in-scope households with Internet access that use each type of access service, for instance, the proportion of households with Internet access that use a broadband service as their means of access. It is expected that countries will collect data at a finer level than shown here. The categories chosen by countries should allow aggregation to total narrowband and total broadband, as well as to fixed and mobile broadband, as defined below. As households can use more than one type of access service, multiple responses are possible.	
	Narrowband	*Narrowband includes analogue modem (dial-up via standard phone line), ISDN (Integrated Services Digital Network), DSL at speeds below 256 kbit/s, and mobile phone and other forms of access with an advertised download speed of less than 256 kbit/s.* Note that narrowband mobile phone access services include CDMA 1x (Release 0), GPRS, WAP and i-mode.	7.8 %
	Fixed broadband	Fixed broadband refers to technologies at speeds of at least 256 kbit/s, in one or both directions, such as DSL (Digital Subscriber Line), cable modem, high-speed leased lines, fibre-to-the-home, powerline, satellite, fixed wireless, Wireless Local Area Network and WiMAX.	31 %
	Mobile broadband	Mobile broadband refers to technologies at speeds of at least 256 kbit/s in one or both directions, such us Wideband CDMA (W-CDMA), known as Universal Mobile Telecommunications System (UMTS) in Europe; Highspeed Downlink Packet Access (HSDPA), complemented by High-Speed Uplink Packet Access (HSUPA); CDMA2000 1xEV-DO and CDMA 2000 1xEV-DV. Access can be via any device (handheld computer, laptop or mobile cellular telephone etc.).	N/A
HH12	Frequency of individual use of the Internet in the last 12 months (from any location)	The frequency of individual use of the Internet can be calculated as either: the proportion of in-scope individuals or the proportion of Internet users, using the Internet with each frequency. It is recommended that countries collect this information in respect of a typical period; therefore, respondents should ignore weekends (if they only use the Internet at work) and breaks from their usual routine, such as holidays. Access to the Internet is not assumed to be only via a computer – it may also be by mobile phone, PDA, games machine, digital TV etc.	
	At least once a day	Once a working day for respondents who only (or most frequently) use the Internet from work	80.4 %

	At least once a week but not every day		12.4 %
	Less than once a week		7.2 %
Reference indicator			
HHR1	Proportion of households with electricity	Electricity is not an ICT commodity, but is an important prerequisite for using many ICTs. It is therefore included in the core list as a reference indicator. Electricity access may be enabled by a grid/mains connection, or by power generated locally (including at the dwelling). Local power includes electricity generated by a fuel-powered generator, or from renewable resources such as wind, water or solar. It excludes sole use of energy storage devices, such as batteries (though these may be used to store electricity from other sources).	99.9 %

In 2007, the International Telecommunication Union (ITU) initiated the process of creating a single Index which can be utilized in measuring the development of information society, the so-called ICT Development Index (IDI), which serves as a substitute for the previous two, namely the Digital Opportunity Index (DOI) and the ICT Opportunity Index (ICT-OI). This single IDI Index serves as a benchmarking tool for measuring:

- **the development of the ICT market in UN Member States**
- **digital divide between the developed and developing countries**
- **developmental potential of the ICT market**

This Index combines 11 indicators divided into three sub-groups:

1 ICT Readiness (infrastructure and access)

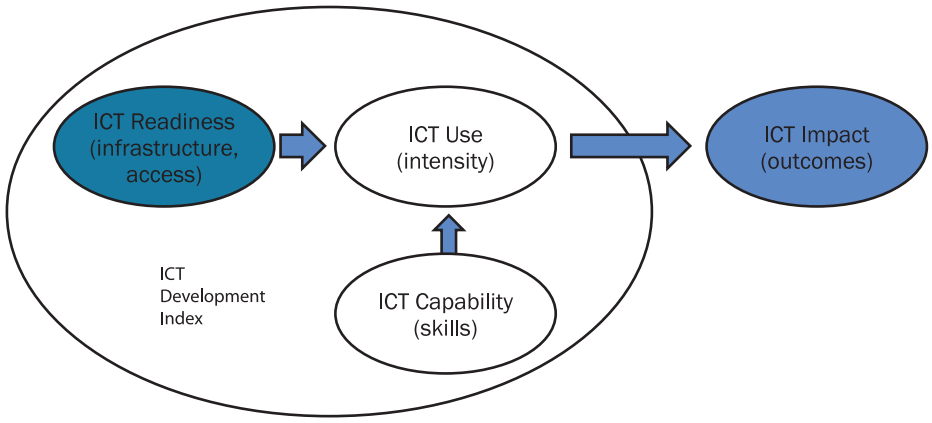
2 ICT use (primarily by individuals, but also households and undertakings) and the intensity of use

3 ICT Capability (skills necessary for the effective use of ICTs)

Given the fact that these three sub-groups of ICT development cannot be monitored by means of a single index, there is a necessity for the establishment of a single composite index for monitoring the

development of information society in each country. Infrastructure, developed to meet the needs of end-users as well as an appropriate level of education, act as prerequisites for the use of ICTs and evolution towards an information society (Figure 12).

Figure 12. IDI Structure
Source: Measuring the Information Society - The ICT Development Index, ITU



The list of 11 indicators is given in Table 8, along with reference (normalized) values prescribed by the ITU, sub-indices value and IDI Index value for the Republic of Serbia in 2011. The values of the sub-indices were calculated by normalizing the 11 indicators by means of reference values. The final value of IDI Index is calculated as a sum of sub-indices multiplied by weight coefficients. The ICT Access and ICT use sub-indices are given 40 per cent weight each, whereas the skill sub-index is given 20 per cent weight.

The value of IDI Index for the Republic of Serbia in 2011 amounted to 5.47, which is a significant growth compared with 4.23 in 2008, 4.80 in 2009 and 5.10 in 2010. Considering the ITU data for the previous years, it may be anticipated that Serbia will secure a place among the first 50 countries on the list based on the IDI Index value.

Figure 13 illustrates normalized values of 11 indicators with values ranging from 0 to 1, whereby 1 represents the maximum value of an indicator. The fact that ICT access indicators (a to e) have significantly higher values than ICT use indicators (f to h) is quite apparent and serves as an il-

Table 8. 2011 IDI for the Republic of Serbia — Source: RATEL

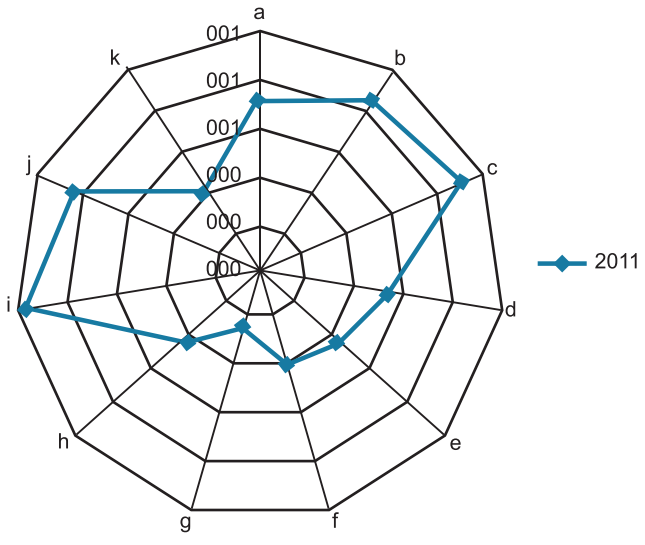
	Indicator	ITU ideal value	Value for Serbia in 2011
ICT Access			
a	Fixed telephone lines per 100 inhabitants	60	42.56
b	Mobile cellular telephone subscriptions per 100 inhabitants	170	142.99
c	International Internet bandwidth per Internet user	280,377	98,260
d	Proportion of households with a computer	100	52.1
e	Proportion of households with Internet access at home	100	41.2
ICT Use			
f	Internet users per 100 inhabitants	100	37.59
g	Fixed broadband Internet subscriptions per 100 inhabitants	60	12.85
h	Mobile broadband subscriptions per 100 inhabitants	100	39.32
ICT Skills			
i	Adult literary rate	100	96.6
j	Secondary gross enrolment ratio	100	82.3
k	Tertiary gross enrolment ratio	100	41.1
ICT Access – Normalized values		Formula	
z1	Fixed telephone lines per 100 inhabitants	a/60	0.71
z2	Mobile cellular telephone subscriptions per 100 inhabitants	b/170	0.84
z3	International Internet bandwidth per Internet user	log(c)/5.45	0.92
z4	Proportion of households with a computer	d/100	0.52
z5	Proportion of households with Internet access at home	e/100	0.41

ICT Use – Normalized values		Formula	
z6	Internet users per 100 inhabitants	f/100	0.38
z7	Fixed broadband Internet subscriptions per 100 inhabitants	g/60	0.21
z8	Mobile broadband subscriptions per 100 inhabitants	h/100	0.39
ICT Skills – Normalized values		Formula	
z9	Adult literary rate	i/100	0.97
z10	Secondary gross enrolment ratio	j/100	0.823
z11	Tertiary gross enrolment ratio	k/100	0.411
L	ICT Access – Sub-index	y1+y2+y3+y4+y5	0.680
y1	Fixed telephone lines per 100 inhabitants	z1*0.2	0.14
y2	Mobile cellular telephone subscriptions per 100 inhabitants	z2*0.2	0.17
y3	International Internet bandwidth per Internet user	z3*0.2	0.18
y4	Proportion of households with a computer	z4*0.2	0.10
y5	Proportion of households with Internet access at home	z5*0.2	0.08
M	ICT Use – Sub-index	y6+y7+y8	0.324
y6	Internet users per 100 inhabitants	z6*0.33	0.12
y7	Fixed broadband Internet subscriptions per 100 inhabitants	z7*0.33	0.07
y8	Mobile broadband subscriptions per 100 inhabitants	z8*0.33	0.13
N	ICT Skills – Sub-index	y9+y10+y11	0.726
y9	Adult literary rate	z9*0.33	0.32

y10	Secondary gross enrolment ratio	z10*0.33	0.27
y11	Tertiary gross enrolment ratio	z11*0.33	0.14
IDI	ICT DEVELOPMENT INDEX	((L*0.4)+(M*0.4)+(N*0.2))*10	5.47

lustration of the disparity between the existing telecommunications infrastructure capacity and the use of such capacity in terms of telecommunications services transmitted by such infrastructure in Serbia, as is the case with the use of broadband Internet services. The value of ICT skills indicators (i to k) is satisfactory.

Figure 13. Graphical Representation of 11 Indicators (normalized values) Source: RATEL



3. PUBLIC FIXED TELECOMMUNICATIONS NETWORKS AND SERVICES

In 2010 the following operators were holders of the licence for public fixed telecommunications network and services:

- Telecommunications Company ''Telekom Srbija'' Joint Stock. Co. – licence to build, own and operate a public fixed telecommunications network and provide public fixed telecommunications network services provision – licence replaced in 2006;
- Telecommunications Company ''Telekom Srbija'' Joint Stock. Co. – licence for public fixed wireless access (FWA) network in 411.875-418.125/ 421.875-428.125 MHz frequency bands and voice services, data transmission services and simultaneous voice and data transmission – Licence issued in 2009;
- Media Works, Ltd. which changed the name in Orion telekom, Ltd. - licence for public fixed wireless access (FWA) network in 411.875-418.125/ 421.875-428.125 MHz frequency bands and voice services, data transmission services and simultaneous voice and data transmission – licence issued in 2009;
- Telenor, Ltd. – licence for public fixed telecommunications network and services. The operator was awarded the licence in January 2010.

In 2011, Telekom Srbija, Joint Stock. Co. was the biggest active operator of the fixed telecommunications network, its business activities being the most important segment of the fixed telephony market, both in financial and technical terms. In addition to the Serbian market, Telekom Srbija is also present in Republic of Srpska and Montenegro. In 2011, upon the decision by the Telekom Srbija, Joint Stock. Co. shareholders meeting, the procedure for concluding a sales agreement in order to purchase all shares from O.T.E. and the contract on own shares acquisition was initiated. On 25 January 2012, Telekom Srbija, Joint Stock. Co. acquired the ownership of the 20% of its original capital previously owned by O.T.E. Telekom

Srbija, Joint Stock. Co. remained an SMP operator and the decisions stipulating the conditions for service provisions were adopted in late 2011.

It is owned by two shareholders: the Government of the Republic of Serbia (80%) and OTE, Greece (20%). It still has the status of an SMP operator and, consequently it is required to apply a special tariff regime for the public fixed telephone network services and cost-accounting for telecommunications service pricing. Telekom Srbija, Joint Stock. Co. is required to observe the terms and conditions laid down in the Rules on the application of the cost-accounting principle, separate accounts and reporting of a telecommunications operator with significant market power and the provisions of the Law on Telecommunications (Official Gazette of RS, nos. 44/03, 36/06 and 50/09-US). Telekom Srbija Joint Stock. Co. provided services via public fixed telecommunications network and public FWA network. Operator Orion telekom provided services via public FWA network began, whereas Telenor began with the commercial provision of public fixed telecom networks services in 2011, pursuant to the terms and conditions from the licence.

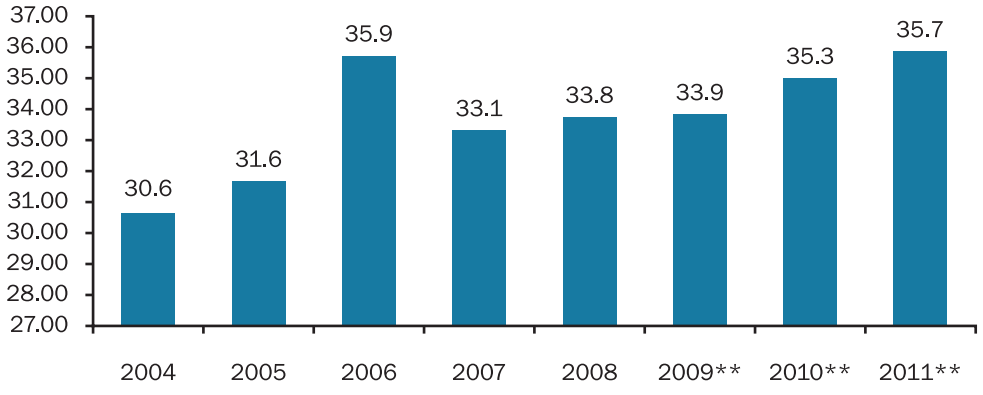
The total revenue from fixed telephone services provided by all operators (Telekom Srbija Joint Stock Co., Orion telekom and Telenor Ltd.) in the territory of the Republic of Serbia in 2011 amounted to 35.7 billion dinars, where the share of services provided via FWA is 760 million. The revenues from the international traffic in 2011 amounted to 8.1 billion dinars, making the total revenue 43.8 billion dinars. The share of revenues from CDMA in the total revenues from fixed telephone service provision in 2011 equals 1.7%.

The investments made in the fixed telephony in 2011 amounted to 5.8 billion dinars, which is by 2 billion dinars or 25% less compared with the investments in the previous year.

The largest share in the total revenues goes to the national traffic, amounting to around 15.5 billion dinars and accounting for 35% of total revenues from the fixed telephone services, a share that is smaller compared to the 41% in 2010. The biggest increase of share in the total revenues from fixed network concerns the telephone subscription charge with 34% in 2011.

Observing the types of services making up the total revenues from the fixed telephone services, the revenues from subscription charge, which increased by 16%, showed the biggest year-

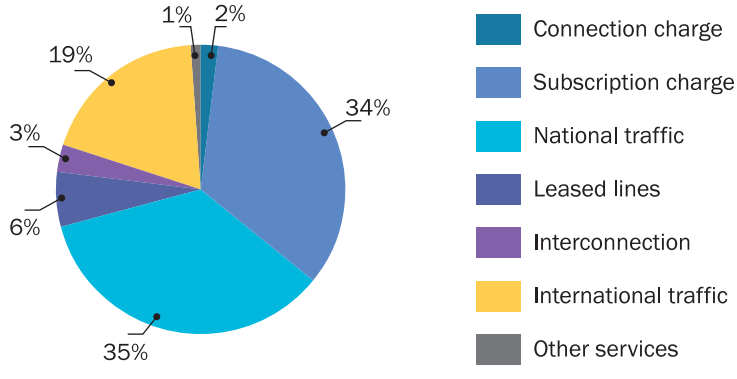
Figure 14. Growth Tendency of Revenues from Fixed Telephone Services (in billions of RSD)* Source: RATEL



* Revenues from fixed telephone services in the territory of the Republic of Serbia including revenues from CDMA network

** Revenues from wholesale Internet services are illustrated within the chapter entitled Internet Services and are therefore excluded from revenues from fixed telephone services

Figure 15. Distribution of Revenues from Fixed Telephone Services in 2011 Source: RATEL

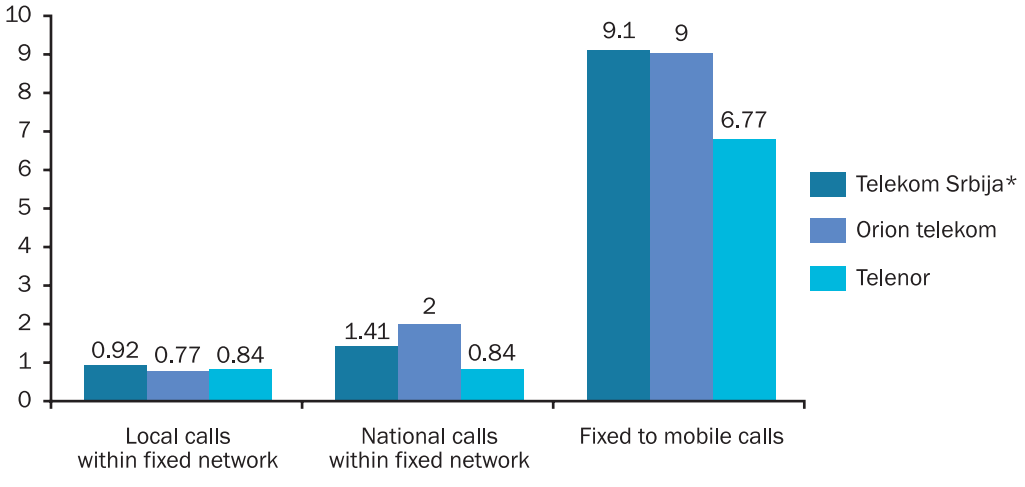


on-year growth, mainly owing to the increase in the amount of charge from RSD388 to RSD430, excluding VAT. RATEL adopted Decision ref. 1-02-052-13/11-3 of 16 June 2011 on approving the modification of monthly subscription charge of Telekom Srbija Joint Stock Co., based on the Regulatory Report on Cost-Accounting Application submitted to RATEL by Telekom Srbija Joint

Stock Co. The Decision stipulates for 300 free of charge call-units to be given with the monthly subscription, instead of the previous 150. The Decision also approved the modification of the local and national call charge, and the levelling of business user charges with the residential user charges. The revenues from the national traffic dropped by 11% due to the decrease in the traffic volume and also as a result of the reduction in the business user charges.

Local and national per-minute rates of each operator are given in Figure 16. With the Decision of 16 June 2011, local call per minute tariffs of Telekom Srbija Joint Stock Co. were increased from 0.4043 to 0.92 dinars and national call per minute tariffs from 2.0215 to 1.41 dinars, excluding VAT. The above rates apply to peak traffic, whereas off-peak traffic rates are 50% lower. The prices of international calls remained unchanged, as shown in Figure 17.

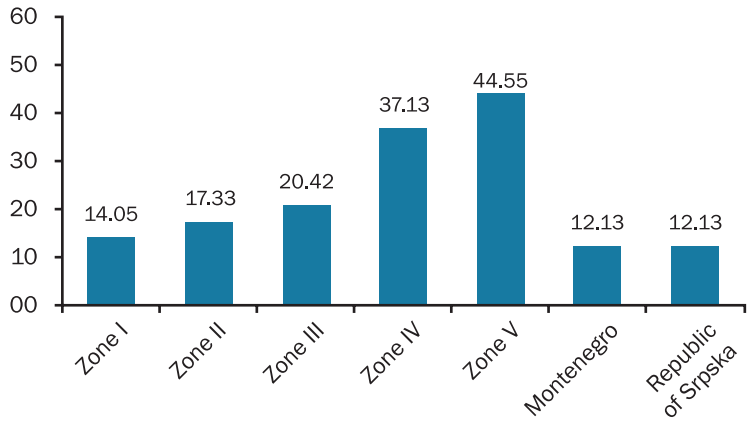
Figure 16. Prices of International Telephone Services in 2011*, VAT Excluded (RSD/min)
Source: RATEL



*The Telekom Srbija Joint Stock Co. rates apply to peak traffic, whereas off-peak traffic rates are 50% lower.

The connection charge of Telekom Srbija Joint Stock Co. remained unchanged, in the amount of 5 000 dinars for residential and 10 000 dinars for business users, excluding VAT and the CDMA

Figure 17. Prices of International Telephone Services in 2011*, VAT Excluded (RSD/min)
Source: RATEL



*List of countries categorized by zones is given at the following website
http://www.open.telekom.rs/home/Content.aspx?temp=0&sid=126&id=694
The prices apply to Telekom Srbija Joint Stock Co only.
Telenor and Orion have not provided data on international traffic rates.

connection charge was 12 000 dinars. As for Orion telekom, the connection charge was 7 000 dinars for residential users and 70 euros for business users, excluding VAT. Telnor provided the price for residential users of 50 847 dinars, without VAT.

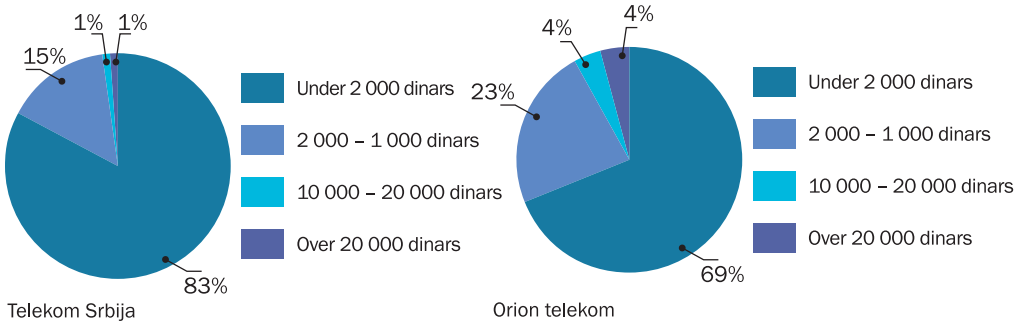
The highest number of Telekom Srbija Joint Stock Co. residential users (around 54%) had monthly bills for fixed-line services ranging between 500 and 1,000 dinars, whereas the number of residential users paying less than 500 dinars makes 19% of the total number of subscribers. There were 21% of residential users with monthly bills ranging between 1000 and 2000 dinars and only 6% with bills over 2000 dinars (Figure 18). The distribution of Orion telekom subscribers is somewhat different, with 43% of subscribers paying between 500 and 1000 dinars, 41% between 1000 and 2000, and a bit less than 20% with bills over 2000 dinars, while the number of users with bills below 500 dinars is rather insignificant.

As for business users in 2011, Telekom Srbija Joint Stock Co., had as many as 81% of subscribers who paid up to 2,000 dinars monthly for fixed-line services, while Orion telekom had 66% of such users. The majority of the remaining business users of both operators have bills ranging between 2000 and 10000 dinars, while the number of users with higher bills is rather insignificant with both operators (Figure 19).

The average monthly bill of Telekom Srbija Joint Stock Co. residential users in 2011 was reduced by 1.5% dropping from RSD1004 to RSD989, mainly due to reduced traffic volume. The average monthly bill of Telekom Srbija Joint Stock Co. for business users in 2011 was reduced by 13% dropping from RSD2291 to RSD1996, due to levelled per-minute call rates for residential and business users. Average bills of Telekom Srbija Joint Stock Co. CDMA network users were similar to the above.

The average monthly bill of Orion telekom residential users in 2011 was RSD1382 and the average bill of the business users was RSD6184. The average monthly bill of Telenor business users was RSD84228.

Figure 18. Distribution of Residential Subscribers According to Monthly Bills in 2011 Source: RATEL



The number of main lines decreased compared with 2010, amounting to 3.03 million. Residential users still prevail with a 90% share in the total number of users, whereas the number of party-lines was reduced by 35%. The digitalization rate rose to 98.54% in 2011.

Figure 19. Distribution of Business Subscribers According to Monthly Bills in 2011 Source: RATEL

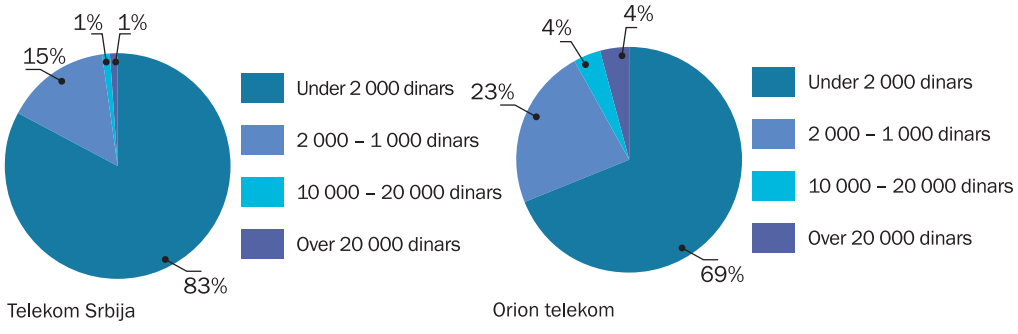


Figure 20. Number of Main Lines in Fixed Network (millions) Source: RATEL

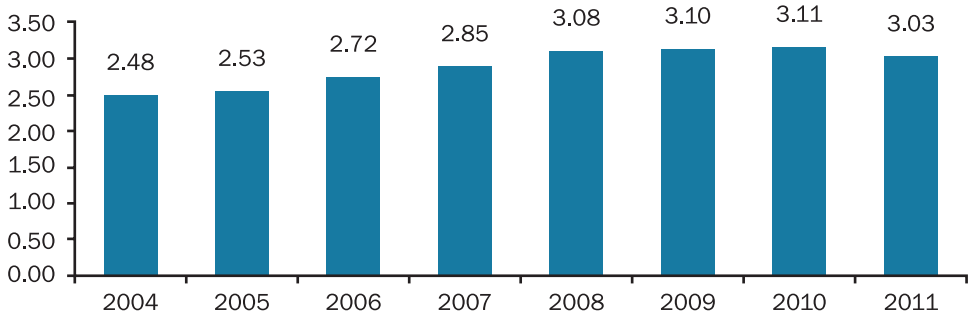
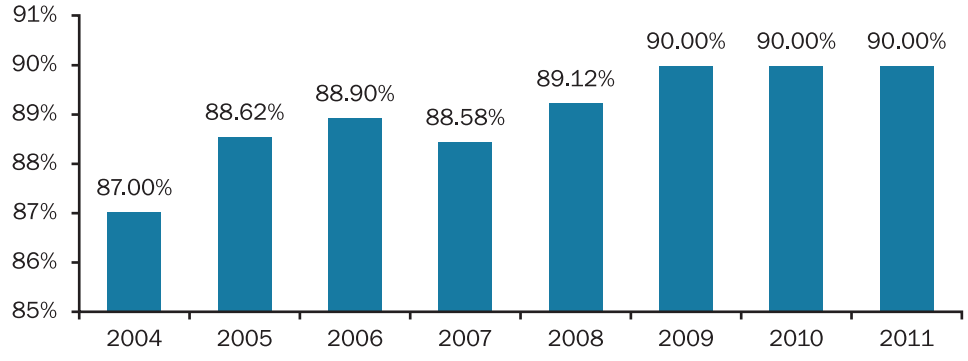
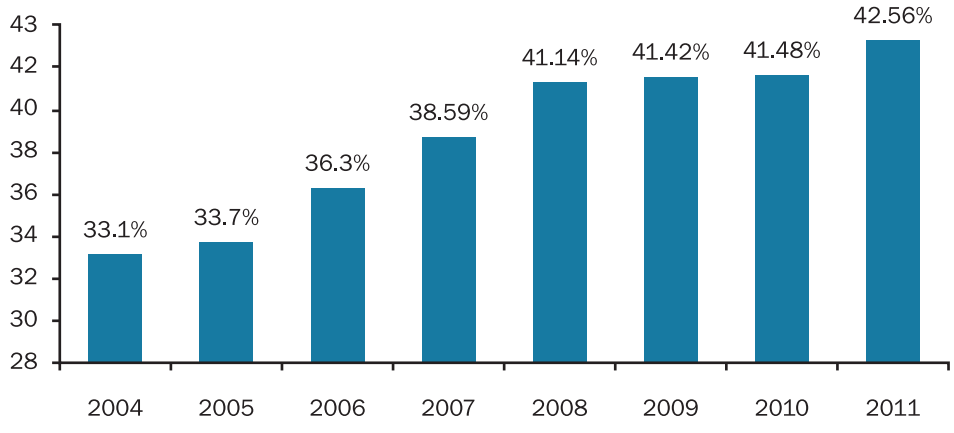


Figure 21. Share of Residential Users in the Total Number of Fixed-Line Subscribers Source: RATEL



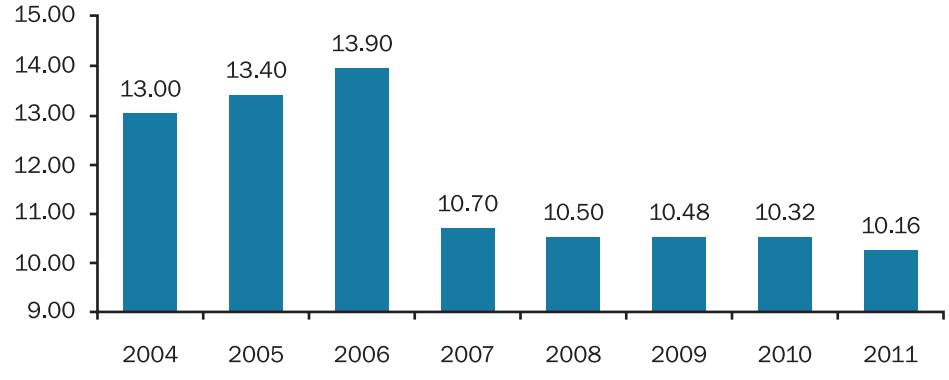
Fixed penetration rate was 42.56%.

Figure 22. Fixed penetration rate (%) Source: RATEL



In 2011 the number of public payphones dropped by 159, amounting to 10 162.

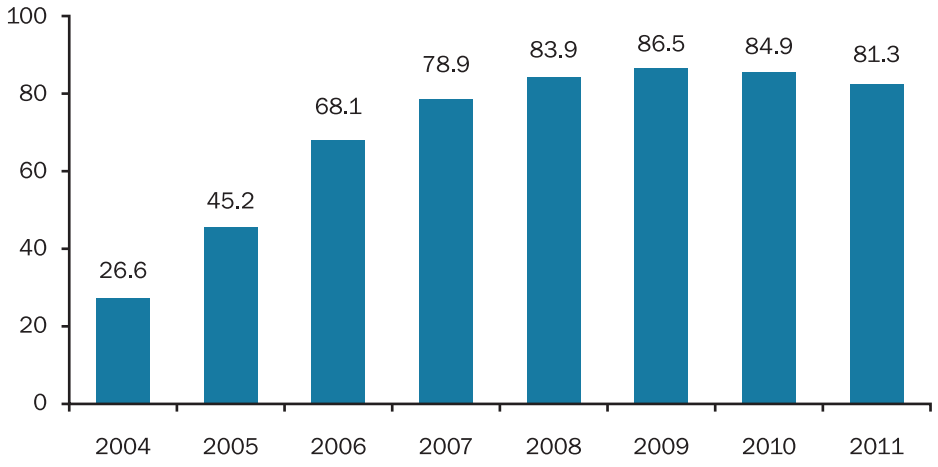
Figure 23. Number of Public Payphones (thousands) Source: RATEL



The breakdown of the number of ISDN connections in the period from 2005 to 2011 is given in Figure 24 below. The number of ISDN subscribers in 2011 was 81.3 thousand. Around 97% of subscribers have a basic rate access, whereas other users have primary

rate access. Residential users make up 64% of basic rate subscribers, whereas the rest are business users. Primary rate access is mainly used by business users. Even though this technology was well advanced in comparison with the dial-up connection at the time it had been first introduced, current modern technologies as well as ADSL connections are likely to limit the further growth of ISDN connections, as reflected by the drop trend in the number of ISDN users.

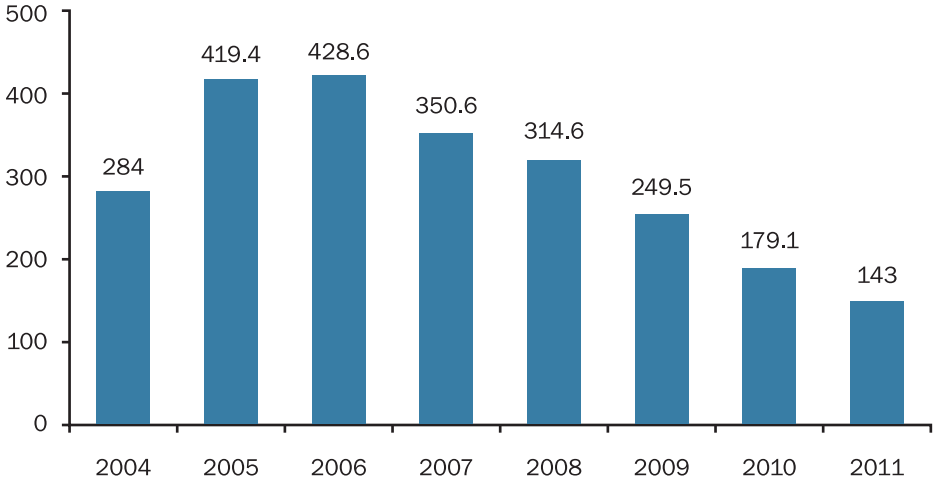
Figure 24. Total Number of ISDN Subscribers (thousands) Source: RATEL



In 2011, the number of unmet requests for new fixed-line connections was around 143 thousand, this being a decrease of 20% compared with 2010. The number of malfunctions per 100 lines in 2011 was 25, compared with 33 recorded in 2010. The percentage of malfunctions repaired within 24 hours was 81%, which is an increase in respect to 67% in the previous year.

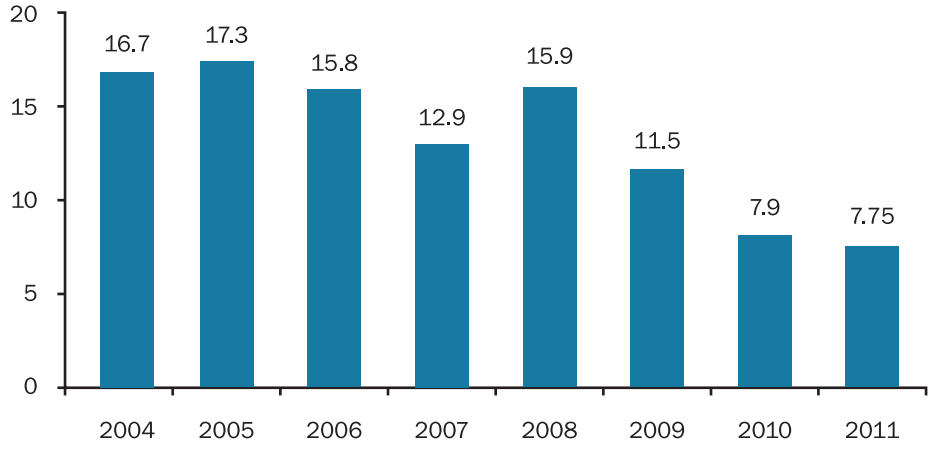
The total fixed network traffic in 2011 is estimated to 7.75 billion minutes of national traffic and 850 million minutes of international traffic, which is an overall decrease of 2% compared with 2010. As shown in Figure 26, the traffic volume varied considerably in the observed period, showing a decreasing tendency, primarily due to other types of services being offered, such as mobile network, electronic messaging or VoIP, etc.

Figure 25. Number of Requests for New Fixed-Line Connections (thousands) Source: RATEL



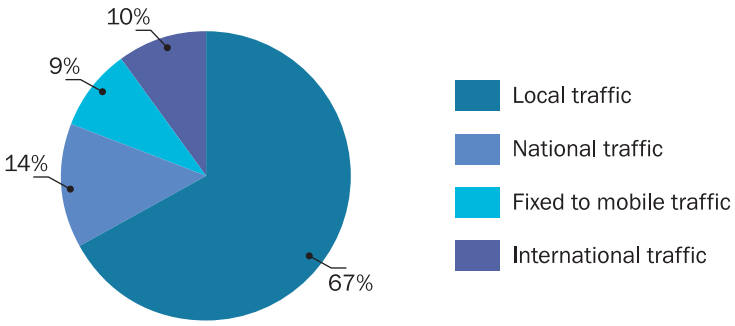
The average call duration of 3.04 minutes remained practically unchanged.

Figure 26. Total Fixed Network Traffic (in billions of minutes) Source: RATEL



The total number of minutes of fixed network traffic is estimated on the basis of data from the exchanges where it is possible to register the consumed call-units or minutes. Such data are extrapolated according to the total number of users in the network. Out of the total fixed network traffic, 74% was local traffic.

Figure 27. Distribution of Fixed Network Traffic in 2011 Source: RATEL



Compared with the previous year, the share of local traffic was 67%, the share of long-distance traffic remained 14%. The volume of fixed-to-mobile traffic continued to decrease, whereas its share in the total traffic increased to 9%.

International traffic makes up around 10% of the total fixed network traffic and it was decreased both in volume and share in the total traffic. This is a direct result of the advent of new technologies and operators providing services at an international level.

There were no significant changes in the number of VoIP operators in 2010. There were 80 000 registered users and 23.03 million of minutes of traffic, where a 50% share goes to international outgoing traffic and 50% to the international transit. The volume of the outgoing international traffic realized through VoIP operators was 100 times smaller than outgoing international traffic realized through the capacities of Telekom Srbija.

There were around 87 000 users of VoIP operators registered in 2011, which is an increase of 8.75% compared with the previous year. 82% of the total 63 million minutes of traffic

went the international transit. The traffic volume was increased by over 170% compared with the previous year.

4. PUBLIC MOBILE TELECOMMUNICATIONS NETWORKS AND SERVICES

There were three mobile operators in 2011 in the mobile market in the Republic of Serbia:

- **Telecommunications Company Telekom Srbija Joint Stock Co. - Mobilna telefonija Srbije MTS**, owned by the Republic of Serbia – the Government of the Republic of Serbia (80%) and by Telekom Srbija[1] (licence replaced on 01. 08. 2006)
- **Telenor Ltd., Belgrade**, 100% owned by Telenor A/S, Denmark, (licence issued on 01. 09. 2006)
- **Vip mobile Ltd**. (member of Mobilkom Austria Group), 100% in the ownership of Mobilkom CEE Beteiligungsverwaltung GmbH, Austria (licence issued on 01. 12. 2006)

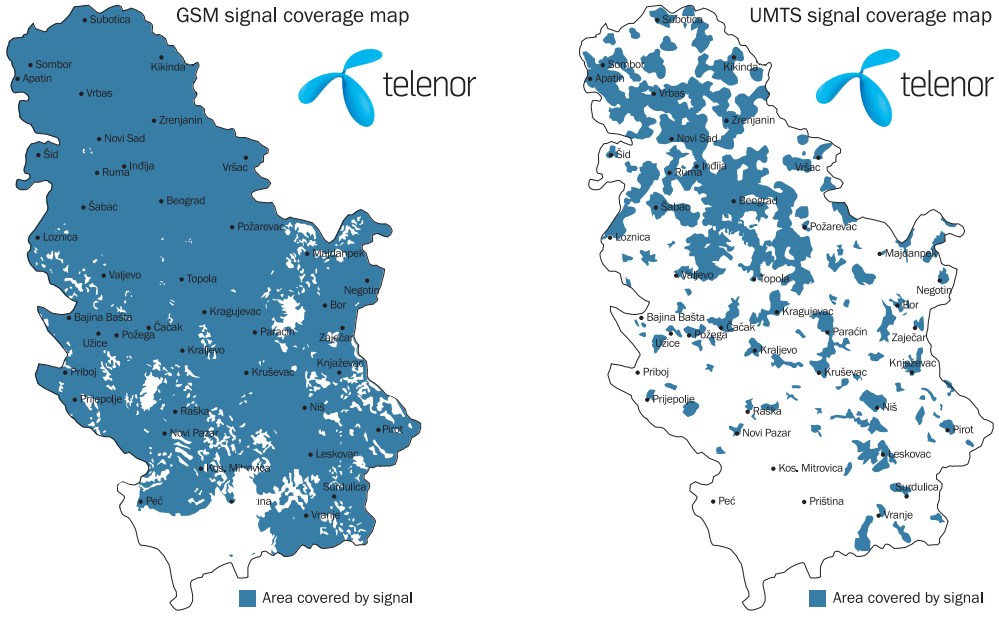
All three operators were granted licences for public mobile telecommunications networks and public mobile telecommunications network services in accordance with GSM/GSM1800 and UMTS/IMT-2000 standards, issued by RATEL. The licences were issued for the territory of the Republic of Serbia, for a period of 10 years, which, upon expiration, may be extended for another 10 years without a special request from the operator, provided the requirements under the licence are fulfilled.

The Norwegian company Telenor has been present in the Serbian telecom market since 31 July 2006, when they bought the company Mobi63, through a bidding procedure, making the biggest direct foreign investment in Serbia so far.

Telenor Ltd. is a part of Telenor Group, present in 11 countries across Europe and Asia and another 19 countries through ownership in VimpelCom. The mobile operators from Telenor Group present in the neighbouring countries are Telenor Hungary (ex Panon) and Telenor Montenegro (ex Promonte). In 2007 Telenor began with the commercial use of the UMTS network, enabling video calls and additional services based on high-speed data transmission. In 2011, Telenor built 219 new base stations.

[1] Telekom Srbija and Greek company OTE signed a Share Purchase Agreement on 30 December 2011 in Athens, whereby Telekom Srbija became the owner of the total share of OTE in Telekom Srbija. Consequently, in January 2012, Telkom Srbija took over the ownership of the 20% of shares. (Source: www.telekom.rs)

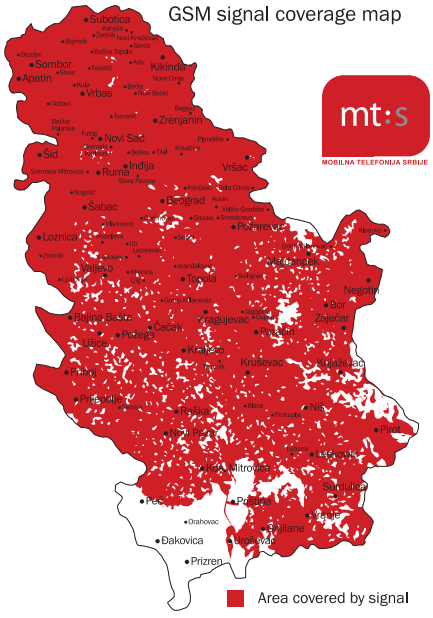
Figure 28. Mobile operator – Telenor Source: Telenor d.o.o.

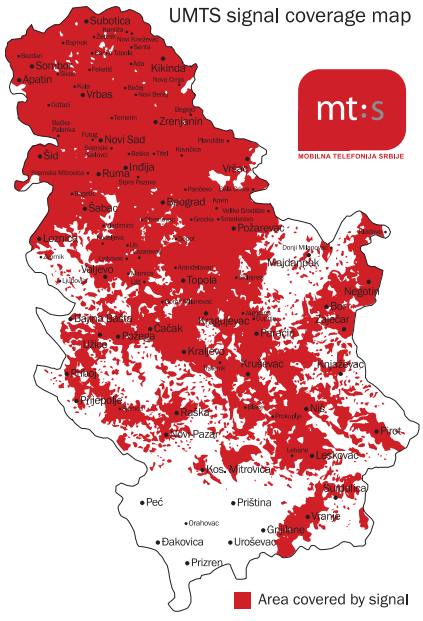


Official data	
Name	**Telenor Ltd.**
Head office	Belgrade
Ownership	100% Telenor A/S, Denmark
Percentage of territory covered by GSM network signal	85.67%
Percentage of population covered by GSM network signal	95.11%
Percentage of territory covered by UMTS network signal	27.68%
Percentage of population covered by UMTS network signal	65.33%
Number of base stations	3,306

MTS - Mobilna telefonija Srbije, as a branch of the Telecommunications Company Telekom Srbija Joint Stock Co., was founded in June 1997 and it began to operate through a GSM standard based network in August 1998.

Figure 29. Mobile operator – Telekom Srbija, Joint Stock Co. Source: Telekom Srbija





Official Data	
Name	**Telekom Srbija Joint Stock Co.**
Head office	Belgrade
Ownership	80% Republic of Serbia – Government of the Republic of Serbia, 20% Telekom Srbija
Percentage of territory covered by GSM network signal	88.2%
Percentage of population covered by GSM network signal	99.48%
Percentage of territory covered by UMTS network signal	70.57%
Percentage of population covered by UMTS network signal	84.91%
Number of base stations	3,063

In December 2006, MTS began with the commercial operation of a 3G network with the latest HSDPA technology. During 2008, the operation of the 3G network was intensified.

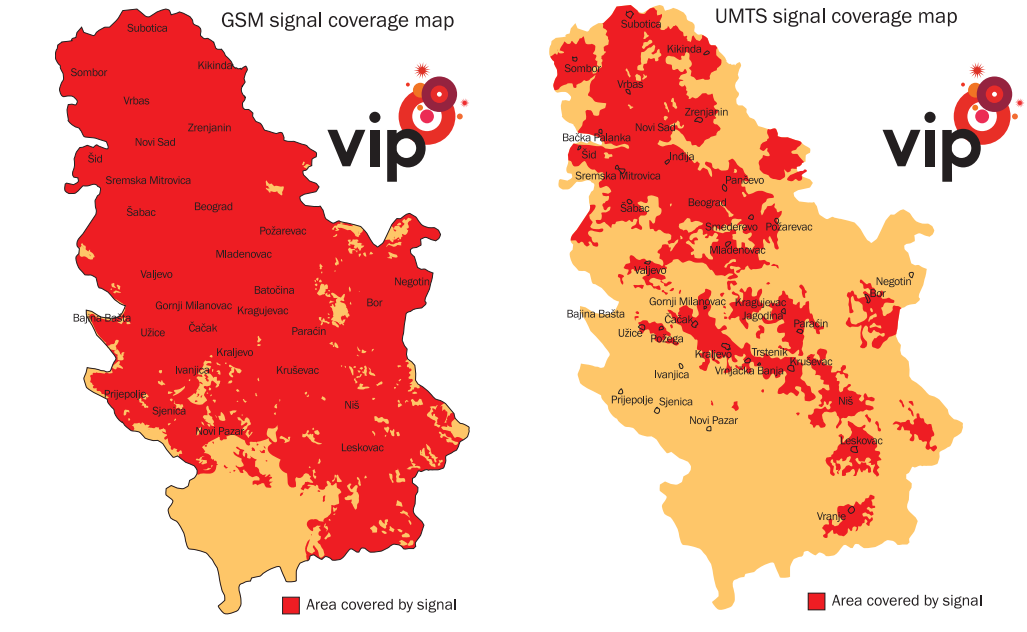
In addition to the Serbian market, Telekom Srbija is also present as a mobile operator in Republic of Srpska and Montenegro.

In 2011, Telekom Srbija Joint Stock Co. built 364 new base stations.

Vip mobile Ltd., the holder of the third mobile network licence, is a member of the Mobilkom Austria Group/Telekom Austria Group, present in eight European countries, including the following countries in the region: Croatia, Bulgaria and Macedonia.

In addition to 320 million euros paid for the licence, Mobilkom Austria made considerable investments in the development of infrastructure and hired a great number of professionals, thus making the biggest greenfield investment in Serbia so far.

Figure 30. Mobile operator – Vip mobile Source: VIP

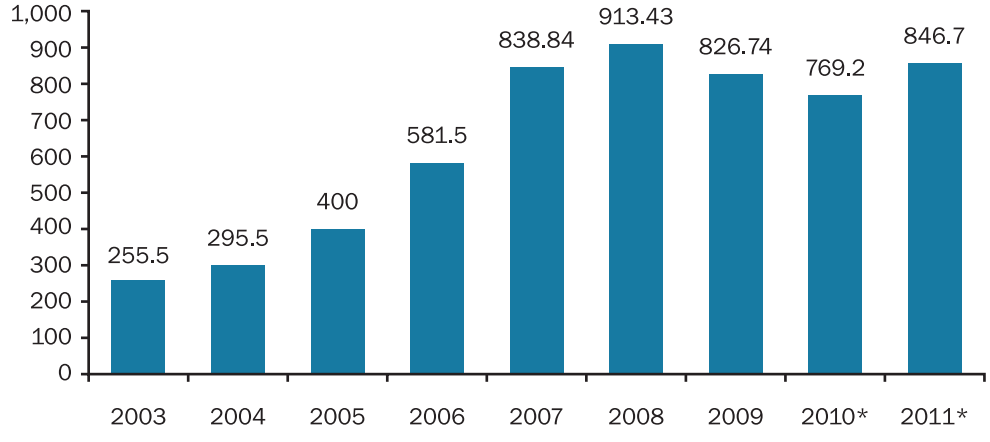


Official data	
Name	**Vip mobile Ltd.**
Head office	Belgrade
Ownership	100% Mobilkom CEE Beteiligungs-verwaltungs GmbH Austria
Percentage of territory covered by GSM network signal	83%
Percentage of population covered by GSM network signal	98.16%
Percentage of territory covered by UMTS network signal	23.28%
Percentage of population covered by UMTS network signal	60.64%
Number of base stations	1,961

In 2011, Vip mobile Ltd. built 294 new base stations and increased the GSM signal coverage and, in particular UMTS signal coverage, both in terms of territory and population.

The revenues from the mobile network services in 2011 amounted to 86.5 billion dinars or 846.7 million euros (Figure 31). The total investments in the mobile market were increased compared with the previous year, amounting to 14.16 billion dinars.

Figure 31. Total Revenues from Mobile Telephony (million euros) Source: RATEL

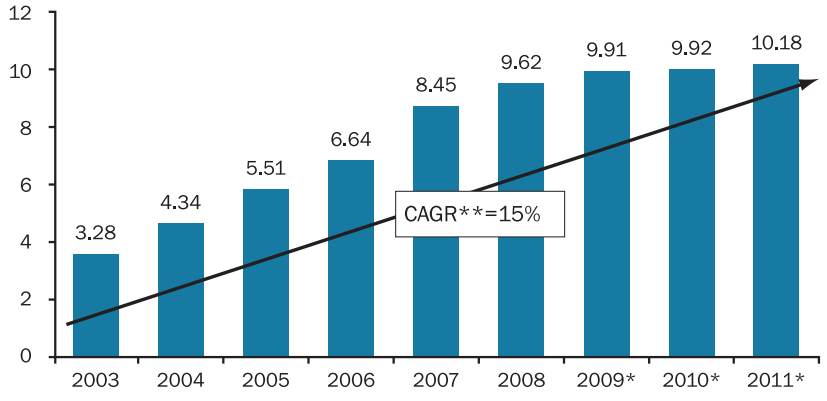


In the national currency (RSD), the revenues were increased by 8.7% in respect to the previous year when the total revenues from mobile telephony service amounted to 79.6 billion dinars, whereas the revenues in euros grew by 10.08%. However, it should be noted that the difference in the revenues in the two currencies is a consequence of the decrease in the average exchange rates for euro in 2011, compared with the previous year.

There was no significant increase in the total number of mobile users, which amounted to 10 182 023. The growth trend in the number of users has been slowing down year after year, further confirmed by the average annual growth rate for 2011. The average growth rate of the number of mobile users in the period 2003 – 2011 is 15%, which is positive although less than in the period 2003 - 2010 when it amounted to 17%.

10.18
million users

Figure 32. Total Number of Mobile Users (millions) Source: RATEL

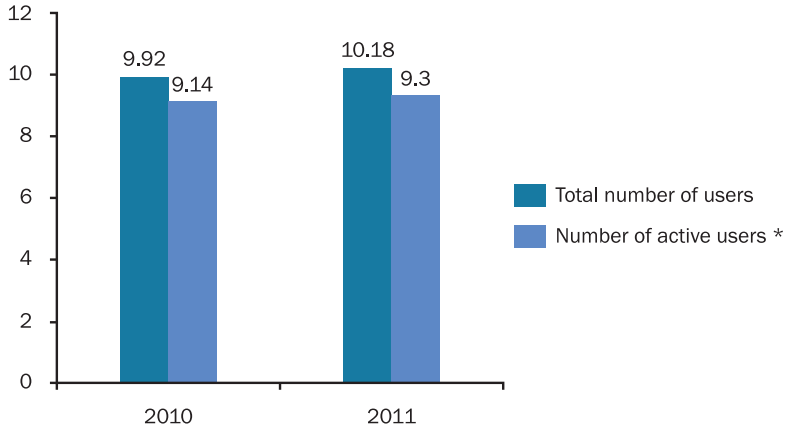


* total number of prepaid users is indicated for Telekom Srbija
** Compound Annual Growth Rate

If only active postpaid and prepaid users, with registered incoming and outgoing traffic in the last three months of 2011 (as defined by the ITU), are considered the number of users amounted to 9.3 million[2] (Figure 33). The number of users determined in this way, also indicates a growth trend.

[2] In this Overview the indicators were calculated according to the number of users of 10.18 million, unless differently specified.

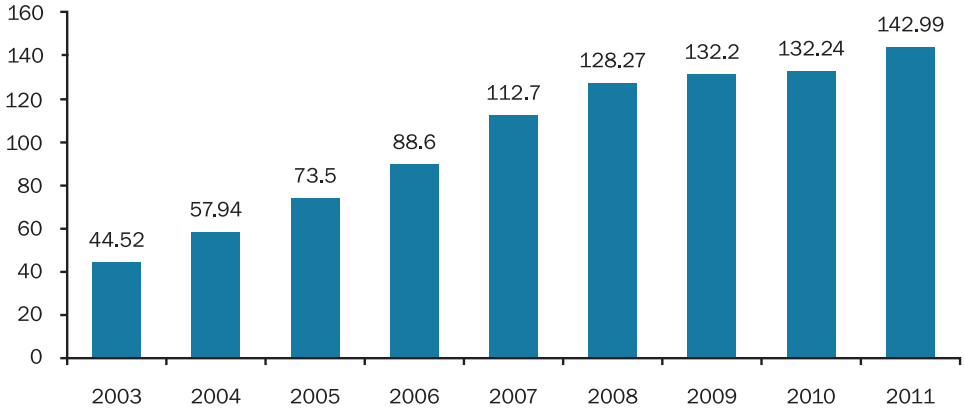
Figure 33. The Total Number and the Number of Active Mobile Users in Millions



* The number of active users includes postpaid and prepaid users active in the last three months, as defined by the ITU.

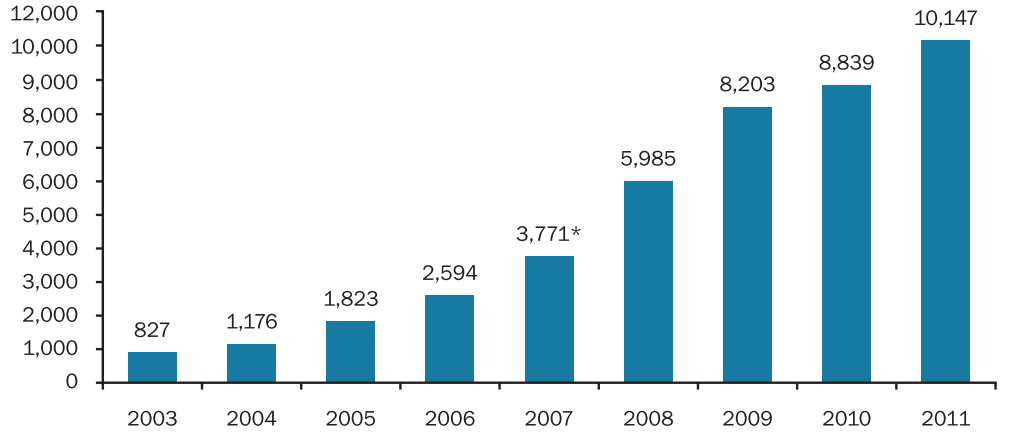
In the past five years the number of mobile network users was higher than the total number of inhabitants. The penetration rate in 2011 was 142.99%, which is an increase of 10.75% compared to the previous year, increase in the number of users and the decrease in the population according to the first results of the 2011 census.

Figure 34. Mobile Penetration Rate Source: RATEL



In 2011 the total outgoing traffic on the mobile network amounted to 10.15 billion minutes of calls, which is an increase of approximately 14.8% compared with the previous year. The annual average of traffic per user in 2011 was 997 minutes or approximately 2 minutes and 44 seconds daily, this being an increase of 11.9% in respect to 2010, when each user annually spent an average of 891 minutes talking on the cell phone.

Figure 35. Total Outgoing Traffic (millions of minutes) Source: RATEL



* Total outgoing traffic for 2007 does not include data for Vip mobile

In 2011 there was a drop in the number of sent SMSs and MMSs. The total of 9.6 billion SMSs were sent in 2011, which is an average of 945 SMSs per user a year or 2.6 SMSs per day. Compared with the previous year, when the total number of SMSs amounted to 9.7 billion or 978 messages per user, there is a decrease of 1%. In 2011, there were 25.17 million MMSs sent, which is an increase of 4.7% in respect to 2010.

If we observe the prepaid/postpaid users ratio, the advantage goes to the prepaid users, yet the share of the postpaid users is growing year after year, amounting to 36% in 2011 (Figure 38). Since 2010, the calculation includes only the prepaid users active in the last 90 days, pursuant to the revised ITU indicators definitions.

Figure 36. Number of SMS messages sent (millions) Source: RATEL

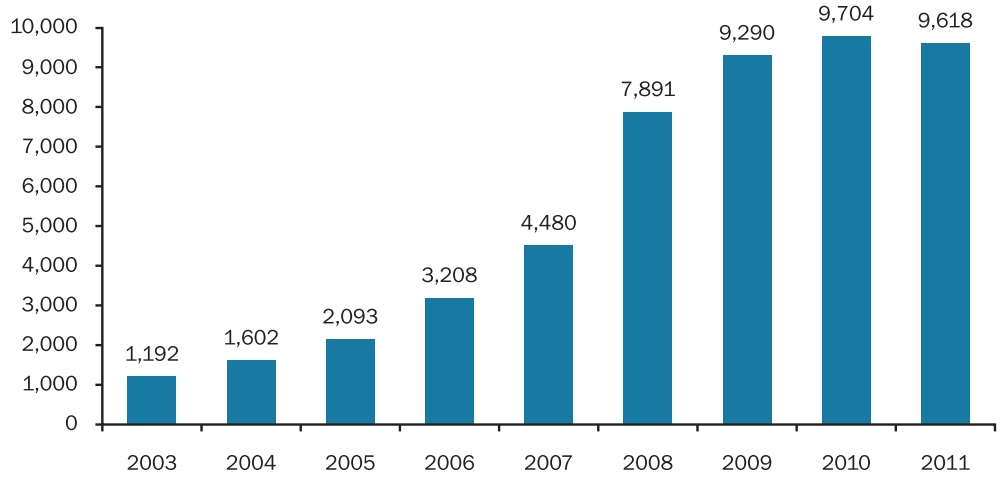


Figure 37. The number of MMS messages sent (millions) Source: RATEL

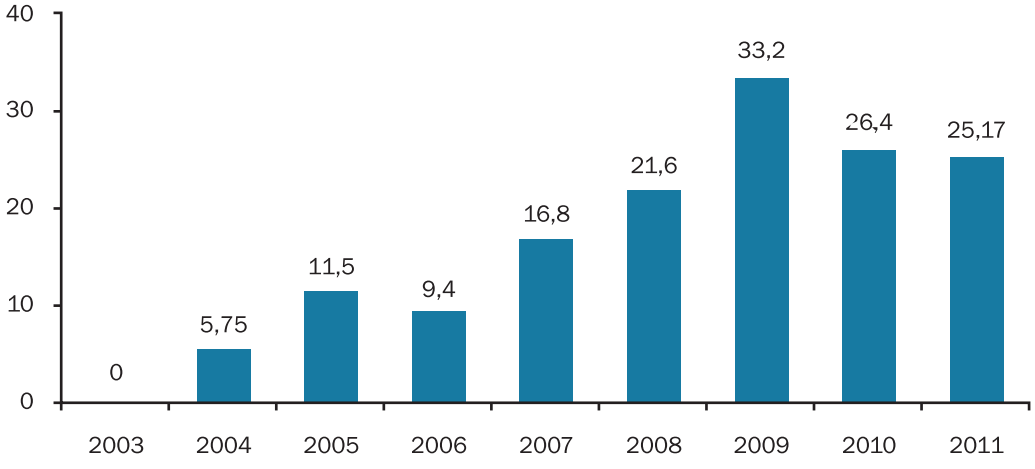
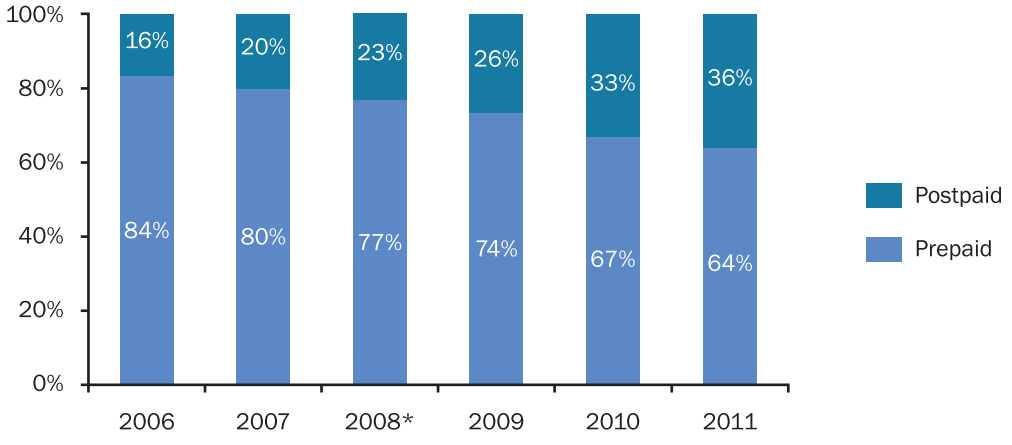


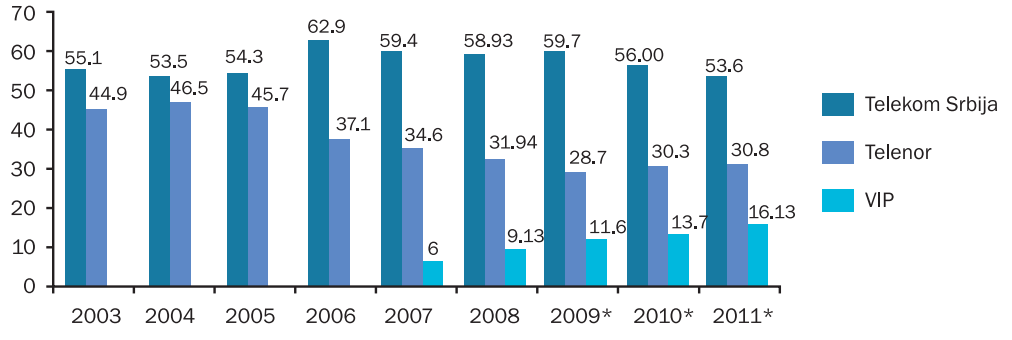
Figure 38. Prepaid/Postpaid Users — Source: RATEL



* 2011 data include the data on the number of active prepaid and postpaid users of all three operators.

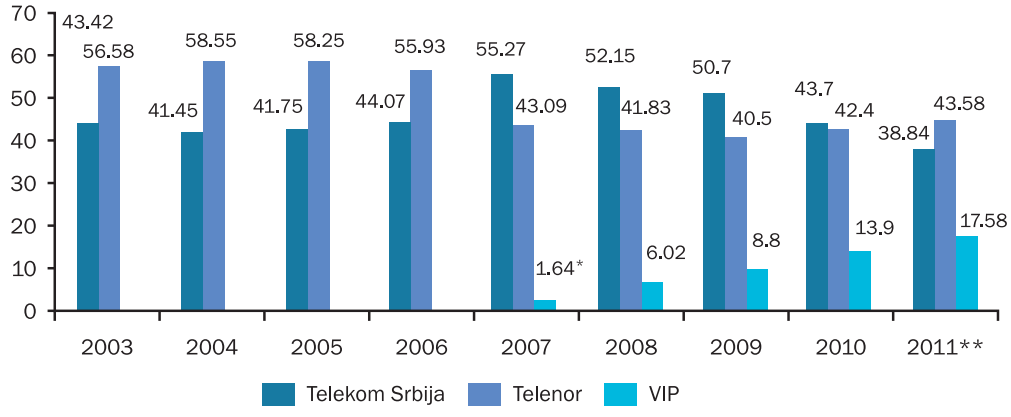
Figures 39. to 43. show the market share of mobile operators in terms of the number of users, share of each operator in the total mobile telephony revenues and share in the total outgoing traffic and the number of sent massages - SMS and MMS.

Figure 39. Market Share in Terms of the Number of Users (%) — Source: RATEL



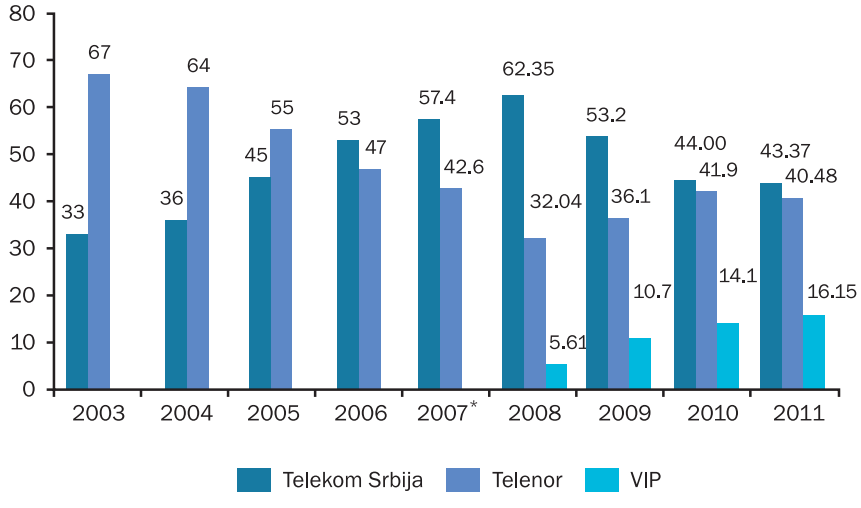
*The data for Telekom Srbija comprises the total number of prepaid users

Figure 40. Share in the Total Revenue from Mobile Services (%) Source: RATEL



* Vip mobile began operating in June 2007.
** If the internal calculation between business segments of Telekom Srbija were taken into account, their share in the total revenues from mobile telephony would amount to 41.35% in 2011.

Figure 41. Share in the Total Outgoing Traffic (%) Source: RATEL



* Total outgoing traffic for 2007 does not include the data for Vip mobile.

Figure 42. Share in the Total Number of Sent SMSs (%) Source: RATEL

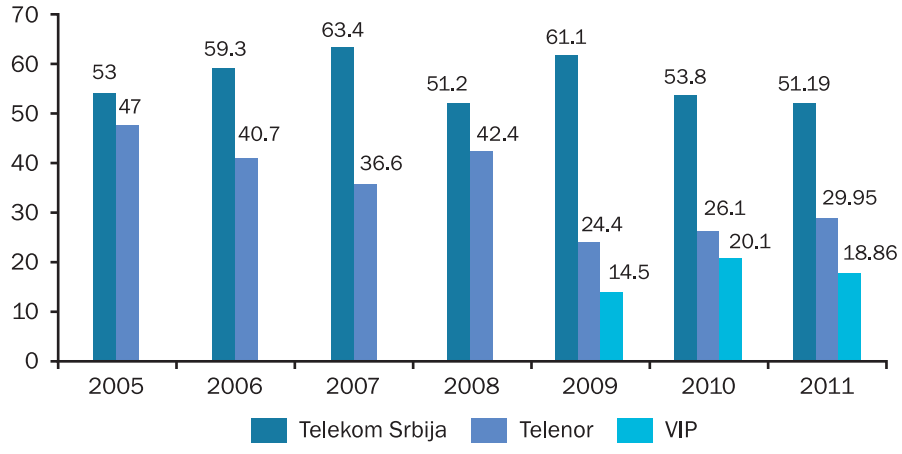
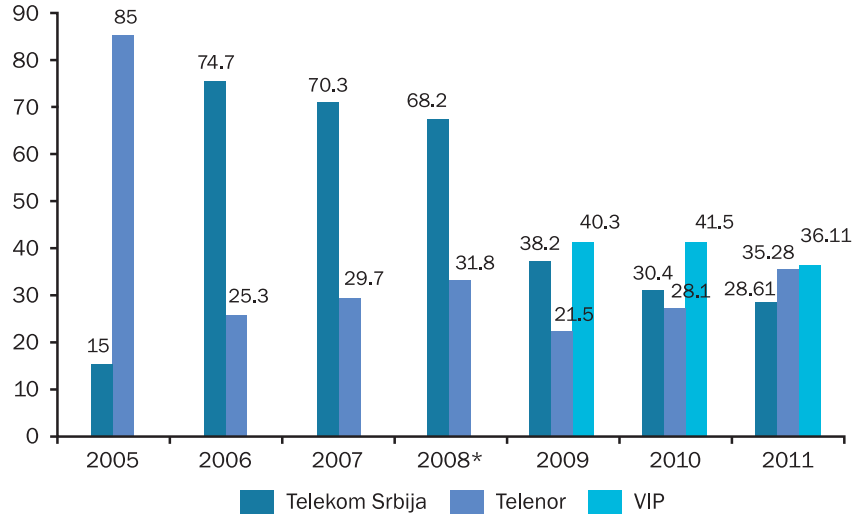


Figure 43. Share in the Total Number of Sent MMSs (%) Source: RATEL



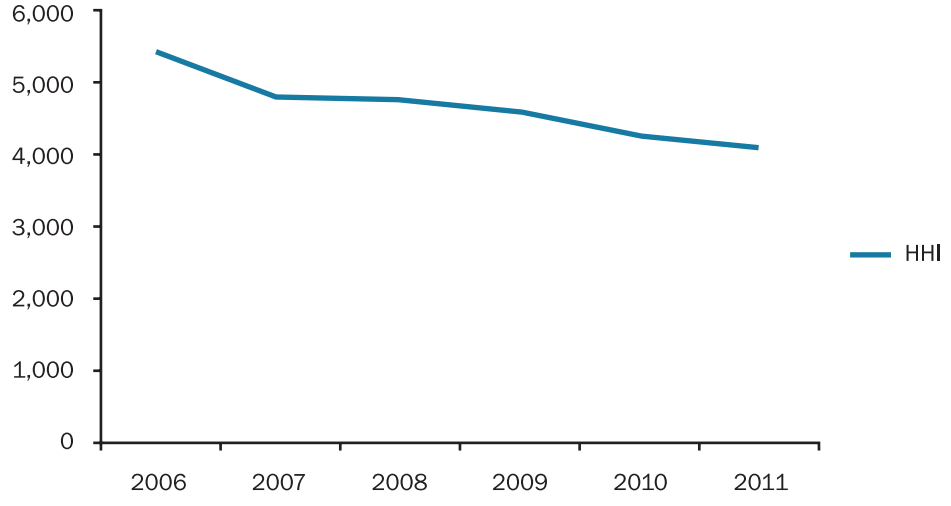
* Data on MMS for 2008 do not include data for Vip mobile

HHI (Herfindahl Hirschman Index) is an indicator used for determining the degree of concentration of a given market and it is defined as the sum of the squares of the market shares of each individual market share. The market share was identified by the number of users.

Table 9. HHI Values in the Period 2006 – 2011

	2006	2007	2008	2009	2010	2011.
HHI	5332	4759	4684	4520	4239	4025

Figure 44. HHI Values in the Period 2006 – 2011

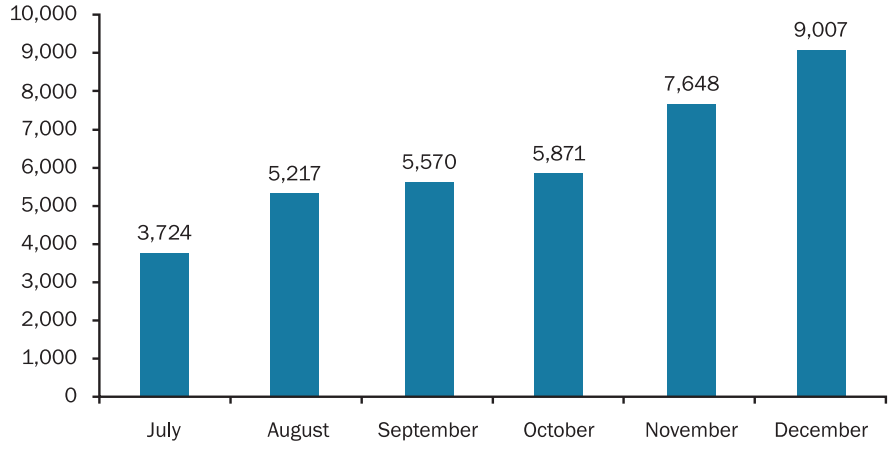


The value of HHI was reduced in the observed period, indicating a decrease in the market concentration and the increase in the competition between operators year after year.

Number portability in mobile networks has shown a constant increase since the introduction, growing from 3 724 in the first month to 9 007 in the last month of 2011.

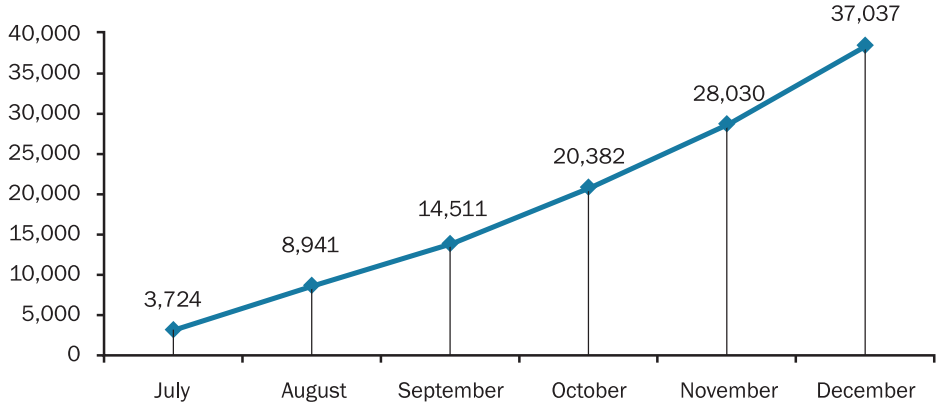
In the end of 2011, there were 37 037 users who had changed the operator keeping the same telephone number. The successful beginning of the number portability was indeed un-

Figure 45. Number of Ported Numbers per Month — Source: RATEL



derpinned by the provisions of the Rules on the Number Portability in Public Mobile Telecommunications Networks, which made it possible for an end-user to change the operator in a simple way with minimum charges. Furthermore, the Rules clearly set out the requirements to be fulfilled by the user when porting the number, as well as the cases in which the operator can refuse to port a number.

Figure 46. Total Number of Ported Numbers over the Year — Source: RATEL



5. INTERNET SERVICES

Internet technologies of today represent the most efficient support to the development of information society but also an indispensable segment of the modern society. Information technologies are a critical factor for economic growth and development of each country. Different studies worldwide have shown that the increase in the number of broadband connections has a direct impact on the growth in GDP. With the purpose of ensuring the exploitation of the full potential of all digital technology services, particularly those such as e-Economy, e-Commerce and e-Administration, an affordable and easy access to telecommunications infrastructure, particularly to broadband Internet, should be provided to all business enterprises and citizens.

Te Internet market in 2011 maintained a positive growth trend from the previous years. This trend began in 2008 when the number of broadband connections exceeded the number of dial-up connections, which continued in 2011. The total number of broadband connections in the Republic of Serbia in 2011 amounted to over 1.2 million (without accounting for 3G network subscribers), which equals 95% of all Internet connections (without accounting for 3G network subscribers). Such allocation of Internet connections is a consequence of the growing demands of end-users who use the Internet for business or leisure, which implies an increasing volume of the data exchanged via Internet.

ADSL access represented the dominant Internet connection in 2011 with around 623 thousand connections, accounting for 51% of all broadband connections (without 3G network subscribers). In addition to the access technologies mentioned, other means available for the Internet access were cable modem, which is another service provided by the CATV operators, directly, via Ethernet, via optical cable, by means of wireless access in the 2.4 GHz and 5.8 GHz unlicensed frequency bands, less often using the 3.4-3.6 GHz frequency band, as well as by UMTS (3G) network of the mobile operators (either via cell phone, or by means of special 3G modems).

In December 2011, there were 232 Internet service providers (ISPs) in Serbia registered within the Authorization Register. Table 10 indicates that the number of ISPs according to the Internet access provided to end-users.

Table 10. Number of ISPs according to Type of Access					Source: RATEL
	2007	2008	2009	2010	2011
Dial-up	60	48	36	42	29
Cable modem	14	22	20	22	21
Opticle cabl	/	/	3	11	11
Ethernet	/	/	24	25	14
Wireless	118	82	78	115	109
ADSL	23	21	27	23	21

Table 11. Total Number of ISPs					Source: RATEL
	2007	2008	2009	2010	2011
ISPs	159	197	199	192	232

The continued expansion of the Internet market is reflected, not only by the increase in the number of users (Internet connections), but also by the constant increase in the total revenues from the Internet service provision in the past years. The total revenues in 2011 grew by 10% in respect to 2010, amounting to approximately 14.9 billion dinars[3]. If the total revenues from the Internet service provision in 2011 are compared with the total revenues in the previous years, a continuous growth trend of the Internet market in Serbia is evident: the total revenues in 2011 were ten times higher than in 2005. It should be noted that telecommunications are among few sectors in Serbia that did not experience a drop but an increase in 2011, as confirmed by the data given in this Market Overview.

The total number of Internet subscribers in 2011 amounted to approximately 1.2 million. However, if we consider the availability of Internet access using 3G mobile network (via cell phone), the total number of potential subscribers in 2011 amounted to 3.8 million, which is an increase of 59% year-on-year.

The total number of broadband connections in Serbia in 2011 was 1.2 million (3G mobile network users excluded), which is approximately 22% more than in 2010. There was a significant increase in the number of subscribers who accessed the Internet using ADSL modem

[3] The total revenues include the revenues from the Internet wholesale

Figure 47. Internet Service Revenues (millions of RSD) Source: RATEL

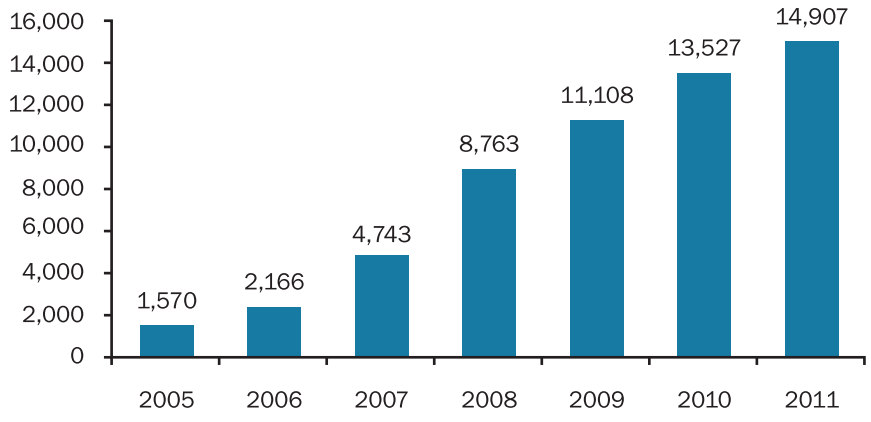
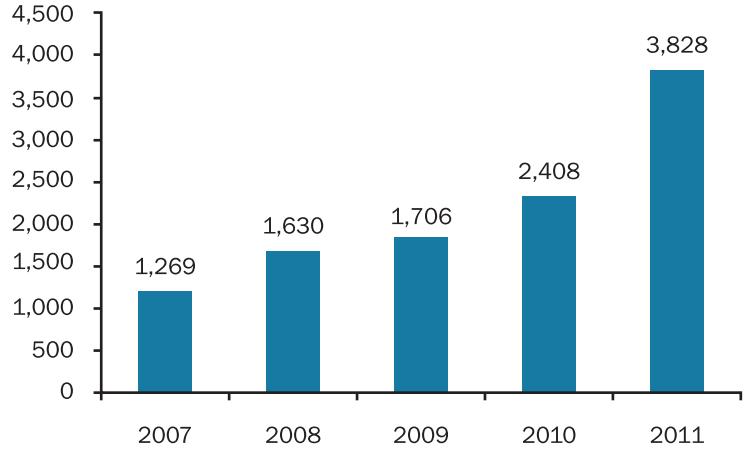


Figure 48. Number of Potential Internet Subscribers in Thousands* Source: RATEL



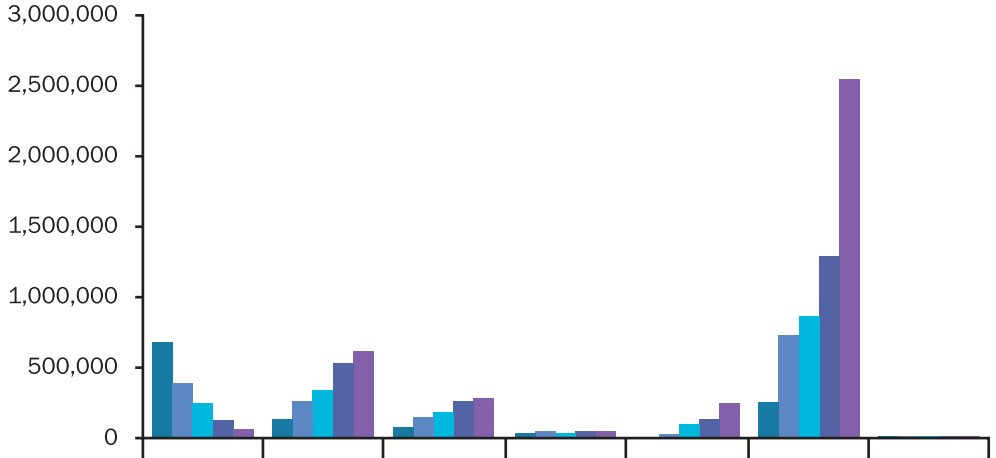
* The total number includes 3G mobile network subscribers

(16%), amounting to 623 thousand connections. There was also an increase in the number of subscribers accessing the Internet via cable modem by 10%.

The biggest increase in the number of broadband users was seen in access via mobile 3G network modem. The number of subscribers is ten times higher than in 2008 when this type of access first became available in the Republic of Serbia, amounting to 249 thousand in 2011, with the share in the total number of broadband users of 20% (excluding 3G subscribers).

In view of the growing demand for high bit-rate data transmission, the number of dial-up connections has been dropping significantly year after year. In 2006 the total number of dial-up subscribers amounted to 882 thousand accounting for 88% of the total number of

Figure 49. Internet Useres according to the Access Technology Source: RATEL

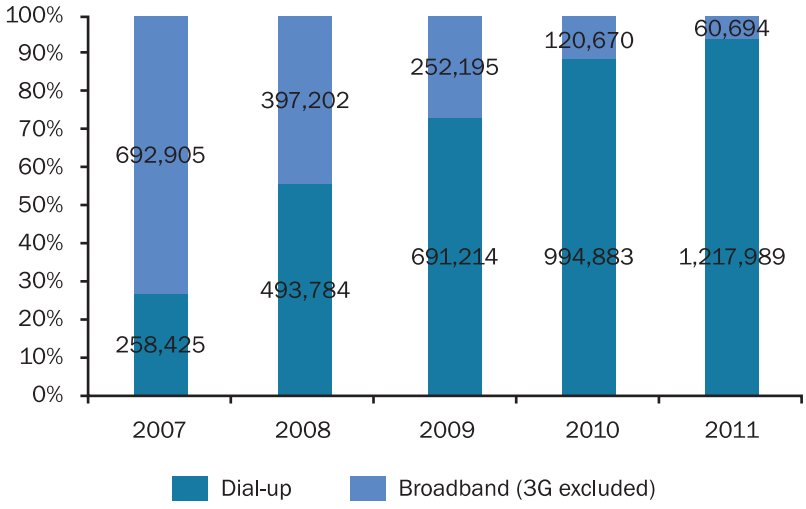


	Dial-up	ADSL	Cable modem	Wireless access	Mobile Internet	3G network subscribers*	Other
2007	692,905	132,359	87,731	36,059	0	257,379	2,276
2008	397,202	267,876	151,154	48,130	25,489	738,401	1,135
2009	252,195	351,252	187,923	45,864	100,628	762,307	5,547
2010	120,670	536,796	260,474	58,305	131,475	1,291,887	7,783
2011	60,694	623,611	285,413	53,754	249,542	2,550,038	5,669

* 3G network subscribers without mobile Internet

Internet subscribers, whereas in 2011 the number dropped to 60 thousand, or 1.5% of the total number of Internet connections.

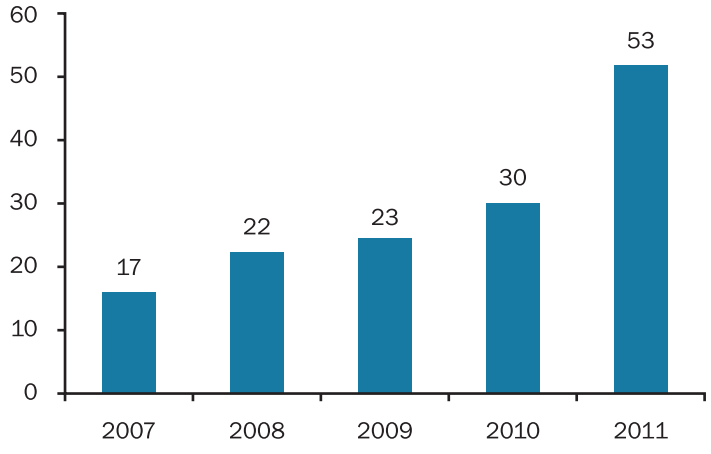
Figure 50. Share of Internet Connections (3G mobile network subscribers excluded) Source: RATEL



In 2011, the number of Internet connections per 100 inhabitants was approximately 53, which roughly corresponds to the number of broadband Internet connections per 100 inhabitants, in view of the rather low share of narrowband connections. However, if the 3G mobile network subscribers are excluded from the total number of broadband subscribers, broadband penetration amounts to nearly 17%. Fixed broadband penetration was around 13%, which is a decent percentage compared with the countries in the region, but still below EU average (according to the available data for 2010, the average for EU candidate and potential candidate countries was 10.6% and the EU average was 26.6%)[4].

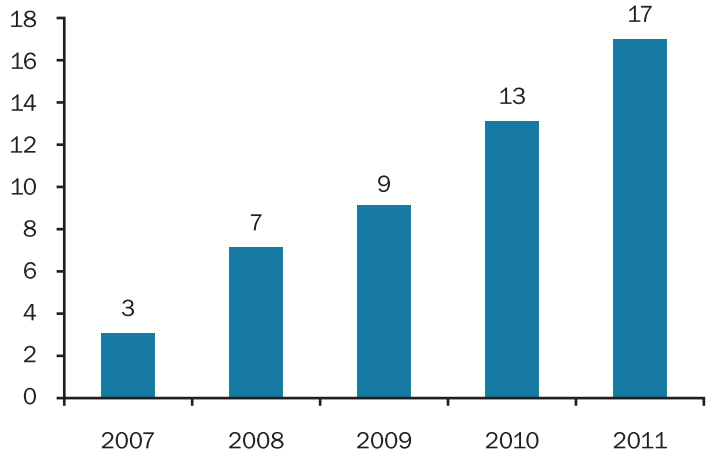
The above facts lead to the conclusion that the Internet sector growth in Serbia is constant, both in terms of total revenues and the number of broadband users. The choice of access technology revealed a step-up towards broadband services usage, reflected in the constant increase of ADSL, cable and mobile Internet access users as well as in the continuous decrease in the number of dial-up users.

Figure 51. Internet Penetration Rate* Source: RATEL



* 3G mobile network subscribers included.

Figure 52. Broadband Internet Penetration Rate* Source: RATEL



Internet service providers offered a variety of bundled services, with access of up to 40 Mbps bit-rate in the retail market. The best selling packages included permanent Internet access and

[4] Source: Supply of services in monitoring regulatory and market developments for electronic communications and information society services in Enlargement Countries 2011-2013 – November 2011, Cullen International

download bitrate of 1536 kbps, accounting for approximately 490,000 connections or about 40% of all broadband connections.

The increased competition in the broadband market and the growing user demands led to an improved quality of Internet service provision, reflected in the constant growth of high bitrate connections. Such trend is best seen in the cable Internet offers, followed by wireless access and mobile network access, whereas ADSL offer did not reveal any significant changes. Table 12 illustrates the tariffs of some packages available in the market.

Table 12. Monthly Supscription Fees for Permanent Internet Connection in 2009 , 2010 and 2011

2009		
Access bitrate	Access Technology	Amount of monthly subscription fee for permanent Internet access (VAT included)
1024/128 Kbps	ADSL	1,425.44 din
1536/128 Kbps	Cable	1,390.00 din
1024/256 Kbps	Wireless (na 2,4 GHz)	1,299.00 din
5 GB free of charge, and 3.84 RSD for every additional MB	Mobile Network	1,480.00 din
2010		
Access bit rate	Access Technology	Amount of monthly subscription fee for permanent Internet access (VAT included)
1536/256Kbps	ADSL	1,532.82
4096/256 Kbps	Cable	1,390.00
1536/256Kbps	Wireless (2.4 GHz)	1,186.00
5 GB free of charge, and 3.00 RSD for every additional MB	Mobile Network	1,050.00 –1,364.00

2011		
Access bit rate	Access Technology	Amount of monthly subscription fee for permanent Internet access (VAT included)
1536/256Kbps	ADSL	1,532.82
6144/512Kbps	Cable	1,540
2048/256 kbps	Wireless (2.4 GHz)	1,000
6 GB free of charge, and 1.00 RSD for every additional MB	Mobile Network	1,050.00

Note: the price lists were taken from the websites of the undertakings and apply to physical entities; each package had additional costs and technical requirements pertinent to the closing of subscription contracts and establishment of connection; some of the packages require subscription contracts, which stipulate subscriber obligations during a specific period of time.

6. USAGE OF ICTs IN SERBIA

The development and usage of ICTs have transformed the modern society into “information society”. The main feature of this society is that ICTs have the main role in both economy and manufacturing, as well as in all segments of the life of an individual and the society as a whole.

Surveys on the use of information-communication technologies by individuals, households and companies in Serbia are regularly conducted by the Statistical Office of the Republic of Serbia.

In 2011, the survey was conducted by telephone on the sample of 2,400 individuals, 2,400 households and 1,200 companies.

As expected, the growth trend of households with a computer continued in 2011. There were 52.10% of the households that owned a computer, which is an increase of 1.6% in respect to 2010. The incidence of computers in households varies depending on different territorial areas: Belgrade 61%, Vojvodina 53% and Central Serbia 47.2%.

The incidence of computers in households also varies between urban areas (60.8%) and rural areas (39.7%) in Serbia. The gap is slightly larger compared to the previous year, since the number of households with computer in urban areas grew by 2.1%, while in rural areas the increase was 1.4%.

In 2011, there were 41.2% of households in the Republic of Serbia with the Internet connection, this being an increase of 2.2% in respect to 2010, or a 4.5% increase in respect to 2009 and 8% in respect to 2008. Once again, significant discrepancies may be observed if we compare the number of households with Internet connection in urban and rural areas in Serbia. While in urban areas of the Republic of Serbia the number of households with Internet connection amounts to 51%, in rural areas there are only 27.2% of households with Internet connection. It should be noted that the growth rate of Internet connections in respect to 2010 was 1.7% in urban and 3.1% in rural areas.

Figure 53. Share of Households with Computer
Source: Statistical Office of the Republic of Serbia

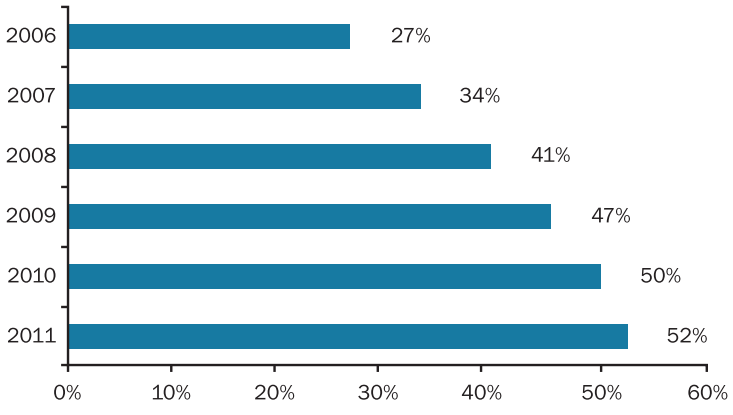


Figure 54. Percentage of Households with a Computer according to the Type of Area (Rural or Urban)
Source: Statistical Office of the Republic of Serbia

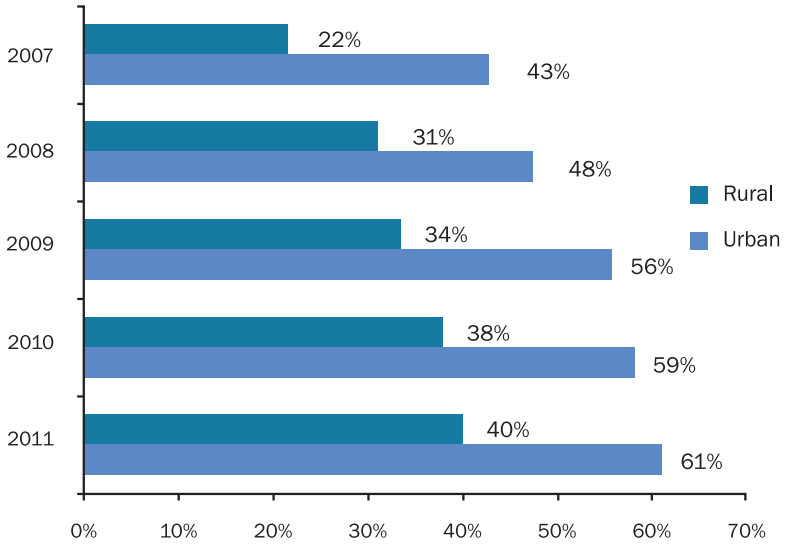
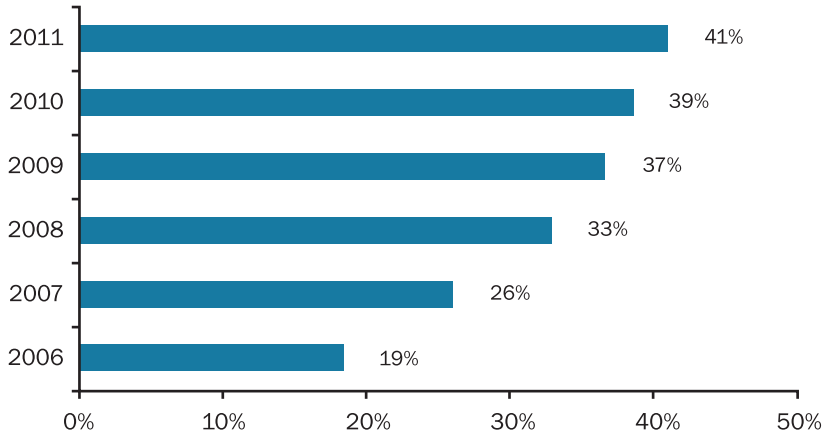


Figure 55. Households with Internet Connection
Source: Statistical Office of the Republic of Serbia



It should be noted that the gap is also related to the household income, as Internet connection was mainly used by the households with the monthly income of over 600 euros (83.8%), while the share of households with the income of 300 euros was only 25.9%.

One of the main indicators of ICT development in the EU is the percentage of households with broadband Internet. With the broadband diffusion, the downtrend of modem connection was continued dropping by 9.7% in respect to 2010 and 21.5% in respect to 2009. In 2011, 50.6% of households with Internet had DSL (ADSL), 29.6% cable and 24.1% had WAP and GPRS connection.

Figure 57 shows the usage of computers by individuals. The survey revealed that 54.3% of the respondents had used the computer in the past 3 months, and 40.1% who participated in the poll had never used the computer, whereas 2.3% participants had used the computer over 3 months earlier and 3.3% over a year before.

The number of computer users in the past 3 months increased by over 150 000 in respect to 2010.

Figure 56. Household Internet Use according to the Type of Connection
Source: Statistical Office of the Republic of Serbia

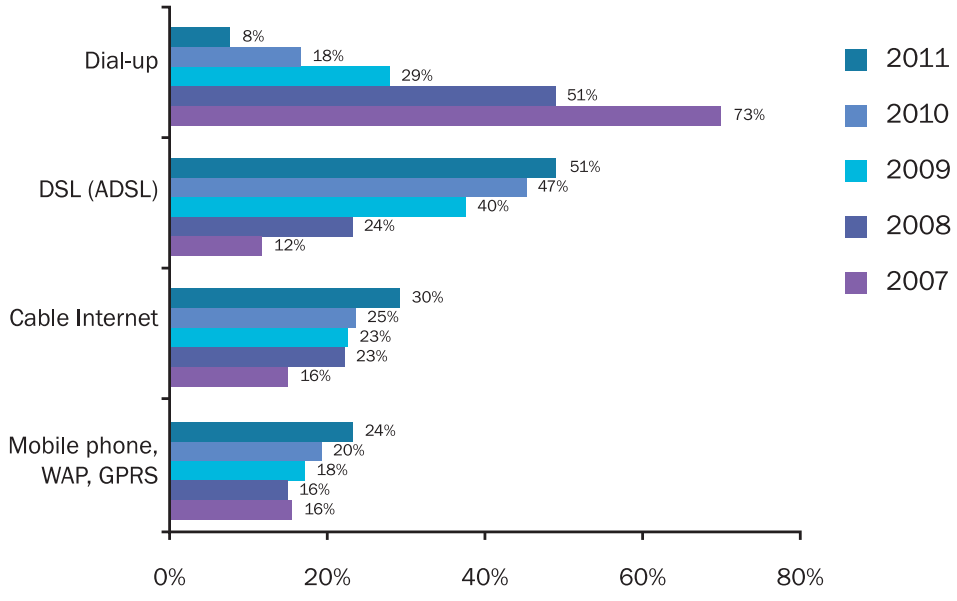
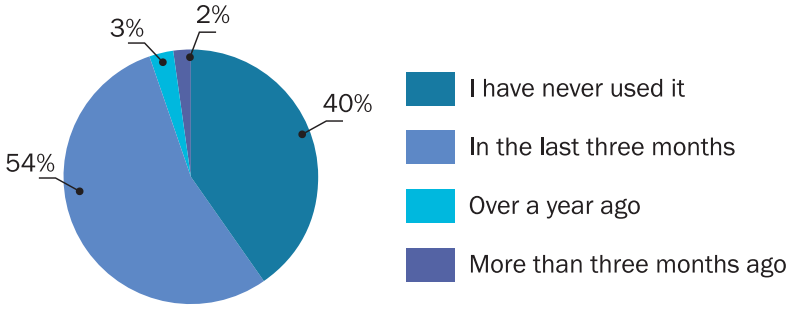


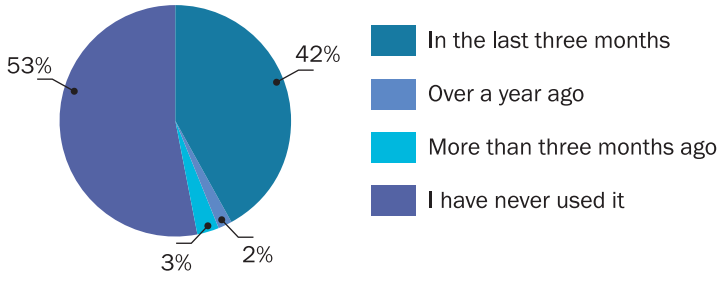
Figure 57. Computer Usage by Individuals Source: Statistical Office of the Republic of Serbia



In the Republic of Serbia 42.2% of people used the Internet in the last three months, 2.2% of the respondents used the Internet more than three months ago and 2.7% of them over a year ago. The percentage of the respondents who said that they had never used the Internet is 53% (cfr. 54.1% in 2010), which is still rather high.

The number of Internet users in 2011 increased by 1.1% in respect to 2010 or by 3.4% in respect to 2009 and 6.2% in respect to 2008. The survey showed that the number of persons who had used the Internet in the past three months increased by over 40 000 compared with 2010.

Figure 58. Computer Usage by Individuals Source: Statistical Office of the Republic of Serbia



The survey showed that 17.3% of respondents among the Internet users, used public administration services instead of personal contact. Over 680,000 individuals used the electronic services of the public administration in 2011 (cfr. 325 000 in 2010).

In 2011, 79.8% of the total number of undertakings with Internet connection used the electronic services of public administration, which is an increase of 9.2% in respect to 2010 and of 10.7% in respect to 2009.

According to the 2011 data, 80.4% (cf. 72.3% in 2010) of respondents used the Internet (almost) every day, 12.4% used the Internet at least once a week, 6.5% used the Internet once a month and only 0.6% less than once a month.

Over 1 900 000 persons used the Internet (almost) every day, which is an increase of over 200 000 compared with 2010.

Figure 59. Frequency of the Individual Internet Use Source: Statistical Office of the Republic of Serbia

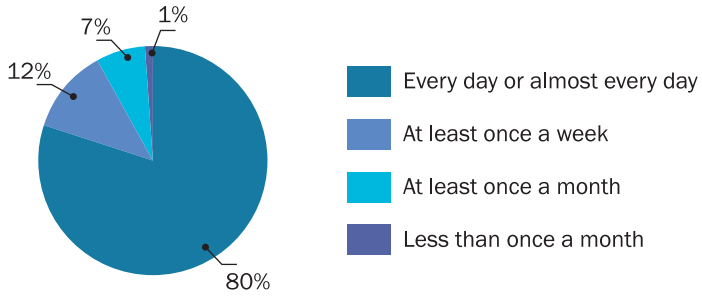
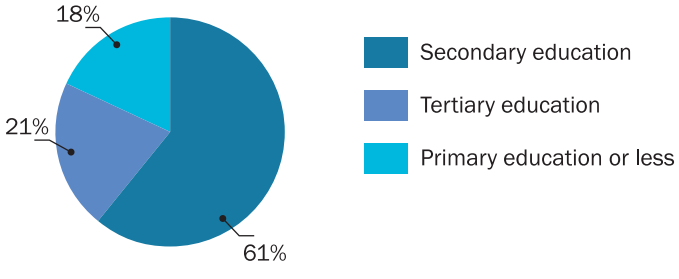


Figure 60 illustrates the structure of the Internet users by the level of education. The Internet is mainly used by the individuals with secondary education (60.8%), followed by the users with higher education or university degree (21.1%), whereas the remaining 18.1% are users with less than secondary education.

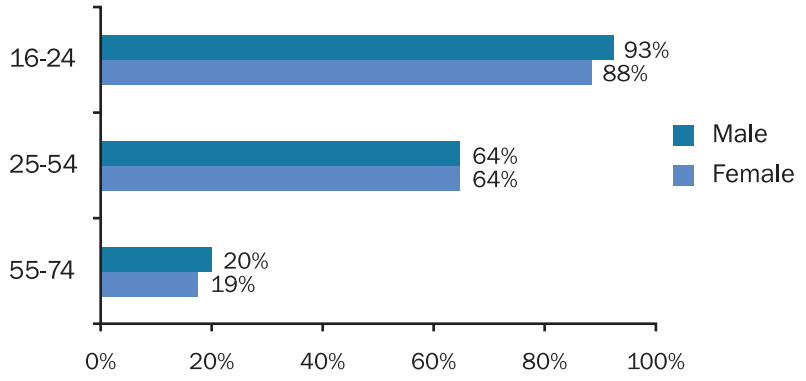
Figure 60. Internet Users by Level of Education Source: Statistical Office of the Republic of Serbia



In 2011 there was a greater percentage of male users in respect to female users in all age groups, with the biggest discrepancy of 4.3%, in the 16-24 age group. The survey showed that in the past 3 months there had been 43.9% of male and 40.5% of female users.

In 2011 the Internet was mostly used for taking part in social networks (Twitter and Facebook) 77.8%, followed by participation in professional networks (profile creation, messages) 68.6%, travelling and accommodation 67.2% which is a significant increase, courses or education related information 65.4%, VoIP 64%, reading or downloading online newspapers/magazines 63.7%,

Figure 61. Internet Usage by Gender and Age in the Past 3 Months
Source: Statistical Office of the Republic of Serbia



Internet banking which is growing with 63.2% (cfr. 9% in 2010) and selling goods and services 59.2% (5% in 2010.).

The survey showed that as much as 91.8% of population in the 16-24 age group has a profile in a social network (Twitter and Facebook).

Figure 62. Private Internet Use (in the last 3 months)
Source: Statistical Office of the Republic of Serbia

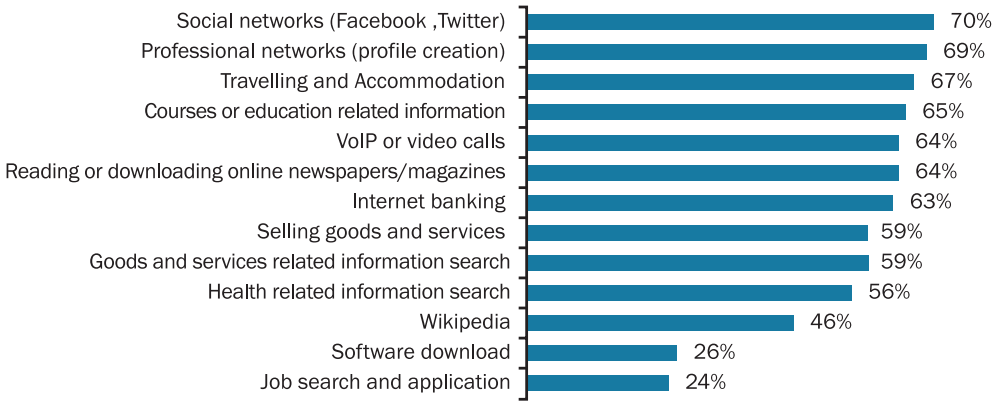
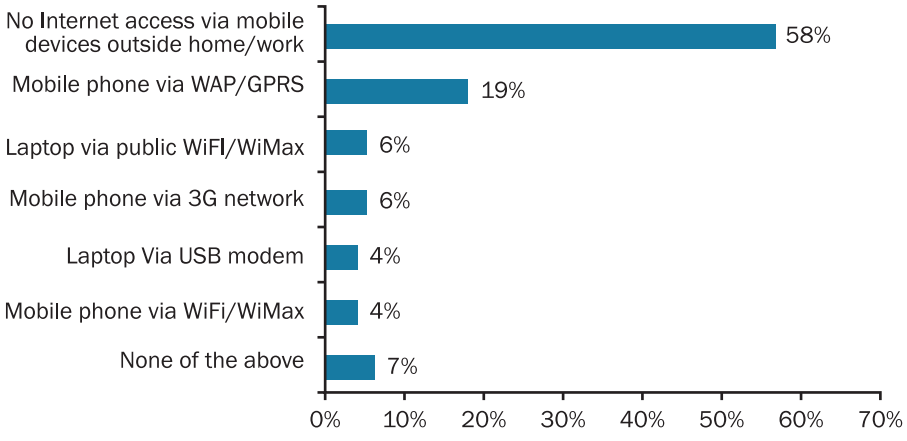


Figure 63 illustrates the use of mobile devices for Internet access. Most users of this type of Internet access use a mobile phone (19.1%) (via WAP or GPRS), followed by laptop via public WiFi or WiMax network (6.1%), 3G network (6%), laptop via USB modem (4.1%) and mobile phone via public WiFi or WiMax network (4.1%), whereas 57.8% of the respondents said they had no Internet access via mobile devices outside home or work.

Figure 63. The Use of Mobile Devices for Internet Access
Source: Statistical Office of the Republic of Serbia



The share of the Internet users according to their employment status showed that the Internet is mainly used by students (99.5%), while the number of employed users grew from 58.2% in 2010 to 61.7% in 2011. There were no changes as regards the unemployed users compared with 2010, as shown in Figure 64 below.

The survey showed a slight growth in the number of enterprises using the computer for business, since 98.1% of them used the computer in 2011 (cfr. 97.8% in 2010).

Among the enterprises with Internet connection, 75.2% used DSL connection, followed by cable Internet (23.6%), whereas enterprises using mobile connections increased from 12.2% in 2010 to 18% in 2011. As expected, a drop in the number of dial-up connections is evident, with 4.9% in respect to 13.50% in 2010.

Figure 64. Share of Internet Users according to their Employment Status
Source: Statistical Office of the Republic of Serbia

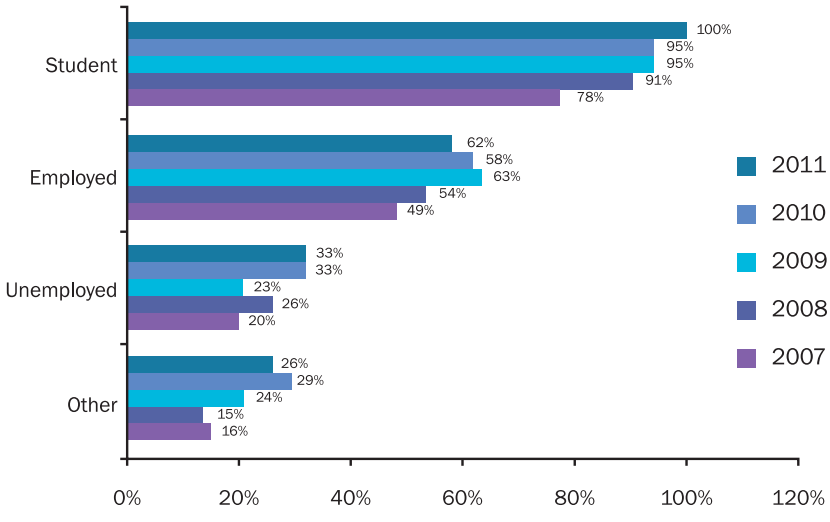
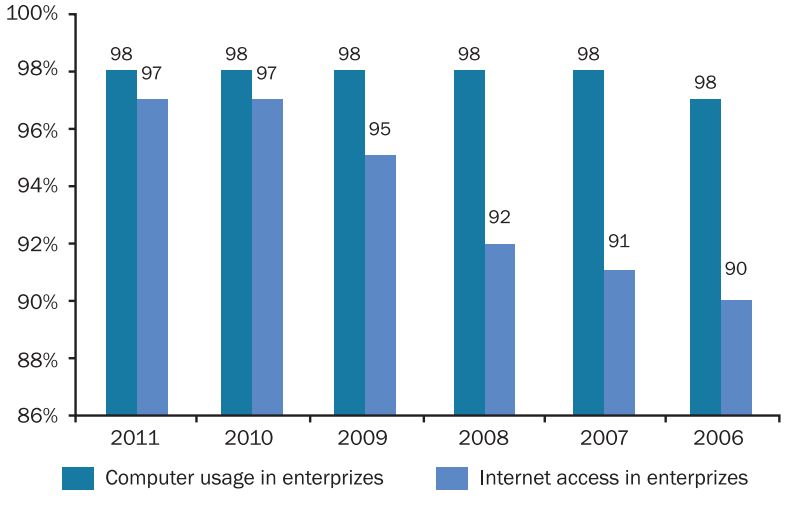


Figure 65. Internet and Computer Usage by Enterprizes
Source: Statistical Office of the Republic of Serbia



The survey showed that 79.8% of enterprises with Internet connection had used public administration electronic services, which is an increase of 9.2% since 2010 and 10.7% in respect to 2009.

Figure 66. Public Administration Electronic Services Usage by Enterprises
Source: Statistical Office of the Republic of Serbia

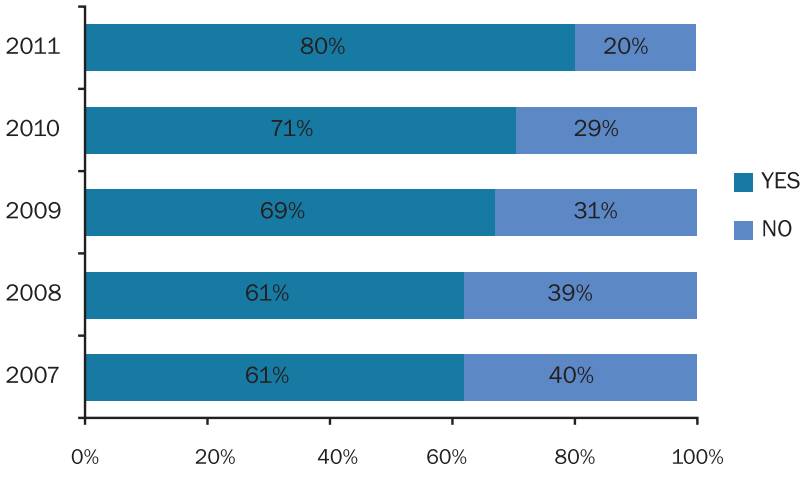
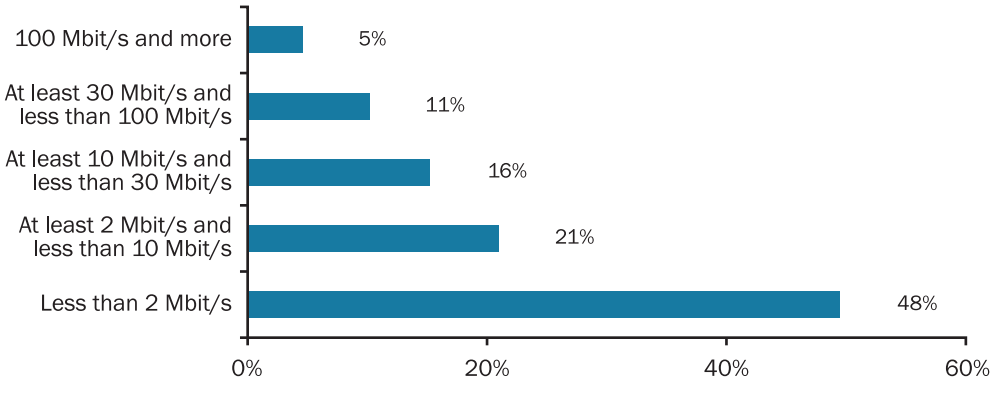


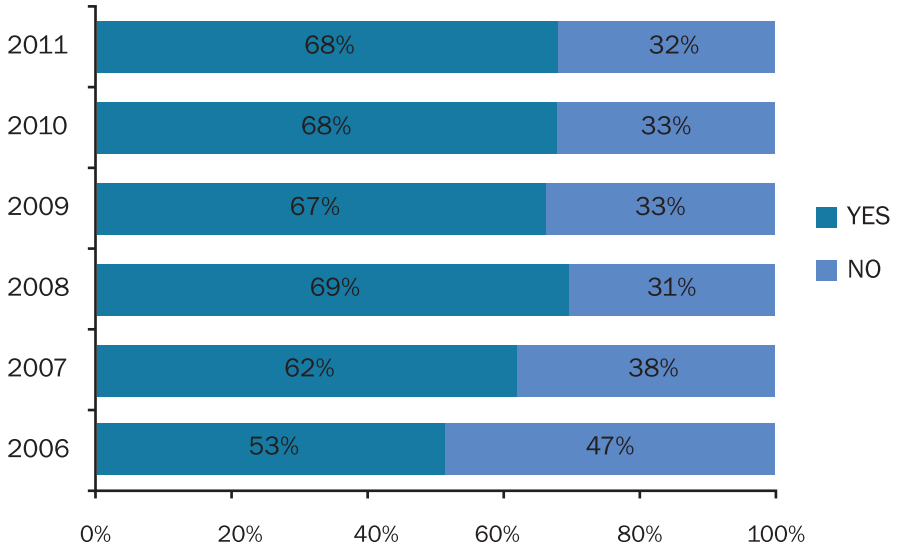
Figure 67. shows the Internet connection bitrate in the enterprises, defined by the contract with ISPs.

Figure 67. Internet Connections in Companies (as defined by the contract with provider)
Source: Statistical Office of the Republic of Serbia



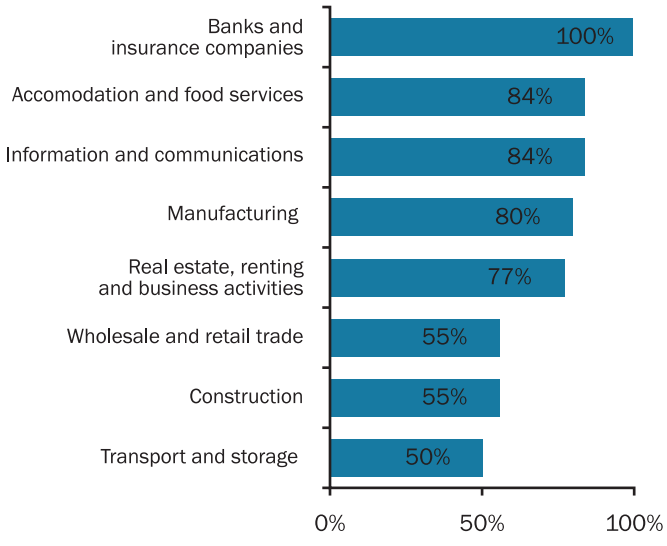
In 2011, 67.6% of the enterprises with the Internet connection had their own website.

Figure 68. Number of Enterprizes with Website Source: Statistical Office of the Republic of Serbia



The number of enterprises with website depends on the territorial area, since in 2011 in Belgrade 76.8% of enterprises had website, in Vojvodina 64.8% and in Central Serbia 58.8%.

Figure 69. Number of Enterprizes with Website according to Business
Source: Statistical Office of the Republic of Serbia



7. MEDIA CONTENT DISTRIBUTION

There were no significant changes in the media contents distribution market in the Republic of Serbia in 2011 compared with the previous year, in terms of structure or transmission technologies. In 2011 there were 82 operators (cfr. 80 in 2010) registered for this type of service, which provided their services via following public telecommunications networks:

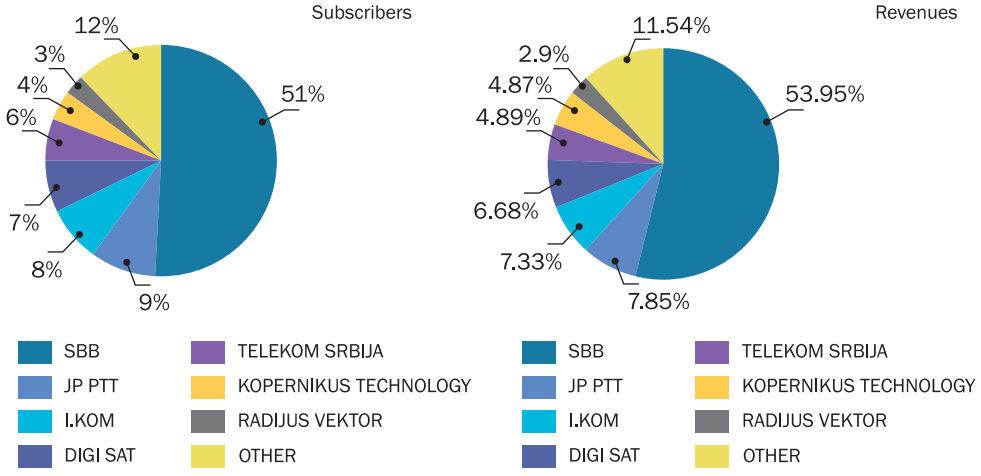
- cable distribution networks (coaxial, hybrid and optical) – CATV, which include analogue and digital CATV, 76 operators
- public fixed telephone network– IPTV, 3 operators
- satellite distribution network– DTH (Direct to Home), 3 operators.

The biggest media content distribution operator in the Republic of Serbia in 2011, in terms of the number of subscribers and revenues made, was once more the company Serbia Broadband – Srpske kablovske mreže Ltd. (SBB), with over 50% of the market share. Considering the circumstances in the media content distribution market in the Republic of Serbia, in July 2011 the Agency passed the decision on designating relevant markets susceptible to ex-ante regulation. By this decision, retail market for media content distribution was designated as one of the markets susceptible to ex-ante regulation. Consequently, upon the completed market analysis procedure, in November 2011 the decision was passed designating company SBB as an SMP operator in the retail market for media content distribution. The decision imposed the obligations to provide retail services under specific terms and conditions, the main objective being price control by applying cost-accounting, as stipulated under the Agency bylaw regulating cost-accounting application, separate accounts and reporting by SMP operators.

Compared with 2010, the situation in the media content market distribution did not change significantly, the important market players in the media contents distribution remaining the same as in 2010, namely SBB, Public Enterprise PTT – RJ KDS, Kopernikus tehnology Ltd., Telekom Srbija Joint Stock Co., I.KOM Ltd., Digi SAT Ltd. and Radijus vektor Ltd. In terms of the number of subscribers, these operators had a joint market share of around 88%. It should be noted that Telekom Srbija

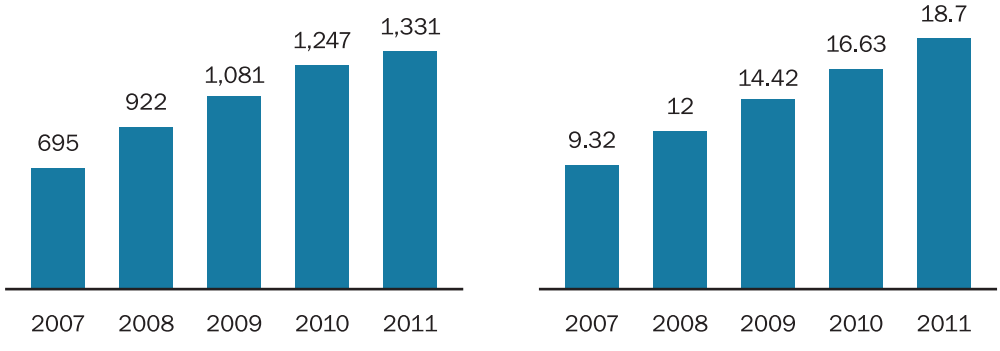
Joint Stock Co. recorded the biggest annual growth rate since they had began with the provision of media content distribution service (IPTV), amounting to around 137%.

Figure 70. Market Share of the Leading Operators in 2011 Source: RATEL



The total number of subscribers of the media content distribution services continues to grow, amounting to around 1.3 million in 2011, which is by 6.7% more compared with 2010. Penetration rate amounted to 18.7%, or 53% in terms of the number of households.

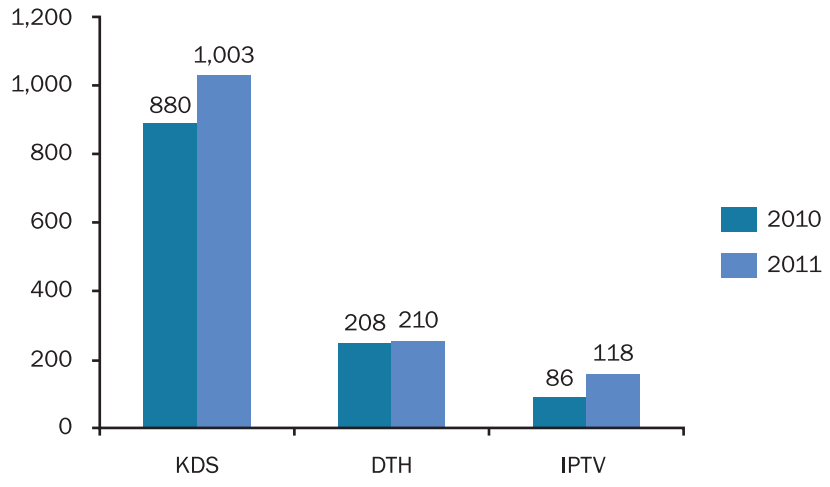
Figure 71. Total Number of Users (thousands)/Number of Users per 100 Inhabitants Source: RATEL



In 2011, the majority of subscribers used the services of media contents distribution via cable distribution operators. According to the data submitted by the operators, there were over one million subscribers of media contents distribution via cable distribution networks, which is a growth of over 14%. Also, the number of IPTV and DTH subscribers is growing.

Analogue CATV subscribers are still dominant among the total CATV subscribers with 89%. However, the number of analogue CATV subscribers is expected to drop to the advantage of digital CATV subscribers, due to growing demands of end-users (HDTV, VoD, etc.).

Figure 72. Allocation of Subscribers According to Network Type (thousands)
Source: RATEL



In 2011, the total revenues from media contents distribution increased by 16% year-on-year, amounting to approximately 10.3 billion dinars. This increase was mainly the result of the increase in the number of users, introduction of new platforms and rise in the media contents distribution tariffs by some providers.

It should be noted that the media content distribution revenue structure is different in respect to the previous year. In 2011 the share IPTV in the total revenues was 22% (cfr. 4% in 2010), whereas

Figure 73. CATV Subsribers Ratio Source: RATEL

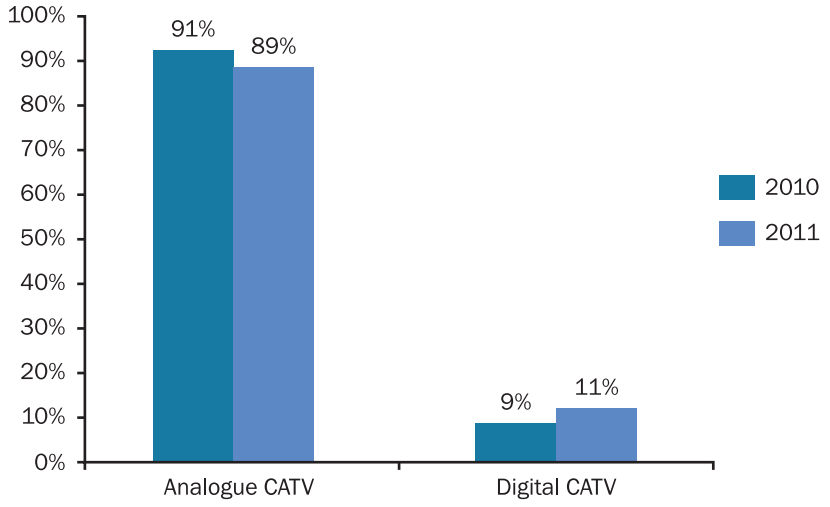
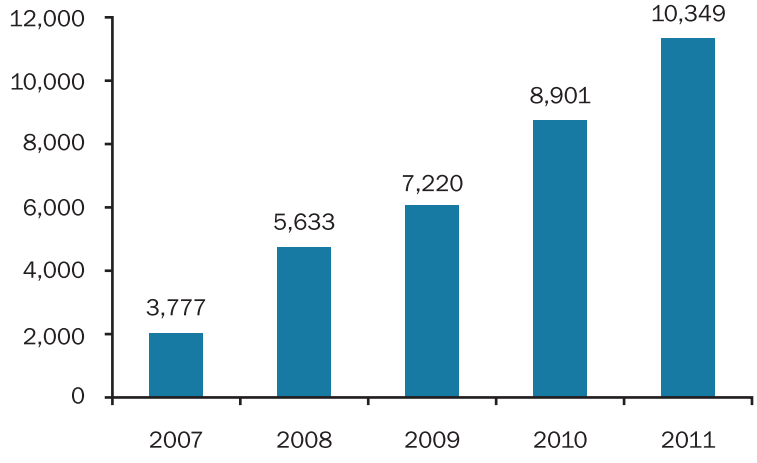


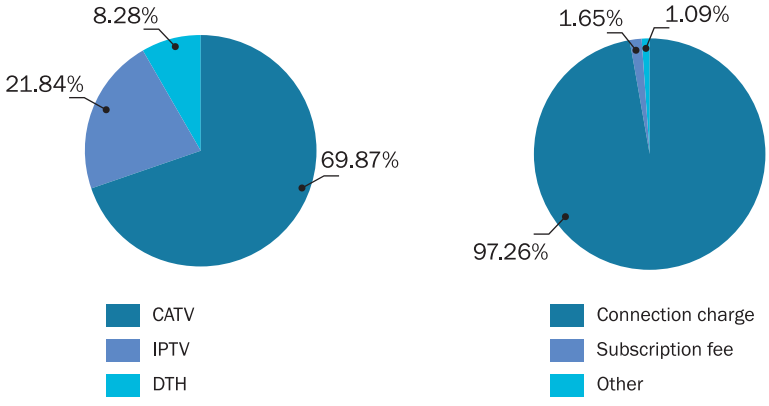
Figure 74. Revenue Growth in the Media Content Distribution Market (in millions of RSD)
Source: RATEL



DTH has a share of 8% (cfr. 21% in 2010). The biggest share in the revenues from the media contents distribution service provision went to CATV services (70%).

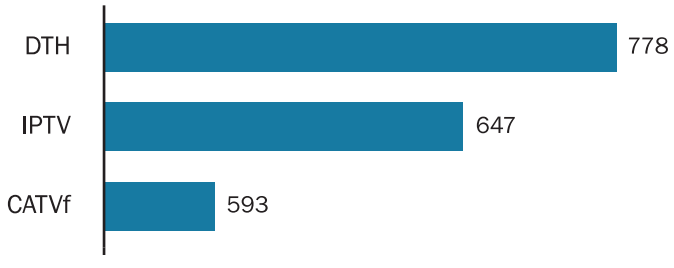
The revenues from the monthly subscription accounted for 97.3% of the revenues, 1.1% went to connection charges, whereas the revenues from Pay TV and other services make up 1.6% of the revenues observed.

Figure 75. Revenue Structure in 2011 Source: RATEL



As shown in Figure 76, in 2011 DTH service subscribers paid an average of 770.8 dinars for the basic service package, while IPTV services amounted to an average of 646.67 dinars on a monthly basis. CATV subscribers paid on average 593.05 dinars a month, which is by 24% less than the average monthly bill received by DTH subscribers.

Figure 76. Average Bill for Basic Service Package in 2011 (RSD) Source: RATEL



As for the number of TV programmes offered, in 2011 the basic IPTV and digital CATV packages consisted of 66 programmes, and the basic DTH service package 41 programmes. The basic analogue CATV package included an average of 51 TV programmes.

Figure 77. Average Number of TV Programmes in the Basic Package in 2011 Source: RATEL

The media content distribution market in Serbia has shown a constant growth tendency since the Agency began following and analyzing electronic communications market in Serbia. In 2011 the growth was seen in the number of subscribers, revenues and investments. Furthermore, the quality of service and the customer relation improved notably.

Based on the analysis of results from the previous years, it may be concluded that the media content distribution market has not reached the full potential yet and that an intensive development can be expected in the years ahead. The main feature of the market in 2011 was a significant growth in the number of IPTV subscribers by 37% in respect to the previous year (CATV subscribers increased by 14%). Having this and the number of potential IPTV subscribers of around 3 million in mind, a change in the overall picture of the media content distribution market can be expected in the coming period. In particular, the potentially high number of IPTV subscribers will surely exercise a competitive pressure on the CATV providers in the years to come, thus contributing to a qualitative development of the market. Such market development is expected to result in a higher quality, greater choice and lower prices of the media content distribution services.

8. BROADCASTING

Based upon users' requests, public tenders as well as decisions made by the Council of the Republic Broadcasting Agency regarding the permit issuance for television and radio programme broadcasting, RATEL issued the broadcasting station permits to the following broadcasters:

For TV signal coverage – commercial service – national coverage			
Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	"HAPPY TV" DOO, Beograd	35	0

For radio signal coverage – commercial service – national coverage			
Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	Privredno društvo za proizvodnju i emitovanje RTV programa "INDEX" DOO, Beograd	15	12

For radio signal coverage – commercial service – the area of province			
Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	„NS – AS“ D.O.O., proizvodnja, trgovina i usluge, Novi Sad	1	0

For TV signal coverage – commercial service – regional coverage			
Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	"RTV-PANONIJA" DOO za emitovanje radio i TV programa-Novi Sad, Novi Sad	1	0
2.	"TV MOST" društvo sa ograničenom odgovornošću za informativno izdavačku delatnost, Novi Sad	1	4

3.	Akcionarsko društvo "TIMOČKA TELEVIZIJA I RADIO", Zaječar	5	8
4.	Javno preduzeće za informisanje "NOVI PAZAR", Novi Pazar	1	0
5.	Privredno društvo "RADIO TELEVIZIJA KRALJEVO I IBARSKE NOVOSTI" DOO, Kraljevo	1	0
6.	RTV ENIGMA DOO, Prijepolje	1	0

For radio signal coverage – commercial service – regional coverage

Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	IDI - NINČIĆ DOO, Prijepolje	3	0
2.	Društvo sa ograničenom odgovornošću za proizvodnju, trgovinu i usluge "MATRIX D", Čačak	3	0
3.	Akcionarsko društvo "TIMOČKA TELEVIZIJA I RADIO", Zaječar	1	0
4.	Zoran Nikolić PR,agencija za proizvodnju radio i televizijskih programa"STUDIO 101", Zaječar	1	0
5.	Privredno društvo "BETA RADIO" D.O.O., Novi Beograd	0	2

For TV signal coverage – commercial service – local coverage

Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	Akcionarsko društvo "INFORMATIVNI CENTAR", Priboj	1	2
2.	Informativno javno preduzeće "PREŠEVO", Preševo	1	2
3.	Javno preduzeće "Radio i televizije Trstenik" sa PO, Trstenik	1	0
4.	Preduzeće za izdavačku delatnost radio i televiziju "MELOS" DOO, Kraljevo	1	0
5.	Preduzeće za proizvodnju, promet i usluge "KLIK - KOMERC" D.O.O., Arilje	1	2
6.	Preduzeće za usluge i informisanje "EKRAN" O.D. Enver Islamović i dr., Novi Pazar	1	0
7.	Privredno društvo "RITAM" DOO, Vranjska Banja	1	2

8.	RADIO TELEVIZIJA RUBIN KRUŠEVAC DOO - OGRANAK TV RUBIN KIKINDA, Kikinda	1	0
9.	Udruženje građana “Forum žena Prijepolja”, Prijepolje	1	0
10.	RADIO TELEVIZIJA RUBIN KRUŠEVAC DOO, Kruševac	0	2

For radio signal coverage – commercial service – local coverage

Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	"ANI PRESS" DOO, Pirot	1	0
2.	"BLUE NETWORK MEDIA" DOO, Titel	1	0
3.	"EURO ALFA EXPORT-IMPORT" DOO, Subotica	1	0
4.	"RADIO FANTASI" društvo sa ograničenom odgovornošću za pružanje usluga, Vrbas	1	0
5.	"Milanović BROADCASTING COMPANY - RADIO FOX" DOO preduzeće za emitovanje radio televizijskog programa, Senta	1	0
6.	"MM PROMENADA 2010" DOO, Batočina	1	0
7.	"UDRUŽENJE ROMA NOVI SAD", Novi Sad	1	0
8.	Akcionarsko društvo "INFORMATIVNI CENTAR" AD, Priboj	1	0
9.	Akcionarsko društvo "RADIO TV PODRINJE", Loznica	1	0
10.	Biskupija Đakovačka i Sremska, Vikarijat Sremski, Rimokatolički župni ured "SVI SVETI", Vrdnik	1	0
11.	DOO za proizvodnju, usluge i trgovinu "JELIMIK" eksport-import, Jagodina	1	0
12.	Društvo za trgovinu, ugostiteljstvo i poslovne usluge "MIG EXTRA" DOO, Svilajnac	1	0
13.	Društvo za usluge poslovne aktivnosti i trgovinu "KISS" DOO, Lazarevac	1	0
14.	Društvo sa ograničenom odgovornošću "RADIO SAJAM", Novi Sad	1	0
15.	Društvo sa ograničenom odgovornošću "RADIO HOMOLJE", Žagubica	1	2
16.	Društvo sa ograničenom odgovornošću za radio i televizijsku delatnost "RADIO TELEVIZIJA RUBIN", Kruševac	1	0
17.	Društvo sa ograničenom odgovornošću informativno-propagandni centar "KULA", Kula	1	0

18.	Dušanka Milošević preduzetnik, radio i televizijske aktivnosti "GLAS PČINJE", Trgovište	1	0
19.	Javno informativno preduzeće "BAČKA TOPOLA", Bačka Topola	1	0
20.	Javno preduzeće "RADIO BELA PALANKA", Bela Palanka	1	0
21.	Javno preduzeće "RADIO-BUJANOVAC", Bujanovac	1	0
22.	Javno preduzeće "ŠTAMPA, RADIO I FILM BOR", Bor	1	0
23.	Ortačko društvo radio i televizijske delatnosti Petrović Branislav i ortak MLAVA-MEDIJA, Petrovac na Mlavi	1	0
24.	Preduzeće za izdavačku delatnost radio i televiziju "MELOS" DOO, Kraljevo	1	0
25.	Preduzeće za informisanje "RADIO BARAJEVO" DOO, Barajevo	1	0
26.	Preduzeće za informisanje i trgovinu "MEGA" DOO, Inđija	1	0
27.	Preduzeće za proizvodnju trgovinu i turizam "PLANETA" DOO, Apatin	1	0
28.	Preduzeće za proizvodnju, trgovinu i usluge "REKS" DOO, Kikinda	1	0
29.	Preduzeće za promet i usluge "SLOBODA - 90" A.D., Krupanj	1	0
30.	Preduzeće za radiodifuziju, marketing i usluge "BROADCAST MEDIA GROUP" DOO, Bajina Bašta	1	0
31.	Preduzeće za radiodifuznu delatnost i marketing “RADIO SEVEN” DOO, Niš	1	0
32.	Preduzeće za usluge "ATLETICO" DOO, Šid	1	0
33.	Privredno društvo “RADIO TELEVIZIJA KRALJEVO I IBARSKE NOVOSTI” DOO, Kraljevo	1	0
34.	Privredno društvo "RITAM" DOO, Vranjska Banja	2	0
36.	Privredno društvo za konsalting i poslove menadžmenta "WIDE SOLUTIONS" DOO, Kragujevac	1	0
37.	Privredno društvo za proizvodnju i emitovanje TV programa "TELEVIZIJA LESKOVAC" AD, Leskovac	1	0
38.	Privredno društvo za radio i televizijske aktivnosti “DUGA-SKY”radio televizija DUGA DOO, Požarevac	1	0
39.	Privredno društvo za usluge i promet eksport-import "LASTAVICA" društvo sa ograničenom odgovornošću, Kruševac	1	0
40.	Proizvodno trgovinsko preduzeće "VINEX LEVACKI GROZD" DOO, Rekovac	1	2

41.	RADIO IMPULS DOO, Bačka Palanka	1	0
42.	Radio stanica “DESPOTOVAC” DOO, Despotovac	2	0
44.	Radiodifuzno preduzeće “RADIO MAX FM” DOO, Jagodina	1	0
45.	Radiodifuzno preduzeće “RADIO KLIK FM” DOO, Zrenjanin	1	0
46.	RTV “M PLUS” društvo sa ograničenom odgovornošću, Mladenovac	1	0
47.	SRPSKA PRAVOSLAVNA CRKVA – EPARHIJA SREMSKA, Sremski Karlovci	1	0
48.	SRPSKA PRAVOSLAVNA CRKVA – EPARHIJA ŠABAČKA, Šabac	1	0
49.	CENTAR ZA TRENING I EDUKACIJU, Novi Sad	1	0
50.	Privredno društvo za trgovinu, usluge i protok informacija “VINOGRADINA” DOO, Valjevo	1	0
51.	Javno preduzeće "INFORMATIVNI CENTAR KOSJERIĆ", Kosjerić	0	2
52.	CENTAR ZA TRENING I EDUKACIJU, Novi Sad	0	2

For TV signal coverage – commercial service – Belgrade region

Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	Javno radiodifuzno preduzeće "STUDIO B", Beograd	1	0

For radio signal coverage – commercial service – Belgrade region

Ord. No.	Name and seat of the radio station owner	Number of issued broadcasting station permits	Number of issued microwave station permits
1.	Društvo za radiotelevizijsku delatnost, marketing i konsalting "RTV CENTAR" D.O.O., Beograd	1	0

9. RF SPECTRUM USAGE AND QUALITY OF SERVICE MONITORING

9.1. RF SPECTRUM USAGE MONITORING

9.1.1. INTRODUCTION

The Republic Agency for Electronic Communications (RATEL) is in charge of RF spectrum management in the territory of the Republic of Serbia (Arts. 81-99 of the Law), as a scarce national resource. As part of the RF spectrum management, RATEL performs permanent monitoring of the RF spectrum usage. The RF spectrum monitoring related activities can be divided into two groups. The first group consists of the classic monitoring activities, i.e. RF spectrum monitoring, whereas the second group concerns technical inspection.

The first group of activities are performed either upon a complaint filed by RF spectrum users, or as part of the regular examination and detection of irregularities in the RF spectrum usage. The second group of activities are usually performed upon request for radio station technical inspection made by users who had been granted permits.

During 2011 the Republic Agency for Electronic Communications has been fulfilling their obligations regarding direct RF spectrum management, as stipulated under the Law, according to all available data. Major attention was dedicated to cases related to resolving harmful interference, in particular in the frequency bands used by radio and TV broadcasters and mobile operators, and also to detection of unauthorized spectrum users.

Many cases were related to radio-station technical inspection as a preventive measure for an adequate and regular RF spectrum usage, since many new RF spectrum permits had been granted. RF spectrum usage monitoring is performed in order to ensure an efficient, economical and safe RF spectrum usage for the holders of licences, radio frequency permits or general authorizations for service provision, as well as for all other spectrum users. This is achieved

through the control of the operation of the authorized spectrum users, by detecting and preventing unauthorized RF spectrum usage, by measurement of data required for spectrum planning and by examination of harmful interferences followed by application of prescribed remedy measures, pursuant to the Law, bylaws, ITU Radio Regulation – RR, 2008 and national and international standards. Monitoring entails the control of RF spectrum usage in the 9kHz-3000kHz band, including the broadcasting parameters and relevant characteristics of the radio stations which are the broadcasting source.

The basic reports on the monitoring activities are the control and measurement results obtained by monitoring either from the monitoring centres or at the location. All results are entered into the monitoring and measurement data base.

Table 13 shows the number of monitoring and measurement results, organized by locations and bands.

Table 13. The Number of Monitoring and Measurement Results, Organized by Location and by Band

Number of measurements / Frequency band (MHz)	45 -87.5	87.5 -108	108 -144	144 -174	174 -230	230 -380	380 -400	400 -470	470 -1000
MC Dobanovci					3253				
MC Niš									
Golija[1)]	8	191	-	196	20	2	52	68	74
Vranje[2)]	-	109	11	78	33	12	44	60	123
Užice[3)]	6	227	18	10	32	1	14	18	342
Srpska Crnja[4)]	0	188	22	12	30	21	52	10	195
Sombor[5)]	9	141	29	10	17	2	70	25	130
Sokolov Vis[6)]	2	160	5	192	42	40	63	111	229
Cer[7)]	7	179	17	8	27	19	84	70	214

[1)] 4 July - 9 July 2011
[2)] 6 June - 10 June 2011
[3)] 12 September – 16 September 2011
[4)] 29 August – 2 September 2011
[5)] 6 June 10 June 2011
[6)] 26 September 30 September 2011
[7)] 15 August 19 August 2011

9.1.2. HARMFUL INTERFERENCE EXAMINATION

Table 14 shows the number of cases related to examination of harmful interferences, by type of users. The dominant number of interferences was seen in the spectrum potions used for broadcasting, followed by interferences of GSM/UMTS systems and microwave device interferences. FM and TV broadcasting stations mainly interfered the operation of the same type of station, whereas the interferences reported by mobile operators had been caused by jammers or DECT phones not working in the frequency bands allocated for these communication devices. Considering that the number of reported interferences to mobile base stations is growing, information was published on RATEL's website (www.ratel.rs), warning that using these devices is illegal and harmful.

Table 14. Reported Harmful Interferences by Users

Affected users	Number of interference cases
Broadcasting	229
GSM/UMTS	38
Ministry of Interior	15
Air Traffic Service Agency	7

9.1.3 DETECTING UNAUTHORIZED SPECTRUM USAGE

Detecting unauthorized spectrum usage is a priority task for RATEL. There is an updated list of broadcasters operating without the required permit, available at RATEL's website. Table 15 provides an overview of the detected radio stations operating without a frequency usage permit, by location of operation. Table 15 and the relevant data refer to the broadcasting stations, which account for 95% of all detected radio stations operating without permit. The concentration of the radio stations operating without permit is rather high in some locations.

9.1.4. MEASURES TAKEN

Presented here are all documents collecting the measurement results or results obtained by examination, used for initiating further administrative and legal procedures if applicable, to the end of resolving detected irregularities in spectrum usage.

Table 15. List of the radio stations broadcasting without permit, as on 31 December 2011

	Identification, location	Frequency (MHz) / Channel (C)
1.	Radio Kult, Požarevac	102.7
2.	Radio Link, Valjevo	102.0
3.	Radio Link, Valjevo	102.5
4.	TV Kronik, Valjevo	N0N
5.	Radio Kosmos, Lazarevac	101.0
6.	Radio Vaki, Zemun	103.7
7.	Radio Šeherezada, Zemun	89.6
8.	TV Palma, Zemun	C 34
9.	Radio Zavičaj, Lazarevac	91.1
10.	Radio Krajina, Futog	103.5
11.	Radio MS, Novi Sad	88.8
12.	Radio Zec, Novi Sad	104.8
13.	Radio Antena, Novi Sad	100.3
14.	Novosadski Folk Radio	105.6
15.	Radio Aškali, Novi Sad	96.9
16.	Radio Skala, Novi Sad	96.9
17.	Radio Suton, Novi Sad	104.2
18.	RadioIKS, Novi Sad	93.8
19.	Radio Max Level, ML, Novi Sad	101.4
20.	Radio 90, Hajdukovo	93.6
21.	Radio D-65, Deronje	100.5
22.	Radio BB, Sombor	96.7
23.	Radio Padina, Padina	88.2
24.	Radio Ibis, Melenci	96.7
25.	Radio Fantom, Melenci	106.6

26.	Radio Narodni, Apatin	101.0
27.	Radio Narodni, Apatin	100.5
28.	Radio Narodni, Beograd	87.5
29.	TV Link, Valjevo	C 61
30.	Radio Eho, Beočin	102.9
31.	Radio Goldi, Apatin	102.5
32.	Radio Duga, Trgovište	92.3
33.	TV Duga, Trgovište	C 27
34.	Radio Minić, Kuršumlija	94.9
35.	Bošnjačka TV, Novi Pazar	C 31
36.	Radio Enigma, Prijepolje	104.3
37.	Radio Rez (Grom), Zrenjanin	106.3
38.	Radio Balkan, Vranje	107.1
39.	Radio Balkan, Fruška Gora	102.2
40.	Radio Balkan, Kruševac	94.8
41.	Radio Balkan, Vršac	98.2
42.	Radio Balkan, Subotica	87.5
43.	Radio Balkan, Novi Beograd	97.9
44.	Radio Balkan, Valjevo	(106.6) 107.2
45.	Radio Balkan, Kragujevac	106.3
46.	Radio Balkan, Pirot	97.7
47.	Radio Balkan, Trstenik	105.0

Table 16 provides the list of administrative and technical documents for 2011. The report on irregularities in the RF spectrum usage is the principal document related to RF spectrum monitoring, in which the data on regularities are registered. This report is usually made in case of remote spectrum monitoring, without a direct contact with the spectrum users and their broadcasting devices. In case it is found that the harmful interferences or their irregularities are caused by a radio sta-

tion located beyond Serbian borders, an international report on irregularity/harmful interference is made. If the monitoring is performed directly with the user, by checking the frequency usage permit and other necessary documents (where conductive measurement of the broadcasting devices is possible), a report on monitoring is made. Documents referred to under points 4-8 are parts of administrative and legal procedure that may be carried out pursuant to the Law and RATEL's competences, and they imply the sanctioning of the users that fail to observe the measures imposed on them to the end of resolving the detected irregularities in spectrum usage, following a warning.

Table 16. Number of Administrative Technical Documents

	Type of document	No
1.	Report on RF spectrum usage irregularities	527
2.	International report on irregularity (harmful interference)	4
3.	Control records	40
4.	Statement request	216
5.	Request for petty offence proceedings	86
6.	Request for criminal charges	46
7.	Report filed to the Broadcasting Agency	458
8.	Report filed the Ministry of Culture, Media and Information Society	187

9.1.5. TECHNICAL INSPECTIONS

Pursuant to the Rules on monitoring, technical inspection involves measurement and conformity check of the broadcasting parameters and radio station characteristics with the assignment requirements and spectrum usage, as set out by the Law and other standards.

In 2011, 4450 technical inspections of radio stations were performed. Considering the number of the new permits issued in 2011, technical inspections were performed for 86% of them.

Table 17 lists the top five RF spectrum users in terms of performed technical inspections in 2011. The number of performed technical inspections listed in Table 17, also refer to the radio stations for

which the permits were issued in the previous years. The Table shows the most active RF spectrum users in terms of technical inspections. The data show that mobile operators and large companies accounted for the majority of technical inspections, as expected considering the number of radio stations they own.

Table 17. RF Spectrum Users with the Biggest Number of Technical Inspection Performed in 2011

RF spectrum usage	Number of technical inspections performed in 2011
Telecommunications Company Telekom Srbija Joint Stock Co.	1077
Telenor Ltd.	505
Vip mobile Ltd.	935
Serbian Railways, Public Enterprise	239
Belgrade Business Taxi, Ltd.	206

9.2. QUALITY CONTROL OF THE PUBLICLY AVAILABLE ELECTRONIC COMMUNICATION SERVICES AND ELECTRONIC COMMUNICATION ACTIVITY PERFORMANCE MONITORING

Pursuant to Arts. 109 and 131 of the Law, the Agency was required to define quality parameters for specific publicly available services, minimum quality of service provision and control procedure for verification of compliance of the operators performance with their responsibilities set out by general requirements for business performance, special obligations imposed on SMP operators, requirements set out by permits for the use of numbering, individual RF usage permits, and other obligations set out under the Law and pertinent regulations.

In this regard, in the last quarter of 2011, the Rules on quality parameters for publicly available electronic communication services and monitoring of electronic communication activity (*Official Gazette of RS*, no. 73/11) was passed and published.

In 2011, 4450 technical inspections of radio stations were performed. Considering the number of the new permits issued in 2011, technical inspections were performed for 86% of them.

The Agency carries out the electronic communications activity control through regular and additional control. The regular control involves data and information collecting, measurement and examination at least once a year. Through regular and additional control, the Agency checks quality parameters of electronic networks and services based on the parameters defined by the Rules.

Although the Rules entered into force in October 2011, the Agency sent 282 requests to the operators, on 9 January 2012, to provide data on quality parameters of publicly available electronic communications networks and services, so that the operators would comply with the new obligations under the Rules as soon as possible and in order to obtain information regarding the quality of services and networks in the Republic of Serbia. Once the received reports are processed, the Agency will carry out a detailed analysis and, if applicable perform additional controls, pursuant with the Rules.

The operators are required to submit the following reports to the Agency once a year, as stipulated under the Rules:

1 For electronic communications services:

- 1.1 Report on quality parameters values for public voice services on public telephone network at fixed location
- 1.2 Report on quality parameters values for public services on public mobile communications network
- 1.3 Report on quality parameters values for public voice services provided via Internet
- 1.4 Report on quality parameters values for broadband services
- 1.5 Report on quality parameters values for media content distribution services

2 For networks:

2.1 Report on quality parameters values for public mobile communication networks

2.2 Report on quality parameters values for public fixed wireless telecommunication networks (CDMA)

The submission of these reports is an obligation of operators, pursuant to the Law and the Rules. In this regard, the Agency has the obligation to provide comparative pricelists of the publicly offered services and other data of relevance for protection and enhancement of consumer and end-user interests.

10. TELECOMMUNICATIONS NETWORKS OF PUBLIC ENTERPRISES

10.1. ELECTRIC POWER INDUSTRY OF SERBIA, PUBLIC ENTERPRISE

The efficient operation of the electrical power system of our country, comprised of the public enterprises Electric Power Industry of Serbia (EPS) and Electric Networks of Serbia (ENS), is entirely dependent on the existence of a modern telecommunications system for relaying technical and business data. The construction of a new telecommunications system for the electrical power companies in our country started several years ago, and is now drawing to a close. All of the planned top-level networks are either completed or nearing completion.

10.1.1. OPTICAL CABLE NETWORK

The optical cable network is increasingly similar in appearance to the high-voltage electrical power transmission network. As regards power lines with a voltage level of 400 kV and 220 kV, it could be said that the cables were fully replaced by installing lines with built-in optical cables. This type of replacement was completed in a large number of power lines with a voltage level of 110 kV and several lines of 35 kV.

The project of installing optical cables at the top network layer has largely been completed and, due to a clear need for new telecommunications connections in lower layers, both regional and local, the network is currently expanding in this direction. Thus current implementation and immediate plans are focused on covering the entire 110 kV power transmission network.

In this way, optical cables connect all important power supply facilities in Serbia. In 2011, the already rolled out network reached the total length of 6,000 km of OPGW (Optical Ground Wire), ADSS (All Dielectric Self-Supporting) and connecting underground optical cables.

The new optical network was mostly built using OPGW cables with 48 fibres, of those 24 G.652 type fibres and 24 G.655 type fibres. Only the initial construction line from Belgrade to Bajina

Bašta utilized a total of 24 fibres of the G.652 type. In some sections, where the state of power-transmission lines was such as to require extremely thin and light OPGW cables, the 24 fibre-cable, with 12 G.652 and 12 G.655 fibres was also used.

The state of the optical network is regularly monitored by measuring losses, chromatic dispersion and polarization mode dispersion (PMD). The quality is very good thus far, remaining within the prescribed margins.

By installing terminal devices and deploying the monitoring system, the fibres in use are automatically under constant control, while the free fibres will still need to be controlled by occasional measurements or special systems.

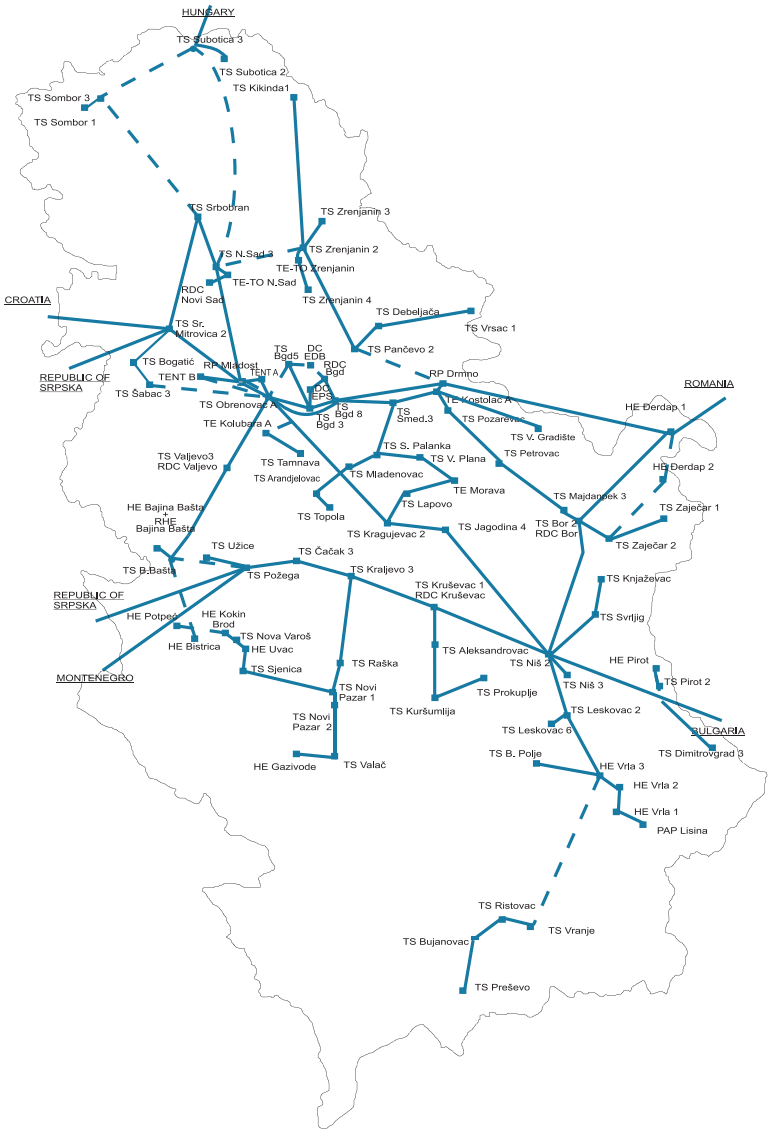
The optical network built thus far is shown in Figure 78. The network reaches nearly all important facilities in the power supply system of the Republic of Serbia. With further development, it will practically cover all significant points in the country, which is very important, both in terms of the power supply and telecommunications. Further development towards regional and local layers will surely make it the most widely distributed optical transfer medium on this territory with multiple usage capabilities.

Since the need for utilising new telecommunications capacities was ever present and increasing, the usage started before the completion and full deployment of the network. This is especially true of the interconnection routes with neighbouring countries during the process of connecting to the UCTE.

10.1.2. EPS TRANSPORT NETWORKS

The new optical telecommunications network contains 80 nodes at trunk level, where adequate terminal equipment was installed. These nodes represent the key facilities in the power supply system of the country, i.e. all hydro and thermal power plants, all mines and all important transformer stations, as well as facilities wherefrom electrical power connectivity with neighbouring countries is established. The entire system is connected to two command centres, the main centre and the backup (Disaster Recovery Centre). The main TC centre is located in the Dispatch Centre.

Figure 78. “Electric Power Industry of Serbia” Optical Network Source: EPS



For the purpose of business, technical and voice data transmission, priority was given to SDH technology (Synchronous Digital Hierarchy), since it is dominant for these types of uses worldwide. The capacities on all major routes are of an STM-16 level, on minor routes they are of STM-4, while certain peripheral and antenna routes are of an STM-1 level. All those points have adequate flexible multiplexers installed to receive various user interfaces utilising the 64 kbit/s channel, comprising the network providing channel transfer in dedicated telecommunications networks.

All planned devices were installed, tested and deployed. Since the topology of an SDH network is of a mesh type, this means that the security systems need to be adequate. Since there are no classical rings in the network, traffic security in an SDH mesh network uses SNCP (Sub Network Connection Protection) systems. They provide security for the traffic on a point-point basis, i.e. between the entry and exit node in an SDH network. The LCAS (Link Capacity Adjustment Scheme) protocol is used for transmitting business traffic and route traffic along various routes.

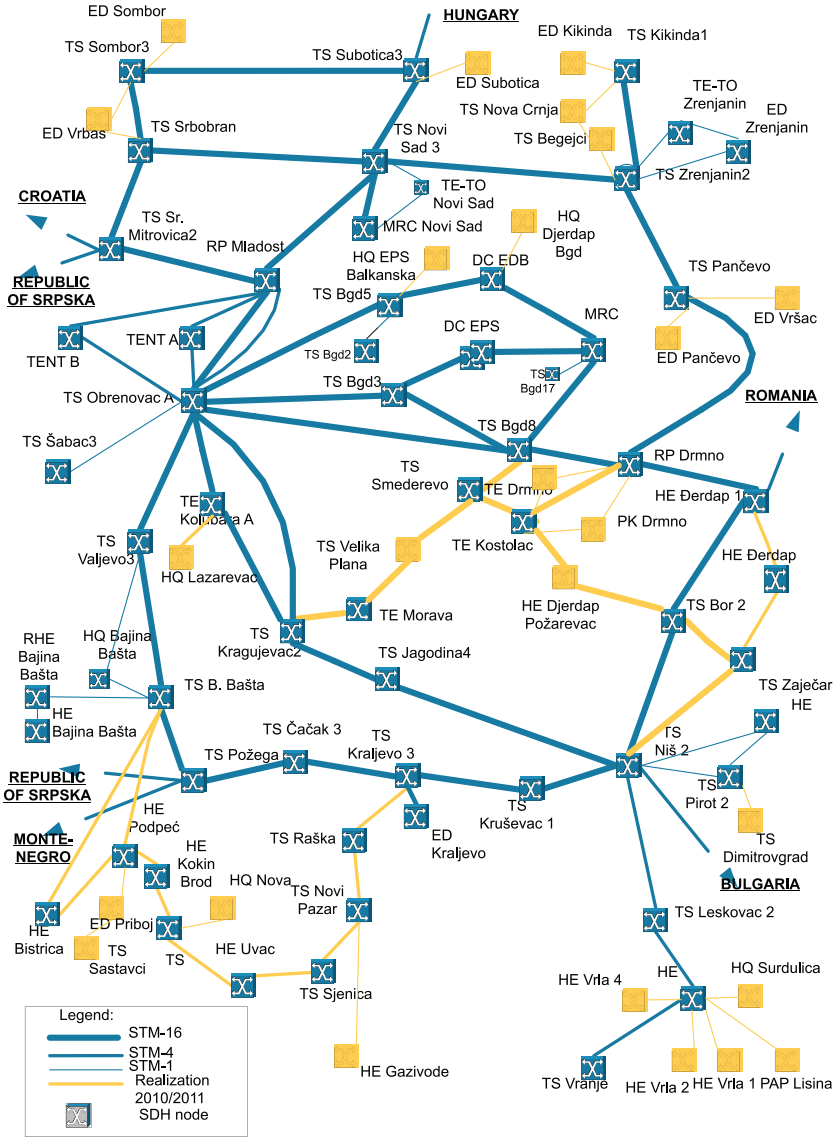
The control and monitoring systems, as well as the synchronization systems, were implemented and became operational. The control and monitoring system is comprised of three independent subsystems: the system for the control and monitoring of the SDH network, the system for the control and monitoring of the FMUX network and the system for the control and monitoring of the synchronisation devices. The control and monitoring system is a centralised, redundant system with high capacities enabling the remote control of all network elements, SDH and FMUX devices, as well as synchronisation devices.

Figure 79 shows all of the nodes with terminal equipment installed and their telecommunications capacities for adequate routes.

10.1.3. EPS PACKET-SWITCHED NETWORK

The deployment of the new telecom system of the Electric Power Industry of Serbia, based on OPGW and SDH technology, provided for a modern infrastructural telecom transport network, which serves a s a base for building a packet-switched network throughout the territory of the Republic of Serbia. The backbone consists of five core routers within electric power facilities on five locations, connected on full-mesh structure through STM-4 interface on SDH devices.

Figure 79. New Telecommunication Network Locations and Capacities Source: EPS



MPLS (*Multi Protocol Label Switching*) technology is applied to the backbone in order to cater to specific network functions, such as VPN (*Virtual Private Network*), clear-cut separation of electric power services, traffic management, improved recovery time and QoS.

As for access routers, the so-called lite VPN model was applied, with VRF (Virtual Routing and Forwarding) created for the needs of some services and VRF Voice for telephone service, and entire traffic in this VRF is propagated through MPLS network via BGP (Border Gateway Protocol). New VRFs will be created for electric power services provided over packet-switched network, and the business data transmission is underway.

There are 27 locations currently connected in the access segment, with two routers on each location connected to different routers in the packet-switched network backbone, due to high level of availability required.

The first service launched through packed-switched network was telephone service.

The technical concept of the EPS telephone network based on IP technology is founded on the centralized call management in the network with two softswitches on two separate locations in cluster architecture.

Access routers in 16 out of 27 locations became IP voice gateways, through integrated cards enabling connection with the existing TDM exchanges and public network.

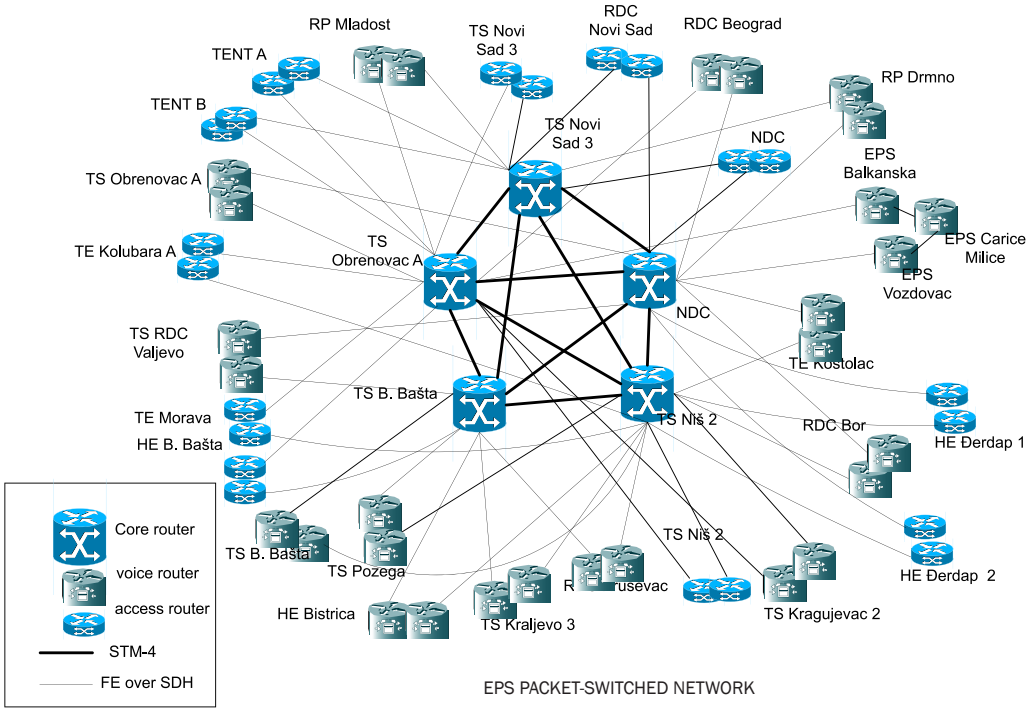
There are another six facilities connected to IP telephone network via access routers, mainly large production or governing/administrative centres, where new IP-TDM exchanges had been installed, and also five locations with fairly advanced TDM exchanges. Other locations with telephone exchanges that had been previously procured and installed, have been connected to a single telephone network via SDH devices, through E1 with 4-wire channels.

The implementation of IP telephony in the electric power system entailed the roll out of a high-availability corporate packet-switched network and strict requirements regarding QoS, thereby creating an infrastructural network which supports the transmission of a greater number of ser-

vices required by electric power system (data transmission for electric power system, business data transmission, video signal transmission for videoconferencing, etc.), leading to a more efficient an rational usage of telecom infrastructure.

Figure 80. shows EPS IP telephone network.

Figure 80. EPS IP Telephone Network Source: EPS



10.2. ELECTRIC ENERGY TRANSMISSION AND TRANSMISSION SYSTEM CONTROL (EMS), PUBLIC ENTERPRISE

Telecommunications system of the Electric Energy Transmission and Transmission System Control (EMS), Public Enterprise represents the backbone of the closed functional system which

covers the territory of the Republic of Serbia and is used for the purposes of the electrical power sector. More than 90% of traffic in the electric energy sector transmitted over OPGW (Optical Ground Wire) covers the needs of the EMS, Public Enterprise, which is in charge of maintaining, monitoring and managing its resources.

Due to the requirements of technological processes pertinent to the electrical power transmission system management, this telecommunications system enables a higher level of information transmission reliability and security, with lower transmission speed and capacity requirements as opposed to public telecommunications networks. Such a concept originates from the rules defined by the UCTE/ENTSO-E (*Union for the Coordination of Transmission of Electricity /European Network of Transmission System Operators for Electricity - Operational handbook*). Several types of services are supported: telephony (operational, business), the transmission of the technical control system EMS SCADA (*Supervisory Control and Data Acquisition*) signal, Electric Power Industry of Serbia (EPS) and EMS business data transmission, SRAAMD (System for Remote Acquisition and Accounting of Metering Data) meter reading, signal transmission for EMS power line protection as well as monitoring and managing the telecommunications system. For the purpose of information transmission, EMS uses several networks of different technologies.

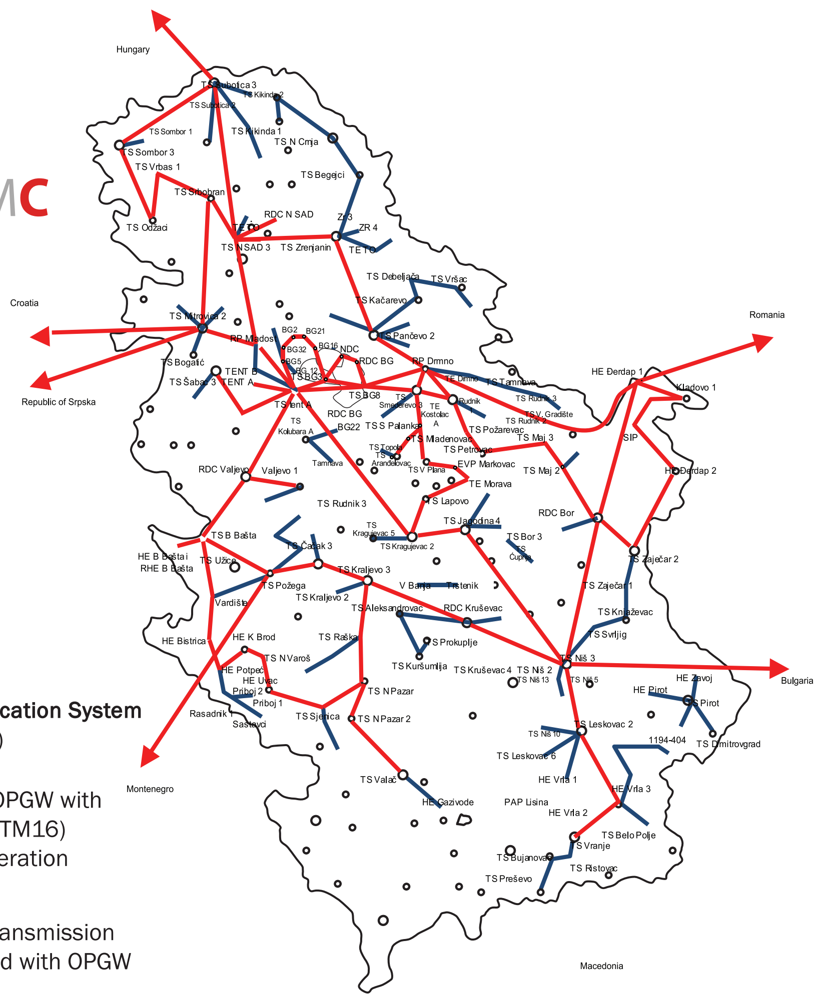
The basis of the EMS telecommunications network is the optical network realized by OPGW cables and optical SDH (*Synchronous Digital Hierarchy*) terminal equipment. The OPGW network of cables is an integral part of EMS power lines (since the power line protection is the basic power function). OPWG network illustration is given by EPS. Both telecommunications systems are used by EPS and EMS for the same OPGW cable network.

In 2011, there were approximately 4135 kilometres of OPGW cables installed. EMS optical terminal devices are installed along 3300 kilometres. These devices are in function in 47 nodes. The speed levels are STM-1 (155 Mbps) and STM-2 (2.5 Gbps). Figure 81 illustrates the EMS telecommunications system.

The necessary path redundancy was achieved through 4 STM-16 and 5 STM-1 optical loops: both SDH and PDH (*Plesiochronous Digital Hierarchy*) links have been in operation inces-

Figure 81. EMS Optical Telecommunications System Source: EPS

EMC



EMS Optical Telecommunication System (end of 2011)

3300 km of OPGW with SDH (STM1-STM16) devices in operation

EMS power-transmission lines equipped with OPGW

santly, whereby the exceptional availability was achieved. Monitoring, management, configuration and the maintenance of the built-in optical equipment, is conducted, in real time, from the operational room of the EMS Telecommunications Centre.

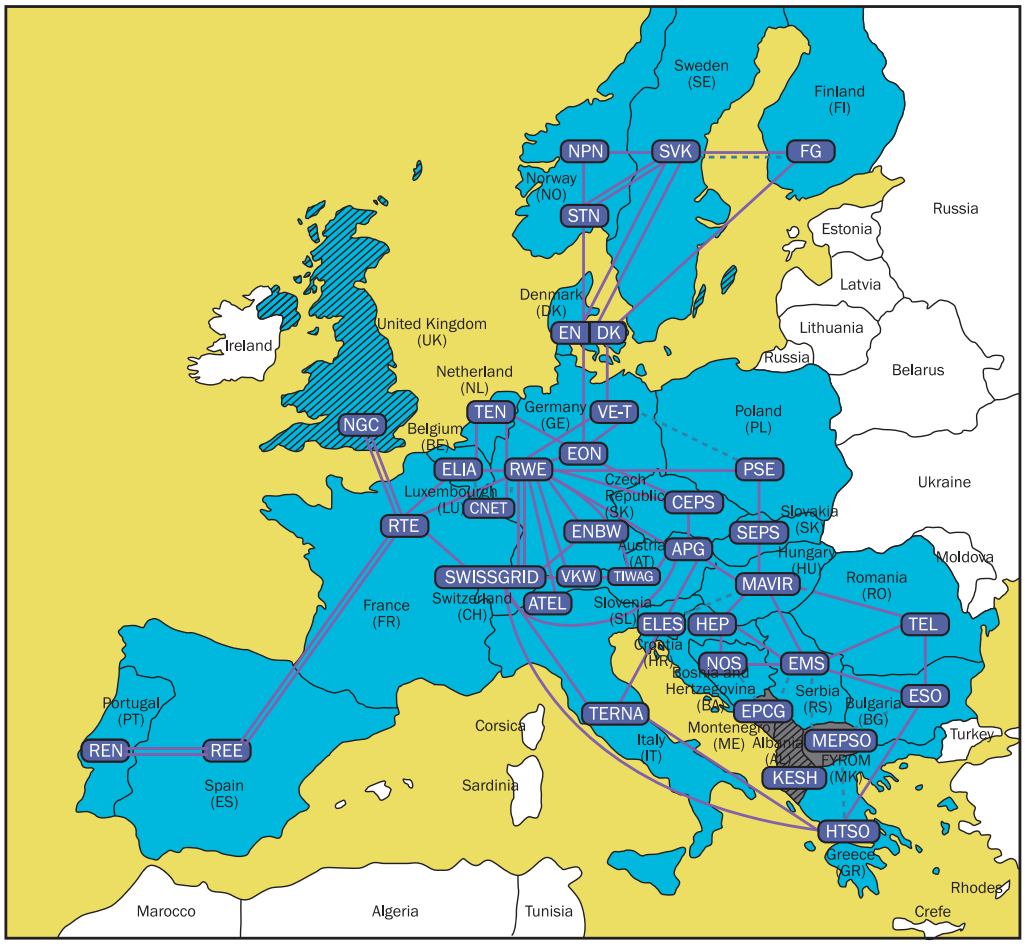
With the use of optics, and in accordance with the UCTE (ENTSO-E) recommendations, EMS is connected with electrical power industries of Hungary, Bosnia and Herzegovina, Croatia, Romania and Bulgaria. Connections are enabled by means of STM-1 links, whereas devices support links up to STM-16. In this way, EMS is linked to the European Energy Network (Electronic Highway - EH). This network is used for the exchange of data on the electrical power systems of European countries in real time, with the aim of ensuring the security of the European electrical power sector. The connection with Montenegro is secured by STM-1 link, but the electrical power industry of Montenegro still lacks the telecommunications resources necessary for the Electronic Highway. Figure 82 illustrates the abovementioned international links, with EMS having a considerably higher number of interconnections in relation to the number of links of most of the other countries.

The network of very high (VH) frequency links consists of sections realized along high-voltage lines. These sections are mainly analogue, with few channels, and connected into the single network via automatic telephone exchanges of the electric power. In terms of percentages, a rather small portion of voice and telemeasuring data are transmitted over VF connections. VF network, although technically obsolete, has maintained its functionality during 2009 and fulfilled the basic implemented technical requirements. With the development of telecommunications systems, VF links are becoming obsolete and will most likely be used for securing alternative paths.

The telephone exchanges are in the process of gradual replacement and migration towards the use of IP technology (out of the 32 existing exchanges, only 16 have satisfactory characteristics). Within the 15/08/PT project for the realization of packet telephone network, 18 packet telephone exchanges were installed within the single EMS and EPS telephone network.

Mobile links, which include base stations, appropriate repeaters and terminal stations of various types, provide efficient operation of fieldwork teams, particularly in rural areas. These mobile links cover most of the territory of the Republic of Serbia. Further development of the mobile net-

Figure 82. European Electronic Highway Source: EPS



Note: Montenegro (EPCG) and Macedonia (MEPSO) and not linked to EH.
Albania is not a member of UCTE/ENTSO-E

work is currently in stagnation. EMS uses 5 radio-relay links in the 7.8 and 23 GHz bands. Digital links with STM-1 and 34 Mbps capacity are integrated into the telecommunications system.

By using own telecommunications system enabled the availability and information security necessary for the real-time operation of the electric energy system and the functioning of the overall electric energy sector. The amount of savings has exceeded the value of the active equipment built in. By building and exploiting the modern telecommunications system, the EMS personnel gained new skills necessary for the activities of operational management, monitoring, as well as maintenance of the EMS telecommunications system. In retrospect, the increasing usage of the optical transmission system can be regarded as one of the main characteristics of the previous period.

The unused capacity is mostly evident in the part pertinent to OPGW cable fibres. In taking this matter into consideration, one should note that EMS power lines (with OPGW cables) end in transformer stations. The abovementioned transformer stations are located outside urban areas. Since the active equipment provides unused capacities as well, one of the existing telecommunications systems (EMS, EPS) may partially be used for the needs of other entities apart from those within electrical power industry. Within such use, the security of operational data related to the technological process of managing the electrical power system in real time (SCADA and SRAAMD) should be of highest importance.

10.3. SERBIAN RAILWAYS, PUBLIC ENTERPRISE

10.3.1. CURRENT STATE OF TELECOMMUNICATION SYSTEM

The telecommunications networks of the Serbian Railways, PE utilize the following types of transfer media:

- transfer along ground cables and
- radio transfer.

The transfer of telecommunications, signals and stable electric traction facility information along electrified railroads is mostly conducted through STA (with no coaxial tube) and STKA (with co-

axial tube) railroad signals-telecommunications cables. The purpose and construction of signal-telecommunications cables is determined by massage type and frequency band required by the above systems.

Optical cables were laid down within the Belgrade railroad junctions (the business facilities at Nemanjina 6 – Belgrade Passenger – Belgrade Centre) and along the sections Belgrade Centre – Pančevo Main, in the total length of 21 km. Optical cables laid along Požega – Kraljevo route in the total length of 65.7 km. The abovementioned optical cables have the capacity of 8 (Pančevo most-Pančevo glavna), 10 (Požega-Čačak), 12 (Beograd Centar-Pančevo most), 24 (Beograd Nemanjina 6-Beograd Centar) i 36 (Čačak-Kraljevo) fibres.

HF transmission along main railroads is realized via 300-channel systems, alongside railroads via 12-channel systems and along non-electrified railroads via 12-channel systems for operation on air-lines and three-channel systems. All transmission systems are realized in analogue technique with electronic pipes and transistor as basic components.

The SDH transfer system at the STM-1 level is used within the Belgrade Railroad Junction (business facilities Nemanjina 6 – Belgrade Passenger – Belgrade Centre), as well as along the sections Belgrade Centre - Pančevo Main where optical cables were laid down.

Radio link systems are a single technical and technological unity in terms of operation and usage. Radio links are increasingly being employed in the railway system due to their flexibility, availability and quality of service, which is of great importance for the operation of railways.

The Serbian Railways PE uses the following frequency bands:

- 147.775-148.300 MHz band paired with 152.275-152.800 MHz for radio networks for communication in traffic control along non-electrified railroads (Zrenjanin-Kikinda, Subotica-Banatsko Miloševo, Crveni Krst-Zaječar, Lapovo-Kraljevo);,
- 167.250-167.375 MHz band paired with 171.750-171.875 MHz reserved for the ZGOP radio networks (in the Serbian Railways network);

- 444.450-445.625 MHz band paired with 454.450-455.625 MHz for local radio networks in larger classification yards and sorting stations, as well as maintenance services,
- 457.450-458.300 MHz band paired with 467.450-468.300 MHz for the locomotive radio dispatch system enabling communication between dispatchers and engine drivers, in use along all major routes (Beograd-Mladenovac-Lapovo-Niš-Preševo, Beograd-Mala Krsna-Velika Plana, Batajnica-Šid, Inđija-Subotica-state borderline, Resnik-Požega, Beograd node rails – cargo and passenger traffic).

A vast array of devices is in use in the radio-systems currently operating on the railroads, from the earliest generation of devices manufactured using transistor components, up to modern microprocessor-based radio devices.

10.3.2. INVESTMENT DEVELOPMENT PLAN

The investment development plan takes into consideration only main railroads. Side railroads the continuity of the telecommunication system will be established on certain routes, according to the technical requirements of the Traffic Department and financial assets, by installing free-standing cable, radio stations at important official sites or partial calibration.

10.3.2.1. CABLES

The plans for the investment works for main routes where no copper cables have been laid down (Niš – Dimitrovgrad and Belgrade – Vršac) envisage the laying of copper STA¬PV1 4x4x1,2NF+12x4x0,9NF and optical cables, mostly with 144 optical fibres, into the ground, whereas along other main routes where railroad copper signals-telecommunications cables of the STKA and STA types are in use (Belgrade-Bar, Belgrade -Šid, Belgrade -Niš-Preševo, Inđija-Subotica, Belgrade - Mala Krsna-Velika Plana) either pylon contact networks or 144 fibre optical cables will be laid into the ground.

In late 2010 an agreement was signed with PTT on building optical infrastructure along corridor X rails. The public tender for construction of the first phase of the optical infrastructure of 461

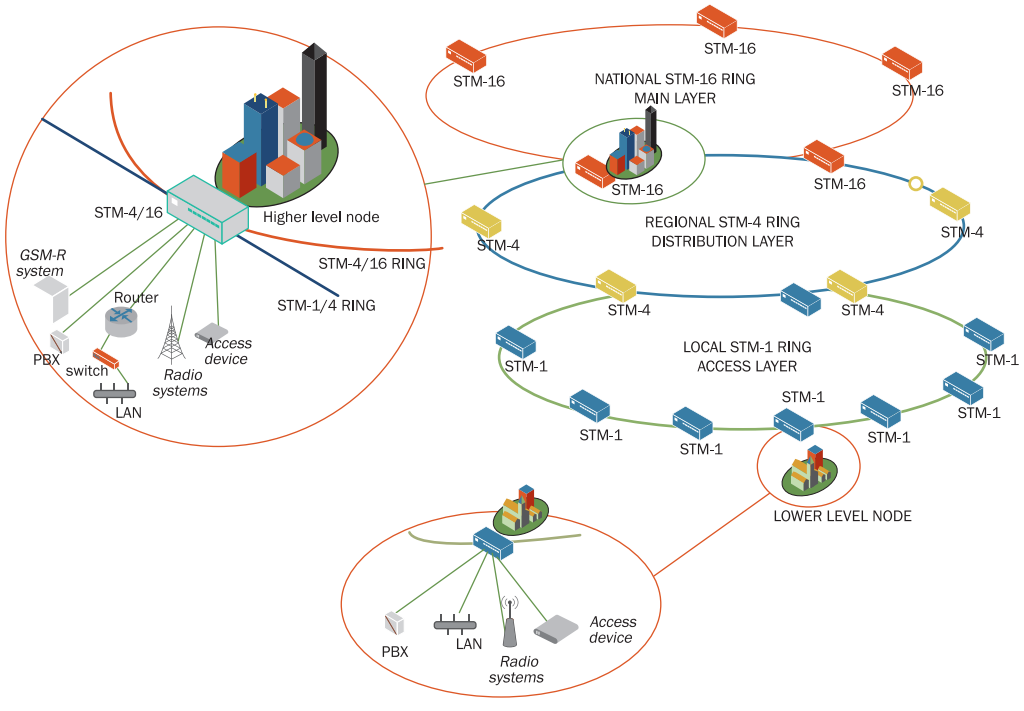
km along the railway tracks of the Belgrade railway node and railway tracks Belgrade– Šid and Belgrade – Niš, is planned for May 2012

10.3.2.2. TRANSMISSION SYSTEMS

The transfer system network architecture consists of three layers:

- Main
- Distribution
- Access

Figure 83. Telecommunication Transmission System Source: EPS



The following total capacities were planned for the main routes on the territory of Serbian Railways:

- STM-1 (Subotica-Sombor, Subotica-Horgoš, Novi Sad-Sombor, Šid-S.Rača, Ruma-Šabac-Zvornik, Prahovo-Zaječar);
- STM-4 (Belgrade-Prijepolje, Niš-Dimitrovgrad, Belgrade.C-Mala Krsna-Velika Plana, Niš-Preševo, Novi Sad-Subotica, Subotica-Kikinda, Subotica-Zrenjanin, Stalać-Kraljevo-Požega, Lapovo-Kraljevo, Kraljevo-Lešak, Beograd-Pančevo-Vršac, Inđija-Šid, etc.);
- STM-16 (Belgrade -Niš, Belgrade - Inđija-Novi Sad, Belgrade C.- Belgrade -Nemanjina);
- Mid-range radio links were envisaged for redundancy, enabling the closure of the ring structures in the transport network.

Based on individual user concentration, applications in use, as well as the service they require, the nodes were divided into higher and lower level nodes.

Higher level nodes belong to the transport or distribution layer.

Lower level nodes mostly belong to the distribution or access layer.

10.3.3.3 CIRCUIT-SWITCHING NETWORK

The telephone network would operate as a three-tiered network. It would be comprised of the transit, regional and local layer.

Nodes in the transit layer are mutually partially networked and are mostly located in the headquarters of the railroad organizational units. All calls are routed according to non-hierarchic alternative principle. Transit nodes are equipped with necessary hardware and software modules which are in charge of the system monitoring and maintenance and where the system backup is located.

Each regional node contains local software enabling autonomous control and complete call processing for all its users.

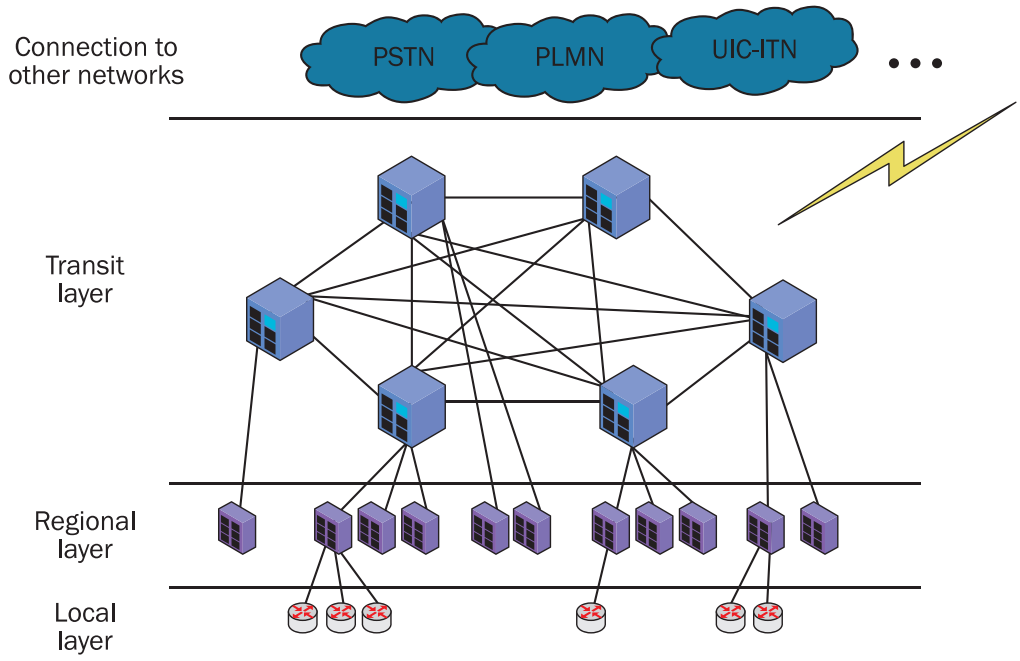
Local layer nodes would be located mainly along the railway and in smaller official sites. They would be realized as remote stages, concentrators or LAN.

Only transit centre Belgrade would be connected to the networks of other railway administrations.

The connection to the public network would probably be realized through transit layer although there some regional nodes should also be able to realize the connection.

The network should have an open numbering system. Each transit node has a code and each user within the exchange can be reached directly by dialling a user number. The numbering of each regional node is an integral part of the relevant transit exchange numbering.

Figure 84. Circuit-Switching Network Source: EPS



10.3.4. RAILWAY DEVICES

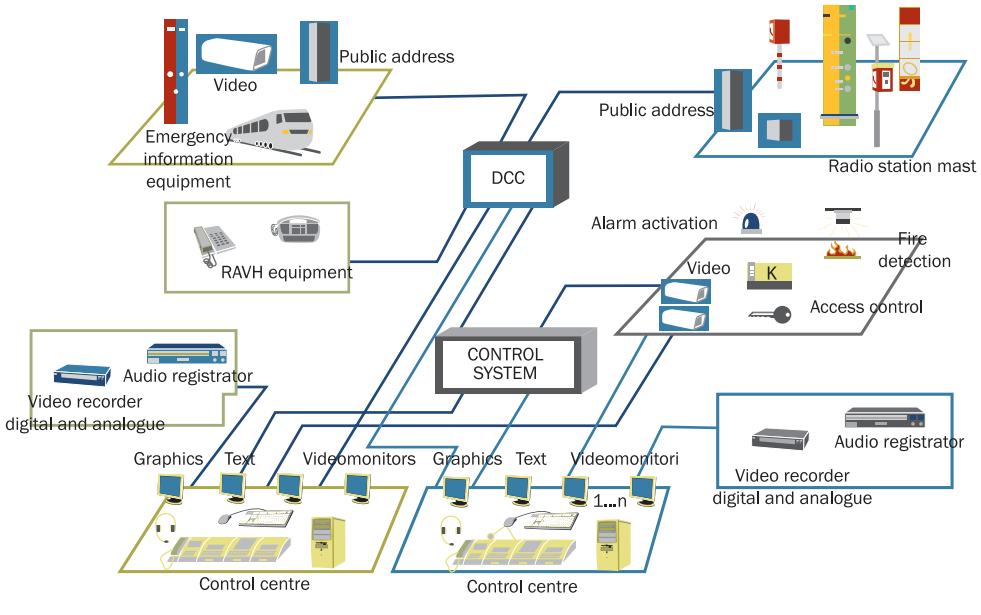
The investment works envisage the setup of modern railroad telephony systems manufactured using digital integrated technologies.

New systems with digital communication nodes (DCN) will be used along electrified international corridor railroads. The installation of a new generation of railroad telephony systems includes changes to current rulebooks and manuals.

New integrated digital systems of railroad telephony will be implemented along the international Corridor X following the completion of the construction of optical infrastructure.

Figure 85 shows the systems that can be integrated within the DCN nodes and the dispatcher centres of the Dispatcher Systems of Traffic and Electrical Traction.

Figure 85. Digital Integrated Railroad Telephony Systems Source: EPS



DCC – Digital communication centre

This solution provides for the traffic and electrical traction dispatchers to communicate with traffic and driving personnel in stations and along the railroad in order to regulate railroad traffic along a dispatcher section and provide for infrastructure maintenance. The system enables selective connections with call identification between nodes and the dispatcher centre.

The main DCN would be located in the dispatcher centre, whereas first-level digital switching nodes would be installed along the railroad in most stations. Communication between the main DCN in the dispatcher centre with nodes along the railroad is established through first-level DCNs. Other, smaller stations would house station and railroad connection concentrators connected to first-level DCNs by multiplexers on copper cables. The main DCN and the first-level DCNs are to be connected by optical cables, while communication will be conducted along a digital transfer system where a 2Mbit-access should be planned for at each node and for mutual communication. The input and output signals, road crossings and railroad telephones should be fitted with intercom-style telephones.

10.3.5. RADIO SYSTEMS

Further choices for integrated mobile communications are digital radio based on the GSM-R networks and bands within the designation of allocated bands were reserved to this end.

As for migration routes, the choice for the mobile segment is to equip the entire pool of vehicles with locomotive radio stations, noting that dual-mode stations shall be procured, supporting both analogue operation at 450 MHz and the GSM-R network.

A stable infrastructure migration model will depend on financial resources.

Local networks should meet the requirements of the relevant traffic volume and the complexity of technological processes of equipping larger stations and expending the existing networks in 450 MHz frequency range.

10.4. ACADEMIC NETWORK OF THE REPUBLIC OF SERBIA - AMRES

The network infrastructure of the Academic Network of the Republic of Serbia – AMRES connects academic, scientific-research and educational institutions of the Republic of Serbia into a single

computing-communications network. AMRES infrastructure network consists of access network, backbone and external links.

Access network connects the end-institutions with AMRES network access points. The access points enable physical access to AMRES network infrastructure and AMRES services to one or more member institutions. In the current active network topology, the access points are located in the following 20 towns: Belgrade, Novi Sad, Niš, Kragujevac, Subotica, Sombor, Zrenjanin, Šabac, Pančevo, Valjevo, Užice, Čačak, Kraljevo, Kruševac, Leskovac, Vranje, Bor, Pirot, Novi Pazar i Kosovska Mitrovica. The access techology mainly used for connecting the institutions to AMRES network is fibre-optics (FTTB), and xDSL VPN and analogue links to a lesser extent.

The backbone of AMRES network consists of intercity and inner-city optical links, which connect the access points.

External links refer to AMRES network connections with GÉANT (Gigabit European Advanced Network Technology), foreign academic networks, telecom service providers and other partner institutions. In the current network topology, the capacity of the primary connection to GÉANT is 10 Gb/s, and to Internet via GÉANT access point in Budapest 3 Gb/s. The capacity of the secondary connection to GÉANT and Internet is 1 Gb/s, via Hungarian academic network HUNGARNET. Additionally, the Intenet connection can be made via network of the telecom operator Telekom Srbija, via 34 Mb/s link. AMRES network is also connected to the Academic Network of Republika Srpska SARNET, via 1 Gb/s optical link.

The **SEELight** project (*South-East European Lambda Network Facility for Research and Education*) has enabled further extension and upgrade of AMRES network infrastructure. **SEELight** project is part of the Hellenic Plan for the Economic Reconstruction of the Balkans, supported by the Greek Government, with the objective to develop and enhance the optical infrastructure of the academic networks in the region, their interconnection and connection to GÉANT through redundant links.

The project consists of three phases. In the first phase, the project management agreement was signed. In the second phase, the contract on leased optical fibres closed in 2010 between the Ministry of Telecommunications of the Republic of Serbia and Telekom Srbija, enabled leas-

ing around 3800 km of optical fibres for the purposes of both backbone and access network. Around 2000 km of optical fibres had already been in place, whereas the rest of the network was completed in 2011 through the implementation of the second phase of **SEELight** project. **The preliminary conditions for connecting academic, scientific-research and educational institutions to AMRES access points were thus created in 53 towns in the Republic of Serbia.**

The Ministry of Telecommunications of the Republic of Serbia and Telekom Srbija closed a 15-year contract on leased optical fibres, valid until November 2026.

Figure 86. AMRES Network Backbone Topology — Source: EPS

11. LIST OF BYLAWS

11. 1. LIST OF BYLAWS WITHIN RATEL'S COMPETENCE

- Rules on the amount of fees for the provision of services within the competence of the Republic Agency for Electronic Communications (*Official Gazette of RS*, no. 41/12)
- Rules on the terms and conditions for access to and usage of the data from a public directory (*Official Gazette of RS*, no. 84/11)
- Rules on obligations of value added services provider (*Official Gazette of RS*, nos. 76/11 and 91/11-corr.)
- Rules on quality parameters for publicly available electronic communication services and monitoring of electronic communication activity (*Official Gazette of RS*, no. 73/11)
- Rules on the minimum content, level of detail and manner of publication of standard offers (*Official Gazette of RS*, no. 70/11)
- Rules on the scope and content of the minimum set of leased lines (*Official Gazette of RS*, no. 70/11)
- Rules on the amount of annual fee for the use of numbering (*Official Gazette of RS*, no. 67/11)
- Rules on the manner of radio stations usage on the national and foreign aircrafts, locomotives, ships and other vessels (*Official Gazette of RS*, nos. 60/11 and 68/11-corr.)
- Rules on the manner of monitoring the radio frequency spectrum usage, technical inspection procedure and protection from harmful interference (*Official Gazette of RS*, no. 60/11)

- Decision on designating relevant markets susceptible to ex-ante regulation (*Official Gazette of RS*, no. 59/11)
- Rules on manner of amateur radio station usage (*Official Gazette of RS*, no. 52/11)
- Rules on the application of the cost-accounting principle, separate accounts and reporting of an operator with significant market power in the electronic communications sector (*Official Gazette of RS*, no. 52/11)
- Rules on number portability on public telephone networks at a fixed location (*Official Gazette of RS*, no. 52/11)
- Rules on general terms and conditions for performing electronic communication activities under general authorization regime (*Official Gazette of RS*, nos. 38/11 and 44/11-corr.)
- Numbering Plan (*Official Gazette of RS*, nos. 32/11 and 35/12)
- Rules on application form for the issuance of licence for the use of numbering (*Official Gazette of RS*, no. 32/11)
- Rules on application forms for the issuance of individual licence for the use of radio-frequencies (*Official Gazette of RS*, no. 08/11)
- Rules on fees for the performance of electronic communications activities (*Official Gazette of RS*, no. 93/10)
- Rules on radio-frequency usage fees (*Official Gazette of RS*, no. 93/10)
- Decision on designating operators with universal service obligation (*Official Gazette of RS*, no. 15/10)
- Rules on number portability in public mobile telecommunications networks (*Official Gazette of RS*, no. 05/10)
- Rules on classes of radio-stations for which radio-station licence is not required (*Official Gazette of RS*, no. 26/07)
- Decision on the manner of keeping the registers, records, data bases and other information within the competence of the Republic Agency for Elec-

tronic Communications and the publication thereof on the Agency website (passed on 11.02.2011 by RATEL's Managing Board, available at www.ratel.rs)

- Rules on terms and conditions and the procedure for the issuance of authorization to a public telecommunications operator for interconnection of a national telecommunications network with a telecommunications network of another country (*Official Gazette of RS*, no. 94/08)

11. 2. LIST OF BYLAWS PASSED BY THE RESPONSIBLE MINISTRY AT RATEL'S PROPOSAL PURSUANT TO LAW ON ELECTRONIC COMMUNICATIONS

- Rules on analogue to digital switchover in TV broadcasting and access to multiplex in terrestrial digital broadcasting (*Official Gazette of RS*, no. 12/11)
- Rules on radio equipment and telecommunications terminal equipment *Official Gazette of RS*, nos. 67/11 and 11/12)
- Rules on Universal Service (*Official Gazette of RS* , no. 24/12)
- Rules on requirements in terms of staff, equipment and premises of an undertaking, company or other legal entity authorized for measuring and testing the operation of electronic communications networks and services, associated facilities, electronic communications equipment and terminal equipment (*Official Gazette of RS*, no. 13/12)
- Rules on stipulating Radio Frequency/Location Allotment Plan for Terrestrial Analogue FM and TV Broadcasting Stations for the Territory of the Republic of Serbia (*Official Gazette of RS*, nos. 9/12 and 30/12)
- Rules on the manner and conditions for the determination of the zone of the electronic communications infrastructure and associated facilities, protected areas and obligations of investors during the construction of buildings and premises (*Official Gazette of RS*, no. 16/12)

Republic of Serbia
RATEL
Republic Agency for
Electronic Communications

Višnjićeva 8, 11000 Belgrade, Republic of Serbia
www.ratel.rs