DTT FORUM
BOSNA I HERCEGOVINA

STRATEGY

ON THE SWITCH - OVER FROM ANALOGUE TO DIGITAL TERRESTRIAL BROADCASTING IN THE FREQUENCY BANDS OF 174-230MHz AND 470-862 MHz IN BOSNIA AND HERZEGOVINA

ENGLISH

CONTENTS

I. SUMMARY

The introduction of digital terrestrial television (hereinafter: DTT) in BH, switch-over from analogue to digital terrestrial broadcasting and analogue broadcasting switch-off in the frequency bands 174-230MHz and 470-862 MHz is the obligation of BH in accordance with the current international regulations in this field.

The Regional conference on radio communications for the planning of digital terrestrial broadcasting service in parts of the regions 1 and 3, in the frequency bands 174-230 MHz and 470-862MHz (RRC-06) organized by the International Telecommunication Union and held in Geneva in 2006, set the basic obligations for the switch-over to digital terrestrial broadcasting for the signatory states to the GE-O6 Agreement. Final Acts of the Geneva RRC06 were ratified and published in the Official Gazette of BH - International Contracts, No. 9/08. This fully concluded the adoption procedure, which puts Bosnia and Herzegovina under the obligation to act in accordance with the above mentioned agreement (GE-06).

In line with DTT Forum tasks, defined in the Broadcasting Sector Policy ("Official Gazette BH", No. 18/07 of March 13th, 2007), keeping in line with global trends, best European practices and international obligations of Bosnia and Herzegovina in this area, and following the principles of promotion of the IT community in Bosnia and Herzegovina, encouragement for a further development of competition and pluralism in the communications sector, stimulation to create conditions for a continued development of media freedoms and protection of all customers and operators in the communications sector in Bosnia and Herzegovina, in terms of a non-discriminatory approach, quality and cost of services, the DTT Forum reached the following several key conclusions through an analysis of the so-far experiences of other countries and the situation in Bosnia and Herzegovina:

1. In Bosnia and Herzegovina, analogue broadcasting will be fully switched-off in UHF band not later than December 1st, 2011;
2. When introducing digital terrestrial television in Bosnia and Herzegovina, the DVB-T standard with MPEG-4 (H.264/AVC) compression system will be used;
3. The transition period for the switch-over to digital terrestrial broadcasting should be as short as possible;
4. The introduction process for the digital terrestrial broadcasting should be conducted in phases (which are interdependent and interrelated)
5. A public campaign should be conducted with the aim to inform and educate the BH public about the introduction process of digital terrestrial broadcasting, to present advantages of digital television and the steps expected from citizens in preparing their households to receive the digital TV signal in accordance with the given deadlines;
6. Provide subsidies for the purchase of the DVB-T receivers. These subsidies will significantly speed up the process of transition to DTT, because it is an efficient way to stimulate citizens to buy these devices as soon as possible .In this way the penetration of receivers in the market will be observed, which will enable TV stations to make sooner decisions to introduce digitalization to their programmes and access the multiplex.

In accordance with the previously stated conclusions, it is necessary to:

- ensure stable, transparent, technologically neutral environment in the communication sector and continuous development of electronic communicational

infrastructure directed toward the development of information society in Bosnia and Herzegovina;

- make prerequisites necessary for promotion of possibilities in digital broadcasting for fulfilling the needs of people with special needs;
- ensure a stimulating framework for volume and production quality increase and reducing transmission costs/ programme distribution for all participants in digital broadcasting;
- ensure a stimulating framework for creating offers with added value for all participants in the process compared to the present analogue broadcasting systems;
- ensure efficient realization and copyright and other related rights protection while using advantages that digital technology offers in this area;
- enable flexible implementation of new services and standards, and introduction of additional programme contents after the analogue broadcasting switch-off and partial release of RF spectrum;
- bear in mind EU directives which say that member countries should ensure that free frequency allocation from the side of state regulatory should be done respecting transparency, non-discrimination and objectivism;

In the Strategy annexes there are more information of DTT Forum work, researches and analysis done for the need of the Strategy, as well as additional material for better understanding of the Strategy and the process of digital broadcasting transition itself.

II. INTRODUCTION

A. STRATEGY PURPOSE

The purpose of the Strategy on the switch-over from analogue to digital terrestrial broadcasting in the frequency bands 174-230MHz and 470-862MHz in Bosnia and Herzegovina is to define optimal solution, ground strategic directions and conditions for transition period and achieve successful closing of analogue terrestrial broadcasting in above mentioned bands. BH will do this through the expert analysis of present state, determination of needs and dynamic of digital switch-over. Furthermore, the Strategy should achieve prerequisites for sustainable development of communication sector, to efficiently use possibilities of digital broadcasting and digital dividend, information society development promotion in Bosnia and Herzegovina and protect interests of all users and operators in communication sector in a sense of non-discrimination approach, quality and service prices, as well as achieving better conditions for improvement of possibilities for informing, education and entertainment of Bosnia and Herzegovina citizens.

This document contains analysis and considers the condition in Europe, regions and Bosnia and Herzegovina through the elements of regulations, programme contents, techniques, social-economical aspects and promotion of digital switch-over.

Introduction of digital terrestrial television (further in the text: DTT) in BH, period of switch-over from analogue to digital terrestrial broadcasting and switch-off of analogue broadcasting in the mentioned RF band is the commitment of Bosnia and Herzegovina which should be done according to present international agreements in this field.

Strategy of switch-over from analogue to digital terrestrial broadcasting in the frequency bands 174-230MHz and 470-862MHz in Bosnia and Herzegovina gives guidelines for work of competent institutions in this field, informs interested parties in the communication sector and makes this subject closer to the citizens of Bosnia and Herzegovina.

B. LEGAL FRAMEWORK

Radio-frequency spectrum (RF) is a limited resource of each state. In accordance with the Stockholm Agreement (1961), RF spectrum part within VHF band (Band I 47-68MHz (channels 2-4) and Band III 174-230MHz (channels 5-12)) and within UHF band (Band IV 470-582 MHz (channels 21-34) and Band V 582-862 MHz (channels 35-69)) is scheduled for analogue broadcasting. With the development of technology and due to the need for better use of RF spectrum, in June 2006 in ITU organization at the Regional conference on radio channels for digital terrestrial broadcasting service planning in regions 1 and 3, within the frequency bands 174-230MHz and 470-862MHz (RRC-06), a regional agreement was reached (GE-06) which predicts introduction of digital and total switch-off of analogue television in Europe, Africa and a part of Asia. GE-06 determined June 17th, 2015 as the end of the switch-over period. After this date, all administrations can freely use all frequencies assigned to them in GE-06 plan for digital services. After this date, analogue broadcasting will not be protected within the above mentioned scope. During the switch-over period (between June 17th, 2007 and June 17th, 2015) the implementation of only one part of digital plan GE-06 with a solution for influence at existing analogue terrestrial televisions in accordance with neighbouring administrations, started.

Also, as recommended by European Commission (COM (2005) 204), all EU members should switch-off analogue terrestrial broadcasting completely and switch-over to digital terrestrial broadcasting no later than 2012.

On June 20th, 2007, at the14th Session of Council of Ministers, a Report and Final Conference document were examined and acknowledged on Bosnia and Herzegovina's participation at the Regional Conference on radio communication for digital terrestrial broadcasting service planning in region 1 and 3 parts, within the frequency bands 174-230MHz and 470-862MHz (RRC-06, in further text: Conference). On August 20th, 2007, BH Presidency made Decision on accepting these documents according to the Law on Procedure of International Agreement Conclusion and Implementation (BH Official Gazette, No. 29/00). The Geneva Final Acts RRC06 were ratified and published in BH Official Gazette- International Contracts, No. 9/08. With this, ratification procedure was completely finished, which binds Bosnia and Herzegovina to act in accordance with above mentioned agreement.

Further on, the Broadcasting Sector Policy (BH Official Gazette, No. 18/07 from March13th, 2007) quotes that *"with regard to the economic situation in BH, the dynamics of switch-over from analogue to digital technology should be defined inclusive with a year 2014."*

DTT Forum tasks are defined in the Broadcasting Sector Policy (BH Official Gazette, No. 18/07 from March 13th, 2007), and in accordance with conclusions from 50th Session of Council of Ministers from May 29TH, 2008, DTT Forum Bosnia and Herzegovina made a Strategy proposal for transition from analogue to digital terrestrial broadcasting within the frequency bands 174-230MHz and 470-862MHz in Bosnia and Herzegovina.

C. TIME FRAME

According to the Article 12 of Final Acts, the GE-06 Agreement came into force on June 17th, 2007 at 00.01 AM according to UTC[1], and the transition period will last until June 17th, 2015 at 00.01 according to UTC.

Considering Bosnia and Herzegovina's commitment towards European integrations, it is important to respect EC recommendations (COM (2005)204) - where all member countries should do digital switch-over no later than the end of 2011.

Having in mind international obligations of Bosnia and Herzegovina, already stated recommendations and deadlines, with the dynamics of the DTT introduction in neighbouring administrations, the DTT Forum has reached following conclusions through condition analysis and best practice in Bosnia and Herzegovina:

- transition period should be the shortest possible;
- Introduction process for digital terrestrial broadcasting should be conducted in phases (one following the other and mutually dependant)

Therefore, the following time frame for introduction of digital terrestrial broadcasting in Bosnia and Herzegovina is accepted:

I - Not later than November 1st, 2009 experimental DVB-T broadcast in Bosnia and Herzegovina should start for MUX A and MUX B.

This period would enable all participants in digital broadcasting to adapt to new way of broadcasting and business in accordance with new regulatory frame. Before this period it is necessary to end release procedures for temporary licenses for all participants in digital terrestrial broadcasting.

II – It is necessary to start the official transition phase of simultaneous broadcasting using MUX A and MUX B not later than June 1st, 2010.

At least three months before the start of transition phase, it is necessary to end release procedures for all participants in digital terrestrial broadcasting.

III – At least six months before final closure of analogue terrestrial broadcasting, it is necessary to end tender procedure and choice of license holders for MUX C and MUX D, which will start to work after complete switch-off of analogue terrestrial broadcasting.

IV – Communication licensees for MUX A and MUX B will ensure that at least 85% (coverage) of population should be able to receive digital terrestrial TV signal until October 1st, 2011.

V - On December 1st, 2011 at 00.01 hrs, analogue broadcasting in whole Bosnia and Herzegovina will end its work in the bands IV (470-582MHz- channels 21-34) and V (582-862 MHZ- channels 35-69).

[1] Coordinated world time

III. STRATEGY GOALS

A. GENERAL AND SPECIFIC GOALS

Following global trends, the best European practice and international obligations of Bosnia and Herzegovina in this field, the goal of the *Strategy* is determining optimal solution for a fast and efficient switch-over from analogue to digital terrestrial broadcasting in frequency band 174-230MHz and 470-862MHz.

In the interest of participants and citizens of Bosnia and Herzegovina in communication sector, basic directions, principles and criteria for digital switch-over were given. Measures were also proposed for stimulating development in communication sector and full utilization of digital broadcasting possibilities.

The Strategy is based on principles for promotion of information society development in Bosnia and Herzegovina, encouraging further competition development and pluralism in communication sector, stimulation for creating conditions for continuous development of media freedom and interest protection for all users and operators in communication sector in Bosnia and Herzegovina concerning non-discrimination approach, quality and service prices.

Advantages of digital over analogue broadcasting systems are numerous for all interested parties, and can be seen through bigger number of services with more quality, and especially in following possibilities:

- **For Bosnia and Herzegovina:**

- Better efficiency in using frequency spectrum;
- Use of free part of the spectrum for new services;
- New market possibilities due to partial spectrum release;
- creating new economy possibilities and employments;
- Promotion of new technology developments;
- Competitiveness increase for service providers;
- Encouraging media pluralism development;
- increased possibility in local contents production;
- Contribution to broadband service development and information society;

- **For service providers:**

- Differentiation in offered content;
- Interactive contents and services, as well as possibility for probation access;
- Reduction in transmission and broadcasting costs;
- Convergence in technologies and services.

- **For end users:**

- Increase in picture and sound quality;
- Better choice in programme contents;
- New services for citizens with special needs;
- Improvement in additional services and increased mobility;
- Service convergence.

It is necessary to ensure the best possible conditions for transition to complete digital terrestrial broadcasting for all subjects involved in production, transmission and broadcast of TV programmes.

Programme producers should be unburdened from building their own systems for transmission/distribution/broadcasting of their programmes. In that way programme producers can devote to their basic activity and rationalization of their business. That will have beneficial effect on broadcaster sustainability, and with that strengthening of media pluralism, quality and volume of local contents. On the other hand, network operators could easier introduce new multimedia services.

It is necessary to encourage and quicken the process of establishing Corporation for production, transmission and broadcasting of digital programme JRTV system in BH. Doing all that, a harmonized, stimulated, but at the same time controlled process of introducing DTT in Public radio-television system in Bosnia and Herzegovina would start.

General goal of the Strategy is to make the transition process to digital broadcasting systems acceptable, and its positive effects available to the great majority of population. Important elements for success of that goal are efficient, clear and timely promotional campaigns, clearly defined obligations and deadlines. Therefore this document should enable enough information to all relevant subjects to be able to plan and conduct activities in their field of competence.

B. EXPECTED RESULTS AND ACTIVITIES

According to accepted international obligations and intentions towards European integrations of Bosnia and Herzegovina, and along with respecting recommendations and directives about transition process from analogue to digital broadcasting systems, and on the basis of knowledge and experience in transition process in European countries and analysis of conditions in Bosnia and Herzegovina, basic expected results will follow:

1. **Analogue broadcasting in UHF band will be completely switched-off in Bosnia and Herzegovina not later than December 1st, 2011;**

   On December 1st, 2011 at 00.01hrs, analogue broadcasting in whole Bosnia and Herzegovina will be switched-off in band IV (470-582MHz – channels 21-34) and V (582-862MHz- channels 35-69).

   Due to universal service receiving obligation in Public RTV system in Bosnia and Herzegovina, VHF band in the band I (47-68MHz- channels 2-4) and band III (174-230 MHz- channels 5-12) will be switched-off when at least 90% of households in Bosnia and Herzegovina get the chance to receive DTT signal, and not later than December 1st, 2012. 00.01hrs.

2. **In introducing digital terrestrial broadcasting in Bosnia and Herzegovina, DVB-T standard with MPEG-4 (H.264/AVC) system of compression will be used.**

3. **Competent institutions will design sustainable legal and regulatory framework for the faster introduction of digital terrestrial broadcasting and enable the initiation of switch-over process from analogue to digital terrestrial broadcasting platforms and their further undisturbed development.**

4. **Make necessary specifications for DVB-T receivers which will be used in Bosnia and Herzegovina.**

5. **Ensure stable, transparent, technologically neutral environment in the communication sector and continuous development of electronic communicational infrastructure directed toward the information society in Bosnia and Herzegovina.**

6. **Make preconditions for promotion of broadcasting possibilities in fulfilling the requirements for people with special needs.**

7. **Ensure a stimulating framework for production volume and quality increase and transmission/distribution cost reduction for all participants in digital broadcasting.**

8. **Ensure a stimulating framework for creating service offer with added value in comparison with current analogue broadcasting systems for all process participants.**

9. **Ensure efficient realization and copyright and other related rights protection while using advantages that digital technology offers in this area**

10. **Enable flexible implementation of new services and standards, and introduction of additional programme contents after the analogue broadcast switch-off and partial release of RF spectrum**

C. CHALLENGES IN INTRODUCING DIGITAL BROADCASTING

For successful implementation of the digital switch-over Strategy, it is necessary that the key subjects, starting from executive, legislative and regulatory bodies do all the necessary work in their field of competence and to offer significant support to the whole process of digital switch-over. It is of special importance to set the deadline for analogue terrestrial broadcasting switch-off.

Active broadcaster involvement in the process of digital switch-over is significant because they will face great challenges in a new business surrounding. Improvement in their present offers and new contents and services will dominantly influence the trust and support to the process. If better offer fails, this process could face resistance with those who see no interest in transition to new technology because it brings them additional expenses. That would raise the question of survival for those broadcasters who timely don't recognize all the benefits of digitalization and who don't engage in the implementation process.

It must be considered that analogue broadcasting switch-off can have significant negative consequences if this process fails. Potential poor management of this process, without timely insight on deadlines for realization of scheduled aims and terms, would result in disabling citizens to receive terrestrial radio and television signal in a present manner. That would significantly damage the whole communication sector. It would be very negative for all subjects who think of themselves as the participants in this process. It would aggravate their position because such flow could provoke resistance in some parts of society towards the whole process.

IV. LEGAL AND REGULATORY FRAMEWORK FOR THE DTT INTRODUCTION

A. STARTING GROUNDS-REGULATORY ASPECTS

The aim of the Strategy is to create sustainable regulatory framework for the introduction of digital broadcasting system and to enable transition from analogue to digital broadcasting systems and their further development, with the stimulation of the whole communication sector and care about the end-users.

DVB-T signal broadcast is done by the terrestrial transmitters which are most frequently in the same locations as former transmitters intended for analogue television.
There are discussions in Europe whether MPEG-2 or MPEG-4 compression standard[2] should be used. All countries that start later with digital television introduction, immediately start using DVB-T MPEG-4 (H.264) standard, and in that way skip one step and reduce costs of inevitable technology change. Using H.264 codec (MPEG-4) bandwidth would double, and that would enable around eight TV programmes and additional contents within one multiplex.

Most of the European countries with developed infrastructure, after DTT introduction in SDTV format works in HDTV format introduction. For that purpose there is a plan for use of HDTV/H.264/DVB-T2 combination, there is a mobile TV development, where DVB-T dominates which is standard adopted for EU countries.

As opposed to analogue television where with weakening of the signal, weakens the picture quality, with digital television there is no such thing. In fact, the quality is equally good with signal weakening until the point where there are no minimal conditions for receiving. It is important to mention that analogue television for broadcasting one TV programme uses one frequency channel, where as with DVB-T broadcasting in one channel could be broadcast up to 10 programmes (such "package" of programmes is called DVB multiplex). In this way the frequency spectrum is saved as a limited state resource. This technological progress introduces certain inevitable changes in a way of organizing production-transmission-broadcast chain, relations between subjects, occurrence of new subjects, but as well as regulatory framework concepts in the communication sector.

Furthermore, the switch-over period, i.e. simultaneous transmission and broadcast (simulcast) of both analogue and digital TV signals is a great financial burden for broadcasting in general. Therefore, an accelerated switch-over is recommended. Also, adoption of a suitable legal and regulatory framework is expected, as well as adoption of favourable economic and technical conditions. Special concerns should be directed towards local and regional broadcasting systems.

In that sense, the legal and regulatory framework should clearly define rights and obligations of different parties in this process. Also, there should be a notion on volume and structure of socially endangered groups of population and persons with special needs.

[2] (Moving Picture Experts Group - MPEG) - Work group of experts for standardization of digital formats of moving picture is a work group of scientists, ISO/IEC standards, who are engaged in inventions, publishing and development of standards for compression and coding of video and audio signals. Work group was founded in 1988. in Otava,Canada. There are around 350 permanent members from industrial, university and inventor's institutions. Official name of the group is ISO/IEC JTC1/SC29 WG1.

B. CONDITION IN BOSNIA AND HERZEGOVINA

According to the Law on Communication in Bosnia and Herzegovina (BH Official Gazette, No. 31/03), Communications Regulatory Agency, in cooperation with the Council of Ministers manages radiofrequency spectrum according to the international agreements. The Agency takes adequate steps in ensuring efficient and undisturbed use of the radiofrequency spectrum in Bosnia and Herzegovina. The Agency adopts plan for purpose of radiofrequency bands, where radiofrequencies and bands are defined for individual radio communications and individual groups of users. According to the Law on Communications' directives, duties of the Communications Regulatory Agency are:

a) Rules proclamation in broadcasting and telecommunication field and providing they're respected;
b) Issuing licenses to the broadcasters and telecommunication operators according to regulations of this law and supervising that the conditions for the issued licenses are respected;
c) Planning, management, purpose and assignment of frequency spectrum, supervising its use, as well as maintenance and release of the plan for using frequency spectrum for the whole territory of Bosnia and Herzegovina.

The Communications Regulatory Agency has changed over to a new regime in broadcasting license issue during 2008, with intention to adjust license issue procedure in BH with approach used in EU countries. Following the supposition that telecommunication, media and information technology sector convergence demands a unified regulatory framework which would enclose all transmission networks and services, EU has adopted a new regulatory framework in 2002 for networks and electronic communication services[3]. By adopting technologically neutral approach, new regulatory framework prescribes different authorizations/licenses for different roles in a chain of values concerning that each of them play different roles and has specific obligations:

- License for "network operators", in charge of infrastructure building and maintenance. Such a license regulates a relationship between infrastructure owner and provider of service and contents.
- License for "service providers", in charge of assembling packages from different TV channels and other services offered to the subscribers for monthly subscription payment. Such a license regulates a relationship between service provider and subscriber, and on the other hand regulates relationship between service provider and content provider (TV stations broadcast via the network).

[3] This regulatory framework consists of four specific Directives: the Directive 2002/21/EC of European Parliament and Council from March 7th, 2003 on General regulatory framework for electronic communicative networks and services (Framework directive), the Directive 2002/20/EC of European Parliament and Council from March 7th, 2002 on electronic communicational network and services authorization (Directive on authorization), the Directive 2002/19/EC of European Parliament and Council from March 7th, 2002 on accession and interconnection of electronic communicational networks and related equipment (Directive on accession), the Directive 2002/22/EC of European Parliament and Council from March 7th, 2002 on universal service and user rights concerning electronic communicational networks and services (Directive on universal service).

- License for "content providers", which implies organization and schedule of TV programmes broadcast via the network. They are responsible for content, but in contrast to analogue terrestrial broadcasting stations, not responsible for delivery of the content to the viewers, with regard to whether the channel is broadcast via cable, satellite, other telecommunication networks or DTT network.

Having in mind that previous License for providing services of RTV programme distribution included cable distributors and cable TV stations' regulation, that is RTV content providers, The Agency commenced the process of establishing separate regulation for RTV programme distributors and audiovisual media services providers, all this with an aim to introduce equal competition and quality service improvement in communication market in BH. New regulatory frame comprises:

Rule on assignment manner and license conditions for audiovisual media services (AVM) took effect in March 2008, thus conditions were made for beginning the process of issuing License for providing audiovisual media services. It is a license for which all legal subjects residing in BH can apply. They have to be registered for radio and television activities. By getting this license, rights are acquired for providing audiovisual media services regardless of the way of distribution, with the exception of terrestrial broadcasting. Audio-visual services provided must be in accordance with Code on RTV programme broadcasting, as well as with other rights and regulations of the Agency concerning broadcast content. This license is "technologically neutral" because it applies to all RTV content, no matter what way signal is being transmitted.

Rule on assignment manner and license conditions for RTV programme distribution came into force in autumn 2008, thus conditions were made for beginning the process of issuing License for distribution of RTV programme. This regulation is also *"technologically neutral"* because the band of License application will broaden to all programme providers to the end users, no matter what kind of distribution network is used. Along with cable distribution, License implementation will be possible to the other technologies of RTV programme distribution: wireless, satellite/DTH, but also to the possible future forms of distribution.

At the moment, three members of Public RTV system and 45 television stations (private and public) have the broadcasting license in Bosnia and Herzegovina. Until now, 15 AVM licenses were issued.

Positive legal regulations in Bosnia and Herzegovina[4] present a good starting point which should be additionally filled in a way to get a quality legal framework for introduction of digital broadcasting in Bosnia and Herzegovina.

C. CONDITION IN EUROPE

In the area of regulating digital broadcasting, "good practice" in EU countries, as well as surrounding countries, primarily concerns technical, substantial and economical aspect, but not the legal aspect in a narrow meaning of the word. Documents dealing with condition analysis in specific countries, in their major part are elaborating exactly already mentioned questions.

[4] More information in *ANNEX: Relevant laws and regulations*

However, when the legal regulation of this matter arrives, practice stretches from a general regulatory framework in some countries (with a need for additional finishing) to more detailed regulation with certain specific features (license issuing procedure, analogue television transmitter switch-off dates) in other countries. European Union gave basic directions for introduction of digital television pointing out the advantages of switch-over to digital broadcasting systems, giving information about member states switch-over process and acceleration of transition process, establishing priorities in the switch-over process etc.

According to the regulation subject, EU legislative which is partly concerned with digital broadcasting too can be divided into three groups:

- Electronic communications [5]

- Audiovisual services[6]

- Competitive rights[7]

Questions of transmission and content itself are separately regulated, but one should have in mind connection between them especially when it comes to guaranty of media pluralism, cultural diversity and consumers' protection. When it comes to the television broadcast regulation, it is significant to mention European Council conventions, which are binding for countries that ratified them or accessed them[8].

Approach of European Union to regulation of digital television brought to some significant changes which occurred after the adoption of a new regulatory framework in 2002. The same implies separated licenses for different subjects:

- License for "network operators", in charge of infrastructure building and maintenance. Such a license regulates a relationship between infrastructure owner and provider of service and contents.

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[5]*Regulatory framework for electronic communicational networks and services-established in 2002.*
Directive 2002/21/EC of European Parliament and Council from March 7th, 2003 on General regulatory framework for electronic communicative networks and services (Framework directive)
Directive 2002/19/EC of European Parliament and Council from March 7th, 2002 on accession and interconnection of electronic communicational networks and related equipment (Directive on accession)
Directive 2002/20/EC of European Parliament and Council from March 7th, 2002 on electronic communicational network and services authorization (Directive on authorization)
Directive2002/22/EC of European Parliament and Council from 7. March 2002. on universal service and user rights concerning electronic communicational networks and services (Directive on universal service).
Directive 2002/58/EC of European Parliament and Council from July 12th, 2002 on personal data processing and privacy protection in electronic communications sector (Directive on privacy and electronic communications).

[6] Directive 89/552/EC of European Parliament and Council from October 3rd, 1989 on coordination of specific directions determined by the law, legal subordinate act or administrative procedure in member countries in area of doing activities of television broadcasting, supplemented and changed by Directive 97/36/EC, and Directive 2007/65/EC of European Parliament and Council from December 11th, 2007.

[7]Areas that cover this right refer also to digital broadcasting with the aim of preserving and encouraging competition in within free market economy.

[8] European convention on cross-border television with Protocol
European convention on human rights and basic freedoms

- License for "service providers", in charge of assembling packages from different TV channels and other services offered to the subscribers for monthly subscription payment. Such a license regulates a relationship between service provider and subscriber, and on the other hand regulates relationship between service provider and content provider (TV stations broadcast via the network).

- License for "content providers", which implies organization and schedule of TV programmes broadcast via the network. They are responsible for content, but in contrast to analogue terrestrial broadcasting stations, not responsible for delivery of the content to the viewers, with regard to whether the channel is broadcast via cable, satellite, other telecommunication networks or DTT network.

Digital broadcasting represents one of the major platforms of approach to information society according to Action plan e-Europe 2005 and a new Strategic framework for European information society and audiovisual policy of European Union- i2010. Above mentioned action plan defines digital switch-over, and guides to making directions and conditions for its implementation.

In other words, European commission in 2003 in its Statement COM (2003) 5412 recognized advantages of switch-over from analogue to digital broadcasting systems and gave basic directions to the countries for implementation of switch-over process. EU Supervising group for the radio frequency spectrum (RSPG)3 has announced that same year opinion on introduction of digital systems and their influence on using spectrum, and pointed out obstacles for accelerated switch-over process. The group initiated certain number of meetings for EU member states, with the aim to achieve certain level of coordination concerning dynamics, deadlines, regulations and adopted technical solutions. The switch-over process acceleration and defining deadlines at EU level had an aim to contribute overcoming current discrepancy in digital television market.

In May 2005, European Commission announced its Statement COM (2005) 2044 concerning switch-over process acceleration. Information was followed by working document SEC (2005) 661 which contains detailed information on the switch-over process to digital broadcasting systems of member states COM (20005) 4615 with an aim to establish priorities in the switch-over process to digital broadcasting systems, all this connected to Regional Conference on radio telecommunications, held in Geneva in 2006.

Towards achieving united approach for usage of spectrum which will be free after digital switch-over, European Commission announced Statement COM(2007) 7006 with directions for more efficient spectrum use which will be provided by digital dividend.

With an aim of coordinating different attitudes and progress level in EU members, as well as for the advantage of harmonized switch-over process, European Commission proposed defining joint approach concerning time schedule for absolute digital switch-over, and the beginning of 2012 is expected to be the deadline for withdrawal of all analogue TV stations.

D. COPYRIGHTS

One of the important elements in communication market are copyrights, that's why in digital terrestrial broadcasting the attention should be paid on respecting

existing legal and sub-legal directives from this area in Bosnia and Herzegovina. All subjects with these competences are obliged to ensure complete implementation of the rules governing author and similar rights and intellectual property rights. In doing this they have to adhere to the highest international standards.

E. THE NEED FOR ACCEPTANCE OF NEW REGULATIONS AND RULES

Production, transmission and broadcasting of digital broadcasting signals are seen from the legal aspect in the following categories: programme content producers (audio-visual media content), multiplex operators and network operators. In most European Union countries, licensing of programme content producers is separated by regulatory rules from multiplex operators and network operators. A producer of the programme content has to be left with the possibility to choose network and operator when conditions for that are made.

Practice showed that interaction between programme content producers, multiplex operators and network operators maintains service quality, competition and market dynamics.

According to the Law on Public RTV system BH ("BH Official Gazette", No. 78/05), and especially articles 1, 3, 5, 9, 11, 12, 17, 19, 26 and 27, it is necessary to ensure a universal TV signal receiving service to the members of Public RTV system in BH concerning digital broadcasting.

In designing a regulatory framework for digital broadcasting, special attention needs to be paid to regulation design and compliance which governs issues of media concentration and control mechanisms, network access to independent production and ensuring media pluralism. In doing this, the highest international standards and best practice has to be obeyed.

In order to protect market and consumers in Bosnia and Herzegovina, prior to the start of the switch-over phase, it is necessary to make a decision on minimal technical requirement and equipment characteristics which will be used in digital terrestrial broadcasting.

The regulatory framework for digital broadcasting should stimulate communication sector progress; it should clearly separate the activity of content production from its transmission and distribution, to protect present communication licensees in transitional period, and to promote fast switch-over from analogue to digital broadcasting. Also, it is necessary to predict issuance of special licenses for other services which will be provided within digital terrestrial system of broadcasting having in mind new technical possibilities, where special care should be paid to protection of end users.

Relevant institutions will adopt clearly defined action plan before the switch-over period start in order to conduct all needed procedures on time. The same plan should predict each phase in the Strategy implementation, above all adoption of the needed legal and regulatory framework, setting deadlines, as well as subventions plan and digital dividend exploitation.

F. IMPLEMENTATION

The key subjects for Strategy realization are:

- **The Parliament and the Council of Ministers of Bosnia and Herzegovina** are responsible for timely adoption of an adequate legal framework and financing or subvention of the part of the process. The adoption of the deadline of analogue terrestrial broadcasting switch-off is of particular importance.

- Communications Regulatory Agency is in charge of the timely development of an adequate regulatory framework, license issuing and other activities connected with the transition process to digital terrestrial broadcasting.

- **Other competent institutions** are in charge of fulfilling obligations from Broadcasting Sector Policy and this Strategy, and in accordance with their portfolio obligations to coordinate Policy measures and also to give maximal support for the transition process to digital terrestrial broadcasting.

- **Broadcasters (commercial and public)** are very important subjects of this process and they determine its success with the dynamics of their involvement. Broadcasters will have to start the adjustment process and they will have an important role in the promotion process, because on one hand, they are the providers of new services of more quality, and on the other they are significant users of new digital distribution systems. The improvement in their offer of already existing and new contents and services will dominantly influence the trust and support to the process.

- **Other significant subjects,** which can significantly influence the dynamics and the Strategy implementation results and the transition process to digital terrestrial broadcasting, are educational institutions, consumer associations and broadcaster associations, receiving equipment providers (STB and IDTV), and of course, the end users.

- **Obligations from the Broadcasting Sector Policy** ("BH Official Gazette", No.18/07 from March 13th, 2007) of the Council of Ministers of BH, the Government of BH Federation, and the Government of Republic of Srpska, among the rest state: - ensure public RTV services financial and technical conditions for introduction of digital technologies; guarantee protection and promotion of media pluralism; preparing public for digital broadcasting, which implies establishment of suitable information process and training for the use of the digital equipment and new services in cooperation with public RTV services; guarantee the development of public RTV services as an essential factor of connection between democratic societies, which enables universal approach to the Public RTV programmes for each individual, adopting the Strategy of digital broadcasting; the Strategy has to define fast transition from analogue to digital broadcasting due to the high price of simultaneous broadcasting; the Strategy also has to protect public as well as private and non-commercial RTV stations' interests, having in mind significance of broadcasting, democratic, social and cultural needs of each society, state must have special interest and together with entities must ensure additional funds for transport network development in order for citizens who pay RTV tax to be able to receive RTV signals; build digitalization Project with clearly defined phases of infrastructure development in scheduled time intervals; to encourage founders, entity governments and privatization directorate to design programmes and establish models for privatization of Public RTV stations which are financed from

public funds; concerning the significance of Public RTV services , the Council of Ministers, the Government of BH Federation, the Government of Republic of Srpska are obliged to ensure that through the forthcoming privatization process future owners of telecom operators will complete their commitment of collecting RTV tax as defined by Law on Public RTV system of Bosnia and Herzegovina.

V. PROGRAMME CONTENTS IN DIGITAL BROADCASTING

From the aspect of programme contents, the aim of the Strategy is to create regulatory and technological frameworks which will enable unobstructed implementation of different technological formats of the programme framework. When creating such frameworks, one should start the assumption that the service and network converging process is ongoing which will lead to multiple ways in content delivery manners, including those that are not subject of this Strategy. Also, we shouldn't forget creation of regulatory and technological frameworks for the purpose of efficient realization and copyright and other similar rights protection with using advantages offered by digital technology in this field. Creation of the regulatory and technological framework should be in a certain scope used for persons with special needs and their requirements.

A. PROGRAMME CONTENTS DEFINING

The term programme content refers to the audiovisual content of different picture size formats, as well as other forms of multimedia contents which can be broadcast and presented in future digital surrounding (sound, moving picture, static picture, text, interactivity etc.).

Programme content, in a sense of distributing manner, can divide into linear and non-linear audiovisual services. The term service refers to the whole way of delivery of certain programme content to the end user, which involves the way of such programme's accessibility (free-to-air, pay-tv, etc.). Programme contents producer (provider) puts together and/or creates certain programme contents with the aim of presenting it to the end user, i.e., to the viewer.

Concerning thematic variations within the offered broadcasting contents, the essence of theme, as with the journalistic form etc., stays very close to the analogue television, like with most classic mass media. With regard to the way in which producer puts together content for its presentation to the end user, a division can be made to: whole programme producers (including informative, educational, cultural, sporting and other contents), specialized content producers broadcasting mainly one theme content (informative, educational, cultural, sporting, entertainment etc.), and producers who deal with commercials and selling goods and services.

B. CONVERGENCY

The term convergence in the communications sector refers to unification of services, systems and networks in the area of broadcasting, telecommunication and computer industry. It is obvious that Internet services, systems and networks have achieved high level of convergence. But, that doesn't mean that everything connected with multimedia will converge into one industry, or one concept service or just one network. It is much likely that certain level of cooperation between RTV diffusion, telecommunication and computer industry will occur, which will result in wide band of services and devices through which contents can be presented (terminals). What service and network provider can see as a convergence, user can see as a divergence of services and devices?

Digital broadcasting systems, like DVB family system, are designed as services from one to many type points of one-direction communication. Their characteristics vary. The DVB-S (satellite distribution) and DVB-C (cable distribution) have relatively high capacity of 30Mb/s, but their receiver is fixed. DVB-T has band in band of 0.02, 1.2 and 5-24Mb/s and can be received through fix, table, or mobile receiver.

Radio and television content is coded in MPEG format, but in the same can be transferred through Internet protocol (IP) or inserted into MPEG transport chain. IP is independent from presentation and transport level, and can be used through any network, including broadcasting networks without protocol convergence. Therefore IP protocol makes convergence between telecommunication and broadcasting networks easier.

Future interactive multimedia service would, most probably, include following components:

- transmission to the users by using digital broadcasting network;
- receivers with a memory and functions which will ensure interactivity and approach to TV programmes in time that better suits the users;
- transmission to the users using telecommunication networks;

It is a hypothesis that in the future the main service will be classic broadcasting, with additional services providing more information.

Directions where new technological formats are opened for presenting audiovisual and multimedia content can be divided into following categories:

- Pay-TV
- Mobile TV
- High definition TV (HDTV)
- Interactive television

With network and services convergence there is possibility of separation between programme content production from its transmission and distribution. Programme content producers are enabled to concentrate only to the production of programme contents, which is their basic activity. Within regulations separate subject categories should be specified, which means to clearly separate content production from its transmission and distribution.
The creation of regulatory and technological frameworks has to take into account the convergence process, as well as potential consequences to the area regulated by this Strategy.

C. PICTURE QUALITY

High picture quality, that is high definition television, implies screen display in higher resolution than present and display format 16:9. For example, former "usual" television set had the 768 X 576 resolution. But, when it comes to digital broadcasting, a quality display has to have HD resolution supportable screen. Top quality HD resolution now is 1920/1080, although recently some experts stated even 1280 X 720 resolutions as satisfactory. Lately, all HD Ready TV devices (which is cheaper version of HD) already have 1366 X 768 resolution. According to the present ball park figure, around 10 percents of population has 16:9 format television sets with resolution over 1200.

The producers of flat screen TV sets are strongly supporting HDTV introduction. Producers indirectly influence TV stations to produce contents in HDTV standard, but also to the end users to buy these receivers.

HDTV programme contents require transmission capacity which is approximately four times bigger than when transmitting programme of digital broadcast standard quality (SD). Therefore, standards are developed which enable decrease in necessary transmission capacity, and at the same time do not cause quality decrease, so that programmes can be efficiently transmitted through network for terrestrial digital broadcasting.

After complete digital switch-over it is necessary to provide space for content broadcast using high definition resolution (HDTV).

D. ADDITIONAL CONTENTS

The following is the list of certain additional content services which can be available through digital television.

1. Improved teletext

It is an improved version of teletext with content and quality comparable with those on Internet pages.

2. Interactive multimedia

Perhaps the most interesting service provided by digitalization is interactive multimedia. If a viewer is provided in some way to communicate with the content offered, we'll get interactive TV, i.e. interactive multimedia. For such a thing it is necessary to have two-way communication which is achieved with return channel between STB and content. Return channel can be, for example simple 56 kbps modem line or broadband like ADSL. According to the CRA data for 2006, 10% of the population uses broadband connections. But, already at the beginning of 2008, number of such users amounts 20%.

Strategy didn't define bands which would be used for return channel for interactivity purposes. It is necessary to regulate return channel ways for programme content producers via other infrastructures (telecommunication, cable and other) as well as conditions of their use for interactivity purposes.

3. Interactive services

Possible uses of interactive DTV can be: voting, shopping, betting, banking, games, quizzes, e-mail reading and sending, e-management and similar. Concerning that these types of interactive services are not directly connected with programme content, they have to be defined with special regulations which would apply to the area of interactive service providers.

4. Translations (titles)

As opposed to analogue picture, DTT allows a translation to be an additional application shown at the same time with picture, but it is not a part of it (similar principle as with DVD movies).

E. ELECTRONIC PROGRAMMING GUIDE

EPG – Electronic Programming Guide allows us to search the whole television content we are able to receive, similar to Internet portals. Digital broadcasting which implies greater number of programmes and additional services is becoming more complex service to access and use by the end-user.

For that reason, EPG becomes very important instrument which allows an end-user to search and access great number of programmes and services simply and with ease. Since EPG puts upon as the only way for easy and controlled approach to digital distribution system services, it becomes the main tool viewers will be able to count on when navigating through different channel offers. The way EPG is designed and the way of presenting information to the end user will significantly influence the viewer concerning his channel choice.

It is necessary to predict certain measures for ensuring pluralism and availability of diverse content to the end user through the EPG system, and create an obligation for multiplex operators and content providers to ensure the possibility for all users of digital service to approach EPG.

F. PERSONS WITH SPECIAL NEEDS

Advantages given with digitalization introduction, as well as appearance of new services in content area, should be in specific size available to the persons with special needs. In November 2007 European Commission presented an initiative of e-Inclusion which deals with access issue to IKT technology for persons with special needs. Also, a special work group was formed ISO/IEC which deals with access issues (ISO/IEC JTC 1 Special Working Group on Accessibility). Having that in mind, as well as the important social element of this problem, it is necessary to regulate that certain programme content providers on state and regional level be obliged to provide certain parts of their programme content to the persons with special needs.

Potential services that could provide persons with special needs to follow programme content in digital surrounding are:

- Sound descriptions
- Titles
- Titles that can be separately added to the picture
- Additional video (for character language)
- Voice titles

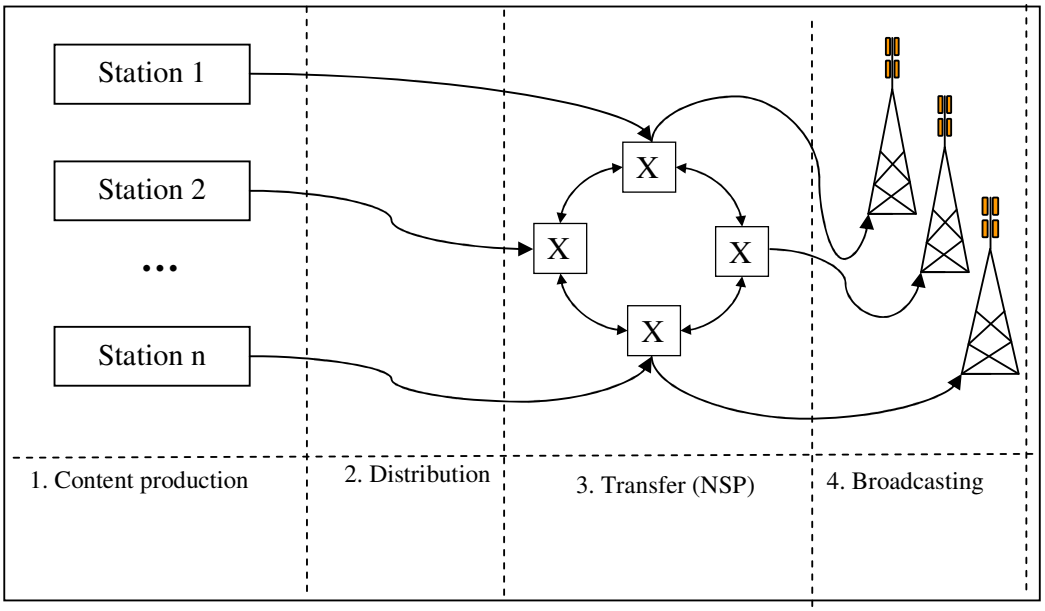
According to socio-economic and technological conditions, it is necessary to define obligatory services which enable persons with special needs to follow programme content.

VI. TECHNICAL ASPECTS OF INTRODUCING DTT IN BH

A. TRENDS AND RESOURCES

1. Trend in further development

More often the users of TV programme broadcasting licenses are making contracts with operators, public telecommunication service providers (Internet service providers and network operators) as their programme distributors. This trend occurred a couple of years ago and is more and more present in the market. In picture No. 1, the above mentioned trend is shown in further chain development of programme broadcasting.



Picture 1 Trend display in market development for analogue broadcasting

This trend is reasonable, and emerges as a result of the following factors:

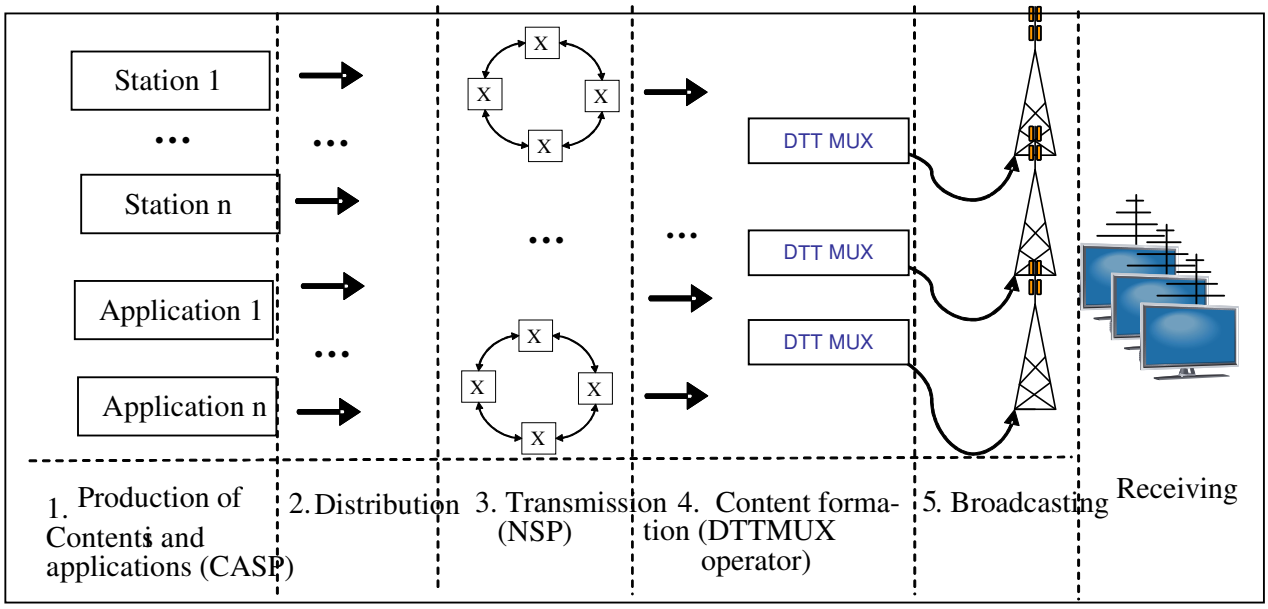
1. **increase of RTV stations' service zones** – the station has a need for programme transmission to distant emissive locations;
2. **liberalization of telecommunication sector and creation of new operators** - which rent their network capacities under significantly favourable conditions;
3. **The need for station efficiency increase and human and technical potential optimisation.**

In such cases, it often happens that the station only has the License for terrestrial broadcasting of radio-television programme, while the issues of getting license and maintenance and the work of transmission systems to the emissive locations is delegate to other market participants. We point out that certain stations have their own transmission system, but, such a system doesn't have significant market role because it is built exclusively for self-requirements and it is, no matter what its size and technology can be, used in distribution segment.

2. The chain of DTT values

On the side of the content production, along with already traditionally present stations as content producers (mostly programmes); there are other service providers, i.e. applications. Picture 2 shows further segmentation and introduction of new participants into the programme broadcasting chain.

Also, on the broadcasting side there is a new technological segment, which is forming of the final content which will be broadcast on one frequency (multiplexing). This important technological segment is solved by DTT multiplex through which packing of a certain number of programmes and their preparation for the digital broadcasting is done. Issues of DTT license user's rights and obligations are important category in regulating broadcasting market in every country.



Picture 2 General schema chain of DTT (future market)

In general, functioning of such market can be described as follows:

- Content and Application Service Provider (CASP) provides content and applications. This content is being distributed to the interconnection points with Network Service Providers (NSP), where such content is concentrated and packed with other CASP contents.
- NSP provides content transmission to the DTT multiplex operator where special content is being extracted from transmission network and via its DTT multiplex is forwarded to broadcasting locations. For an explanation, one NSP can transmit many different TV programmes through its network, and DTT MUX operator extracts only those TV programmes which have broadcasting license within that DTT MUX operator network.

It is obvious that with beginning of DTT introduction in BH, a revision of rights and obligations of all participants in the market will have to be done.

B. ANALYSIS OF NECESSARY RF RESOURCES FOR INITIAL INTRODUCTION OF DTT

After considering possible segments of future market and recognizing participants in such a market, radiofrequency resources should be analyzed in order to ensure their undisturbed work. The aim of this part is to explain:
1 – TV channel choice for initial digital terrestrial broadcasting,
2 – Broadcasting locations choice for initial broadcasting, and
3 – Determine necessary transmission capacities for programme supply of this system.
The submitted analysis is directed towards the issues of initial introduction of digital terrestrial broadcasting and implies achieving as higher coverage as possible in the above mentioned period.

1. DTT plan structure

Radiofrequency spectrum (RF) is a limited source of each country. In the organization of ITU (International Telecommunication Union), with the agreement from Stockholm in 1961, analogue broadcasting band is scheduled, and in 2006 in Geneva a regional agreement (GE-06) which predicts introduction of digital and complete switch-off of analogue television in Europe, Africa and apart of Asia, was adopted. GE-06 determined June 17th, 2015 as the end of the switch-over period.

In the mentioned Regional Radio-communicational Conference (RRC-06), according to the broadcasting expert, BH arranged an excellent frequency plan for digital terrestrial broadcasting. On June 20th, 2007, at the 14th Session of the Council of Ministers of BH, the Report on Bosnia and Herzegovina's participation at the Regional Radio-conference RRC 06 in Geneva was considered and adopted. The final document from the conference "Regional agreement- planning digital terrestrial broadcast service in Region 1 within the frequency bands 174-230 MHz and 470-862 MHz" was also adopted. On August 20th, BH Presidency made the documents according to the Law on Procedures of Conclusion and Execution of International Agreements ("BH Official Gazette", No. 29/00). Picture 3 shows geographical structure of DTT plan in BH.

According to the principles of planning, and on the basis of technical limits in planning digital network and propagation conditions, BH plan contains 9 allotments (an area in which one SFN network functions). Each allotment was given 1 VHF and 7 UHF frequencies (in table 1 channel numbers were given instead of the frequencies)[9]

[9] Very often, in technical literature, frequency stated in a table is replaced by terms DTT multiplex or SFN (Single Frequency Network). In fact, these synonyms are possible considering that one DTT multiplex charges one SFN, which works at one of the frequencies given in the previous table.

Picture 3 BH DTT plan structure (allotments)

BIH	BJELAŠNICA	KOZARA	LEOTAR	MAJEVICA	PLJEŠEVICA	TROVRH	TUŠNICA	VELEŽ	VLAŠIĆ
1	6	6	7	9	6	5	5	7	7
2	24	27	32	25	24	21	25	26	22
3	28	32	40	31	47	48	38	36	29
4	30	33	46	53	50	33	44	39	35
5	40	37	56	55	52	38	49	42	46
6	47	45	52	60	55	44	58	50	57
7	54	61	63	65	65	45	60	55	59
8	61	66	65	68	67	58	62	69	64

Table 1 – Allotments are named after the main referent object

This means that each allotment has eight SFN networks where five to ten TV channels of standard picture quality can be broadcast (which mean 40-80 TV channels in total). Number of TV channels that can be broadcast in one allotment depends on a compression choice (H.264 MPEG-4) and a DVB-T system choice (following table). In cases where higher initial coverage should be provided as soon as possible, it is usual to use DVB-T C2 standard whose capacity is approximately 20Mb/s (see table 2). An overview on DVB-T standard technical characteristics is given in the following table:

Table 2 –DVB-T system variants and net flow values (Mb/s)[10]

System variant code	Modulation type	Code ratio	Net flow in (Mb/s) for different values of guard intervals (guard intervals (GI))			
			GI= 1/4	**GI=1/8**	**GI=1/16**	**GI=1/32**
8 MHz variants						
A1	QPSK	1/2	4.98	5.53	5.85	6.03
A2	QPSK	2/3	6.64	7.37	7.81	8.04
A3	QPSK	3/4	7.46	8.29	8.78	9.05
A5	QPSK	5/6	8.29	9.22	9.76	10.05
A7	QPSK	7/8	8.71	9.68	10.25	10.56
B1	16-QAM	1/2	9.95	11.06	11.71	12.06
B2	16-QAM	2/3	13.27	14.75	15.61	16.09
B3	16-QAM	3/4	14.93	16.59	17.56	18.10
B5	16-QAM	5/6	16.59	18.43	19.52	20.11
B7	16-QAM	7/8	17.42	19.35	20.49	21.11
C1	64-QAM	1/2	14.93	16.59	17.56	18.10
C2	64-QAM	2/3	19.91	22.12	23.42	24.13
C3	64-QAM	3/4	22.39	24.88	26.35	27.14
C5	64-QAM	5/6	24.88	27.65	29.27	30.16
C7	64-QAM	7/8	26.13	29.03	30.74	31.67

With assuming DVB-T C2 standard and GI= ¼ we have determined the final capacity of a DTT multiplex (DTTMUX) which is 19.91 Mb/s, i.e. the capacity of one SFN network. Starting from this assumption, with the aim of enabling as higher number

[10] GI (guard interval)
QAM Quadrate amplitude modulation
QPSK Quadrate phase-shift keying

of TV channels in one DTTMUX as possible, it is necessary to make an adequate choice of TV signals' compression in order to put as many TV channels in one DTTMUX as possible.
Since 2-2.5 Mb/s are required for one programme of standard quality, if MPEG-4 compression is used, it is possible to transmit 8 to 10 TV channels with standard picture quality (SD) through one DTTMUX, depending on other contents (audio, TTX, EPG, MHP, additional services).

It is important to mention that MPEG-4 is compatible with the new DVB-T2 standard which was adopted recently, and which enables DTTMUX capacity increase in 30% (two-three additional TV channels of standard picture quality).

2. The choice of initial digital channels

The commencement of digital broadcasting is done in the frequency domain in which analogue terrestrial broadcasting already operates. Regional Radio-communicational Conference RRC06 was dealing with issues of future broadcasting. The same conference couldn't find a solution how to do the switch-over from analogue to fully digital terrestrial broadcasting, so it was left to the administration of the States Signatories to do the work according to the condition of the market in each country individually.

The choice and number of the channels for initial introduction was determined by administrations at a sub-region level. Together with Croatia, Serbia, Montenegro, Hungary, Slovenia and Austria, BH agreed that the initial introduction should be done on two channels in each allotment.

The choice of the channels should cause minimal changes in present use of analogue TV stations. The use of each individual channel will be separately coordinated at international coordination meetings. The transition of present users from one frequency to the other represents all by itself a very large and complex job. Having that in mind, CRA will conduct a detailed analysis of justifiability in opening new public call for TV frequency assignment and establish more rigorous criteria concerning the changes of technical annexes for analogue terrestrial broadcasting of TV channels.

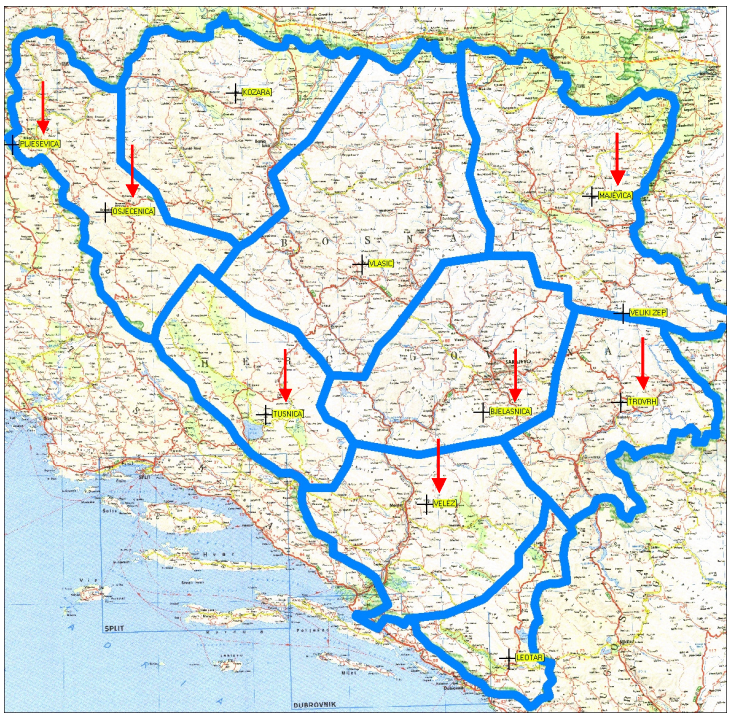
3. The choice of initial emission locations

As earlier mentioned, the design of digital frequency plan was conditioned with:

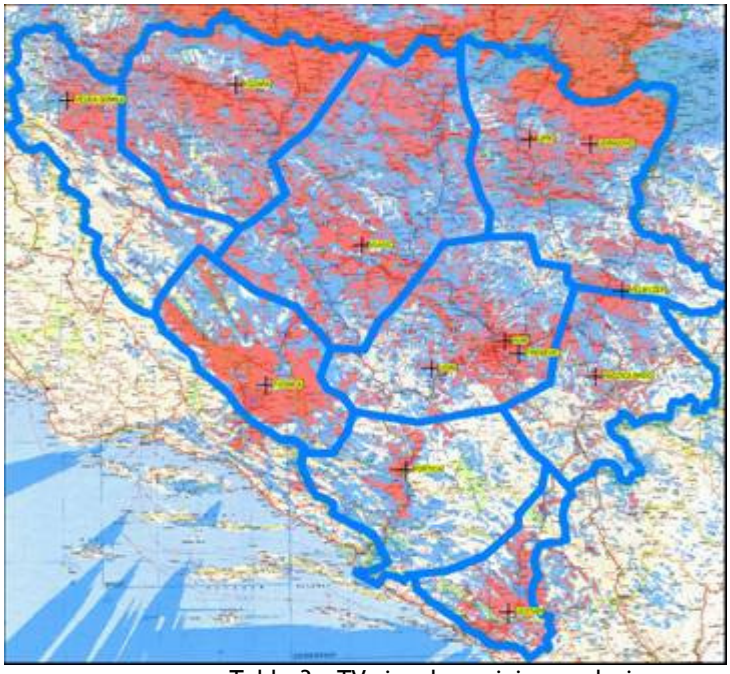
- propagation-technical limitations of DTT system and
- Existence of referential objects- emission locations in BH.

The following picture shows the plan and the proposal of alternative locations (red arrows) in Bosnia and Herzegovina for introduction of digital terrestrial broadcasting. The reason for this choice of alternative locations is non-existence of emission infrastructure in all locations according to which the plan was made.

Pictures 4 and 5 – Reference and alternative locations for initial broadcast of DTT programmes



4. - Choice of these locations was made in accordance with the previously stated conclusions.



5. – The coverage of alternative locations and estimated number of covered population

Table 3 – TV signal receiving analysis

Room antenna receiving		Roof antenna receiving	
Covered area	21.474 km2	Covered area	41.943 km2
Covered population	36.91%	Covered population	78.27%

To ensure the coverage of greater percentage of BH population, further activities should be conducted in choosing additional locations in each allotment.

VII. SOCIO-ECONOMIC ASPECTS OF DTT INTRODUCTION

The economic issue of the introduction of digital terrestrial broadcasting (DTT) includes the analysis of the electronic media market in Bosnia and Herzegovina and analysis of the introduction of DTT in other countries. Detailed costs and price calculation for digital switch-over are not shown considering constant price changes in this market. The same thing applies to the costs of parallel broadcasting of digital and analogue terrestrial broadcasting (simulcast), where it is clear that this transition period should be as short as possible.
Socio-economic analysis strives to consider advantages and disadvantages of introducing DTT for all interest groups as shown in the table 4.

Table 4: *Advantages of DTT introduction for certain interest groups*

Participant	Investment	Benefits
Audiovisual media content producers	- new studio equipment - new production methods	- lower transmission costs - higher advertising incomes - new incomes
Network/multiplex operators	- new transmission equipment - new antenna system - partly new connections	- lower energy consumption - equipment rationalization - cheaper programme monitoring
Users/viewers	- new receiving equipment - partly new antenna systems	- better picture, sound and additional services - multi-channel surrounding
Equipment producers	- new technology adoption - new equipment	- new workplaces - selling possibilities - production and material rationalization
State/public administration	- financing information technologies - subvention for equipment and service - educational and promotional campaign	- stronger competition and media pluralism - digital dividend income

The aim of the economic analysis of a broadcasting market is to consider the condition in which the sector is found and how prepared it is for the challenges imposed with the switch-over from analogue to digital terrestrial broadcasting.

A. FINANCING EXAMPLES OF DTT INTRODUCTION IN EUROPE

Examples of other countries show that the increase in costs concerning double transmission is between 40% and 70%. Energy savings after the transition will be proportionally bigger concerning that one new transmitter replaces three or four old ones. Today, EU documents on the switch-over policy from analogue to digital broadcasting are mostly focused on terrestrial platform. In the example of the analyzed countries the conclusion can be made that the Strategy and the implementation of digital switch-over must take into account and comprehend all advantages and disadvantages for participants and involve all interest groups. An accent is placed upon added value and new services which will be achieved by digital switch-over. In table 8, there is a short overview of socio-economic analysis of DTT in some countries.

Table 5: *Overview of DTT introduction in some countries with the most important elements*

COUNTRY	DESCRIPTION
Austria	- Austrian government supported the annual fund for digitalization in the amount of 6, 75 million Euros. Cost analysis showed that digital network should be commercial, functional business model which doesn't rely on the state subventions.
Czech Republic	- Government's co financing of digital switch-over of TV programmes is divided into direct and indirect: a) Financing of information campaigns, market monitoring, and b) Compensation of the acquisition of the basic equipment for admission for chosen groups of people with a help of the European grants.
Italy	- All those who had an access to analogue TV must have an access to digital TV, too. TV digital switch-over must be financially acceptable to the majority of citizens and practicable for the country. Enable pluralism with new technology and enable new operators to access the system. - 110 million Euros from the state budget as a help to the households for buying receivers in amount from 50 to 70 EUR.
Germany	- Primary aim was to increase significance, strength and existence of terrestrial transmission of signal broadcasting introducing digital TV. Data showing successful transition to digital television in Berlin are based on short transition phase of parallel broadcasting lasting for 10 months, financial and other support to private programme producers, financial support for low income households, and very intensive campaign informing population on advantages in using digital terrestrial television in relation to analogue one.
Spain	- Circulus vitrosus: there wasn't enough interesting content on DTT, consumers don't buy set-top boxes, low demand, no volume economy, high price, TV operators do not spare the budget for creating new contents. - In the second phase, free-to-air DTT started to offer interactive contents such as public services and e-Government. TV stations are obliged not only to ensure contents, but also to conduct stronger promotional campaign through their analogue channels. The Government will additionally support this through tax relief.
Croatia	- The Government of the Rep. of Croatia planned partial subvention of STB procurement and strong informative campaign.
Slovenia	- Transition process to digital television should be market oriented, and also supported by public policy measures. - Compatibility of equipment which user's already possess with new equipment; equipment necessary for digital switch-over needs to be accessible and available to the majority of population. - One of the reasons for problems in initial phase of introducing DTT in Slovenia was poor STB penetration due to the lack of promotional-informative campaign and lack of acquisition subvention for STB. Compatibility of equipment which users already possess with the new equipment is of special significance. Post and Electronic Communications Agency (APEK) of the Republic of Slovenia has published a document which contains minimal technical requirements for DVB-T receivers which are used in the Republic of Slovenia.

B. POSSIBILITIES AND PROPOSALS FOR FINANCING DTT INTRODUCTION IN BOSNIA AND HERZEGOVINA

European institutions have directions for acceptable forms of public support:

1. Investment in the network of transmission in zones with low signal coverage and zones of low commercial interest of investors (rural areas, low populated areas);

2. Compensational financing of public RTV stations for broadcasting costs, using all broadcasting technologies and in that way ensuring coverage of high percentage of population;

3. Subventions to users for buying digital receivers, which are in accordance with specifications for DVB-T receivers which will be used in Bosnia and Herzegovina.

4. Financial compensation for broadcasters, which, due to the specific interests have to switch-off analogue broadcasting before the expiry date of existing licenses, if it is going to enable available capacity for digital broadcasting.

1. Subventions for the endangered categories of citizens

Based on the experience of other countries, and analysis of EU recommendations, subvention of population is proposed when buying DVB-T receivers. Subventions will significantly increase transition process to DTT because it is efficient way to encourage citizens to buy these devices. In this way, receivers penetration will be followed in the market as well, which will enable TV stations to make up their mind sooner for digitalization of their programme and access to the multiplex. Only by encouraging population to faster transition, "enchanted ring" which occurred in some countries (Slovenia and Spain) can be avoided. Population wasn't motivated to buy set-top boxes; TV stations had no motive to switch-over to digital broadcasting due to low penetration, when due to small number of stations in multiplex broadcasting price for each station is growing etc.

For the purpose of having the same attitude towards the whole population and possibility of monitoring the penetration, subvention of all households is suggested in certain percentage which will be determined afterwards. Subvention of the part of the price of average DVB-T receiver is suggested. At the moment it is not possible to determine absolute amount of the voucher because of the constant change in the receiver price, but this amount will be determined in the appropriate moment.

Subventions will be connected with RTV tax, i.e. only households which complete their legal obligation and pay tax will get subvention voucher. In that way rate of charge will increase significantly, and that fund could be used for the digitalization of the Public RTV system of BH and for offer increase in programme content.

For additional acceleration of the digitalization process and reducing the time for simultaneous broadcasting on analogue and digital platform, it is necessary to limit the period for voucher duration at six months from the beginning of transition phase.

2. Protection of consumers and competition relations

In the switch-over process to digital terrestrial broadcasting special attention should also be paid to consumers' protection. One way of doing that is introducing the obligation of placing stickers saying *"DTT Forum recommends"* for those receivers that comply with prescribed technical standards. In that way consumers would be protected from buying inadequate equipment, and at the same time competition relations of the market wouldn't be violated. Therefore it is necessary to clearly define technical specifications and equipment standards which have to be satisfied.[11] In compliance with positive regulations, any kind of prohibition or conditioning during import and selling goods or tied product sale is not allowed in Bosnia and Herzegovina, which would, by the way, break the rules from the Law on Competition ("BH Official Gazette", No. 48/05, Law on Changes on the Law on Competition- "BH Official Gazette", No. 76/07. Of course, competent institutions in Bosnia and Herzegovina can decide to make an exception having in mind that this is an economic service issue of public interest.

Promotional campaign of DTT introduction in BH should also include consumers' protection. In that sense it is necessary to make a plan for consumers' education on DTT in general, together with the manner and kinds of planned subventions for buying only those receivers that satisfy prescribed technical standards. All above mentioned should be in accordance with the Law on Consumers' protection in Bosnia and Herzegovina ("BH Official Gazette", No. 26/06).

3. Public RTV system in BH

In most European countries public RTV services have a significant role in transition to DTT. In many countries an economic support for operators and users has been established, where country governments provided mechanisms of indirect financial support (from tax stimulations and loans, to direct subvention for operators and end users) for the transition process.

In compliance with the Law on the Public RTV System in Bosnia and Herzegovina ("BH Official Gazette", No. 78/05), it is necessary to provide universal service of receiving TV signal to all members of Public RTV system in BH in digital terrestrial broadcasting. Also, in compliance with European practice and recommendation of the European Commission (Rec 2003)9 and Rec. 1641(2004)), it should be guaranteed that the Public RTV services, as an essential factor of cohesion in democratic societies, should also be maintained in digital surrounding to ensure universal approach of individuals to Public RTV service programmes, having in mind their significant role upon transition to digital terrestrial broadcasting. Also, it is important to ensure that Public RTV system BH should be the leader in transition process to DTT due to its dominant position in BH broadcasting market and its leading role. Competent institutions have the responsibility for the adequate functioning of Public RTV system and the help during the process.

[11] Examples from other countries show different solutions for this problem. The USA has, for example, adopted the Law which prescribes that an imported TV equipment should be compatible for receiving a digital signal. Thereto, during the whole transition process to digital signal merchants can continue with the sale of non-compatible TV receivers, but they are obliged to warn buyers and emphasize the sticker with the warning up to what date TV receivers which are not compatible for digital signal receiving are valid. In March 2008, France also adopted a law which prescribes that all TV receivers sold in France must have built-in DVB-T receiver.

Subvention of citizens should be connected with RTV tax, which will enable increase in tax charge rate. These funds should be used for financing part of the process of Public RTV system digitalization. An adequate regulation of uncollected debts would bring RTV system additional income and facilitate necessary investment.

4. Other TV stations

All TV stations in BH market (private and public) will meet increased expenses during the simultaneous broadcasting period, among other things for multiplex lease and investment in present equipment digitalization. After the transition period their expenses will significantly decrease for the same coverage they have at the moment, which is proportional for eventual higher coverage in territory and population of Bosnia and Herzegovina. Taking into account other TV stations (private and other public), it is necessary that official transition period of simultaneous broadcasting should be the shortest possible and that analogue terrestrial broadcasting should be switched -off at the shortest possible period.

5. Digital dividend

With transition to digital terrestrial broadcasting, there will be a significant release of frequency spectrum, which represents a special advantage for Bosnia and Herzegovina. Competent institutions should decide how to use them. After the switch-off of analogue terrestrial broadcasting, released frequencies can be used for different purposes, primarily for introduction of new telecommunication services, as well as for introduction of new programme contents and zone coverage increase.

In the widest sense, the use of released frequencies represents digital dividend. Digital dividend represents a new and significant income source for each country.

Bosnia and Herzegovina must determine how it will use its free frequencies in the future. It is important to emphasize that digital dividend varies from country to country. Small countries, whose frequencies overlap with those in neighbouring countries, can't achieve digital dividend, for example, in Great Britain which benefits greatly from its geographical position. In fact, frequencies are not familiar with state boundaries; therefore countries must cooperate and ensure that one country's transmission doesn't obstruct other country. It is necessary to carefully consider potential users of available frequencies, then set technical limits to prevent obstruction and think of efficient allocation.

EU directives prescribe that member states should ensure that allocation of free frequencies done by the state regulator should be managed by principles of transparency, non-discrimination and objectivity. Free frequencies enable introduction of wide spectrum of new mobile telephone services with high-quality video and interactive media available on mobile phones. Also, they can be used for voice services, for higher coverage of rural areas, or for other possible new technologies which would be commercially interesting for this released part of frequency band. These frequencies are suitable for cost decrease along with coverage increase and development of new services. Free frequencies should be used according to market oriented principle and directed towards users, companies and individuals which will use them fully and therefore maximize dividend. Relevant institutions will determine who and under which conditions will get frequencies which will be available after analogue TV is switched-off.

6. Proposal for activities

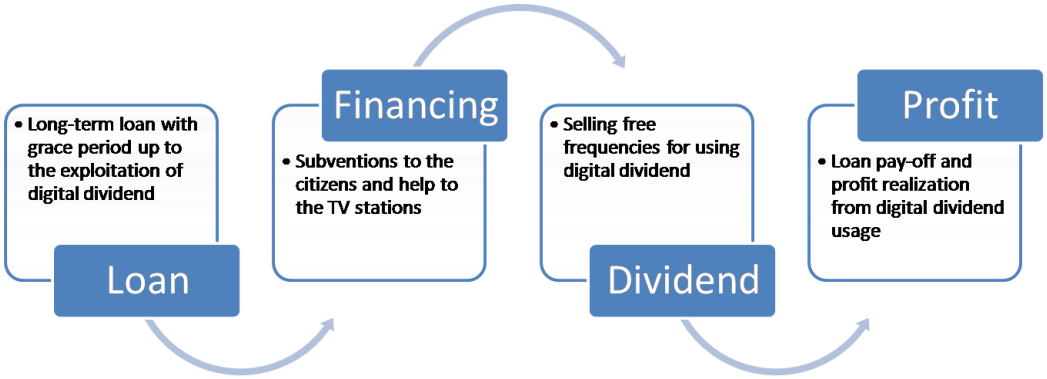
On the basis of conducted market analysis in Bosnia and Herzegovina, analysis of successful cases in the region and Europe, together with economic analysis of some countries, the following activities are proposed:

1. **Subventions for population** – help citizens with money voucher for partial financing of DTT receiver buying. This will significantly accelerate the digitalization process and increase RTV tax charges.
2. **Protection of consumers and competitive relations** -take into account protection of consumers in every aspect of DTT introduction, but without violating competitive relations in the process.
3. **Public RTV system as the leader in the DTT introduction** – Public RTV system should be the leader in DTT introduction process, because it is legally obliged to inform population of Bosnia and Herzegovina without interruption.
4. **Other TV stations** –Towards the stimulation of digital switch-over and expense decrease, TV stations will only pay an amount of state contribution for using radiofrequency spectrum in digital broadcasting. In the transition period they will be exempt from paying the same for analogue broadcasting. The annual amount of the state contribution is prescribed by the Decision on the State Contribution for the Use of Radiofrequency Spectrum ("BH Official Gazette", No. 01/07)
5. Means achieved by the state contribution for using radiofrequency spectrum will be restructured and assigned as one of the financing sources of the digital switch-over, for the period until the complete switch-off of analogue terrestrial broadcasting. Annual amount of the state contribution is prescribed by the Decision on the State Contribution for the Use of Radiofrequency Spectrum ("BH Official Gazette", No. 01/07), and they represent the main budget sources for Bosnia and Herzegovina's institutions.

6. **Digital dividend** – Possibility for investment return is provided through an exploitation of digital dividend and creation of extra-profit.

Possible ways of financing the process of transition to digital terrestrial broadcasting are long-term loans or other sources of help from international community institutions. For example, BH can take a long-term loan with grace period up to the moment of digital dividend utilization. Subventions to the citizens, informative-educational campaign and other help to the communication licensees in the communication sector are financed from these resources. After the beginning of the digital dividend exploitation, loan can start to pay off and to make a profit out of the digital dividend. (Picture 6)

Picture 6: *Model ROI - investment return*



VIII. DTT INTRODUCTION IN BH - PROMOTION PLAN

A. PROMOTIONAL INFORMATIVE CAMPAIGN

The aim of the public informative campaign is to inform and educate BH public on the introduction process of digital terrestrial broadcasting (DTT), presenting the advantages of digital television and steps expected from the citizens in enabling their households for receiving digital TV signal in accordance with the set deadlines.

Other countries' experiences showed that success of the whole process depends on well planned and successfully realized informative-educational public promotional campaign.

1. Specific targets

The aim of the campaign is to inform citizens with digital broadcasting concept, to present the term itself, advantages for the users, to meet them with details of the state subventions and with the deadlines, to motivate them to timely ensure technical prerequisites for DTT receiving in their household. Also, it is important to give answers to the questions/issues that citizens may come across during the DTT transition process.

2. Target groups

The target groups of the promotional campaign are households in Bosnia and Herzegovina which are directed to terrestrial TV signal receiving. Individual activities will target special groups depending on the plan and the need during the transition period and the campaign duration.

3. Implementation period

Concerning the message complexity which wants to be sent through public informative campaign on digital broadcasting introduction, there are two dates important in that process: the commencement of the pilot (experimental) project of digital terrestrial broadcasting and the commencement of official transition period. We propose two two-month phases of intensifying PR activities (after the commencement of the pilot DTT and the transition phase). The rest of the time will be used for citizens' education through sponsored TV and radio shows, joint activities of public advocacy with campaign partners, and ad hoc events. The realization dates of the campaign elements will depend on the starting time for specified phases in the transition process to digital terrestrial broadcasting.

B. PROMOTIONAL ACTIVITIES

During the planned campaign all communicational elements will be used, with special emphasis on advertising and public relations, concerning that this is mass campaign which should comprise wide target market. Other communicational elements will be used based on the market analysis, demands and needs, as well as in accordance with DTT penetration dynamics and it will aim more specific groups.

1. PROPOSAL FOR PROMOTIONAL ACTIVITIES

- **Advertising via mass media**

This activity implies creating TV commercials, radio jingles and billboard posters, and adequate hire of mass media in accordance with afterwards determined media plan.

- **Educational flier distribution**

Sending fliers to home addresses of all registered telecom operator users with a bill for August 2009 (content comprises the frequently asked questions and notifications of the pilot DTT broadcasting commencement) is proposed.

- **Sponsored half-hour TV shows**

To ensure continuous education of citizens, sponsored shows need to be contracted, and according to their viewer ratings and coverage, shows would be broadcast twice a month (six episodes in each) - the most popular format: TV features and appropriate guest(s) in a studio.

In the shows, issues concerning the introduction of digital television would be discussed, as well as positive examples and experiences from the countries already using digital broadcasting, and practical applications according to the segments of using digital television etc.

Activity holders: campaign manager and DTT Forum secretary

- **Sponsored half-hour contact radio shows**

Radio programme- is a good alternative to television in the morning hours from 8-12 AM, when TV programme records low rating. Sponsored shows would be broadcast once a week (five shows each) in the chosen radio stations across BH.

Activity holders: campaign manager and DTT Forum secretary

- **'Purchased' newspaper articles**

Issue reviews by DTT Forum, CRA and Ministry of Communications and Transport representatives.

Activity holders: campaign manager and DTT Forum secretary

- **Establishing free phone line for information**

In cooperation with the public telephony communication licensees open free telephone line where citizens could get more information on DTT.

Activity holders: campaign manager and DTT Forum secretary

- **Travelling branded bus**

Rent a bus which would be branded with a design of the DTT campaign. The bus would be used in major towns of BH, as well as mobile info display of campaign through Bosnia and Herzegovina.

Activity holder: campaign manager

- **Placing advertisements-posters in public transport**

Media buying for an advertisement campaign in the means of public transport in Sarajevo, Banja Luka, Mostar, Tuzla and Bihać.
Activity holder: campaign manager

- **Placing outdoor advertisement**

Media buying for jumbo posters and so-called *City lights* in the towns across BH and on the main travel routes.
Activity holder: campaign manager

- **Regular setting of DTT information on public RTV service (JRTVS) web sites and other public stations**

Ensure regular setting of information concerning the digitalization process in BH on the web site of public RTV services, as well as on the other public radio and TV stations.
Activity holders: campaign manager JRTVS BH

- **Introduction of 'scroll' text during the programmes broadcast on public RTV system**

Presentation of a short information on the digitalization process during popular programmes on Public RTVS.
Activity holders: campaign manager and JRTVS BH

- **Involving municipal administration in the DTT promotion process**

Invite all municipalities to involve actively in the promotion process of introducing DTT, for example, by placing DTT information on municipality web sites, by distributing information during the meetings with citizens, i.e. representatives of community centres, etc.
Activity holders: campaign manager and municipality administration

- *'Open door'* **days**

In bigger shopping centres across BH in sections of so-called white-goods department where set-boxes, digital television sets and other required equipment will be available. A DTT Forum representative will be available for all enquiries by the citizens; a company manager will be in charge of appropriate media promotion of the event;
Activity holders: campaign manager and DTT Forum member

- **Digital info corner**

Instalment of a stand with promotional materials in bigger shopping centres across BH in sections of so-called white-goods department where set-boxes, digital television sets and other required equipment will be available.
Activity holder: campaign manager

Additional promotional activities

Generating media, and at the same time public attention for all DTT Forum activities, CRA and Ministry of Communications and Transport: organize additional promotional activities aimed at educating specific target subgroups - public and private broadcasters and telecom operators *(like public announcement, press conference, thematic newspaper column, etc.)*

2. PROMOTION PARTNERS

1. Public broadcasters
2. Other broadcasting communication licensees
3. Telecom operators
4. Public postal administrations in Bosnia and Herzegovina (SP, HP, BHP)
5. Internet portals
6. Big shopping centres and audio-visual technical equipment shops
7. Banks
8. Municipalities and towns in BH

PRESS CLIPPING

- Ensure qualitative and quantitative analysis of monitoring media writings about the campaign and activities of the campaign implementers and partners, especially the first part of the campaign. Use the results for possible processing in the transition period and in the second part of the campaign.

Activity holders: campaign manager and DTT Forum secretary

Preparatory activities

- *Preparing creative concept for Advertisement section (TV, radio, press media and outdoor advertisement, i.e. billboards and 'city lights')*
- *Testing creative concept by focus groups in five towns (Sarajevo, Mostar, Banja Luka, Brčko, Bijeljina)*
- *30-35 seconds of TV spot production*
- *30-35 seconds of radio spot production*
- *Promotional material design for advertising in press media*
- *Media space rent plan-OHH of outdoor advertisement*
- *Negotiating-making contracts with shopping centres, banks, posts on possible help throughout promotion*

Preparatory activities

- *Negotiating-making contracts with TV and radio stations on sponsored shows*
- *Preparing concepts in a cooperation with the producers*
- *Negotiating-making contracts with shopping centres on organizing 'Open door' day and Info corners*

3. Budget

Experiences of the countries which have already started the process of the transition to digital broadcasting, or have already finished it, clearly show that good promotional and informative campaigns are crucial for the success of the whole process of digital television introduction. Above mentioned promotional activities are a fundament for ensuring good informing of population on the digitalization process, timely switch-off of analogue terrestrial broadcasting and digital dividend utilization. The fact is that the biggest part of money in each campaign is being used for renting media space, especially television one. Competent institutions in Bosnia and Herzegovina are obliged to ensure successful digital switch-over.

IX. DYNAMIC SWITCH-OVER PLAN

Bosnia and Herzegovina will fully switch-off analogue way of broadcasting in the UHF band not later than **December 1st, 2011** at 00.01 hrs UTC+1. Based on experiences of other countries, analysis of the communication sector in Bosnia and Herzegovina, and the fact that due to great parallel broadcasting costs on both analogue and digital platform, the switch-over process has to be the shortest possible.
According to international agreements, the initial introduction in Bosnia and Herzegovina will be done in two channels per each allotment. Channel choice is such as to cause minimal changes in present use of analogue TV stations. The use of each individual channel will be separately harmonized at international coordination meetings.
After the Strategy adoption DTT Forum will suggest the Council of Ministers an Action plan for task realization in the Strategy implementation and successful switch-over to complete digital terrestrial broadcasting.

Within digital switch-over, following phases should be realized:

I - Activities before the start of official transition phase in BH:

- adopting a legal and regulatory framework for initiating the DTT pilot project
- commencement of the pilot DTT broadcasting,
- adoption of technical specifications for DVB-T receivers in Bosnia and Herzegovina,
- analysis of DTT pilot broadcasting,
- adopting the budget for the Strategy implementation and complete switch-over to DTT,
- choice of the road map for implementation of the transition phase and complete switch-off of analogue broadcasting,
- adoption of the budget for promotional campaign,
- adoption of the subvention project for the acquisition of DTT receivers,
- invite tenders for promotional campaign (advertising) holders,
- assignment of the licenses for subjects in digital terrestrial broadcasting,
- assignment of the license for MUX A (JRTVS),
- assignment of the license for MUX B(by allotments),
- inviting other necessary tenders for the transition period,
- initiation of the promotional campaign,

II – Activities from the beginning of official switch-over phase to complete switch-off of analogue terrestrial broadcasting in the bands IV (470-582 MHz - channels 21-34) and V (582-862 MHz - channels 35-69):

- continuation of promotional campaign,
- realization of subvention project for DTT receivers acquisition,
- monitoring MUX A and MUX B coverage with DVB-T signal,
- monitoring penetration of DVB-T receivers,
- decision from competent authorities on digital dividend utilization,
- invitation for necessary tenders for period after the switch-off of analogue terrestrial broadcasting (MUX C, MUX D, other possible released frequencies) and

- switch-off of analogue terrestrial broadcasting in the bands IV (470-582 MHz- channels 21-34) and V (582-862 MHz- channels 35-69) on December 1st, 2011 at 00.01 hrs

VII. ANNEXES:

ANNEX 1: DTT FORUM OF BOSNIA AND HERZEGOVINA

Based on the conclusions and recommendations of the Conference on 'Introduction of Digital Television in BH', held on March 30th, 2006 in Sarajevo, the Forum on digital television (DTT) was formed on May 8th, 2006, and its tasks are defined in the Broadcasting Sector Policy ('BH Official Gazette', No.18/07 from March 13th, 2007). According to the conclusions from the 50th Session of the Council of Ministers of BH from May 29th, the DTT Forum of Bosnia and Herzegovina developed the Strategy proposal for the switch-over from digital to analogue terrestrial broadcasting in the frequency bands of 174-230MHz and 470-862MHz in Bosnia and Herzegovina.

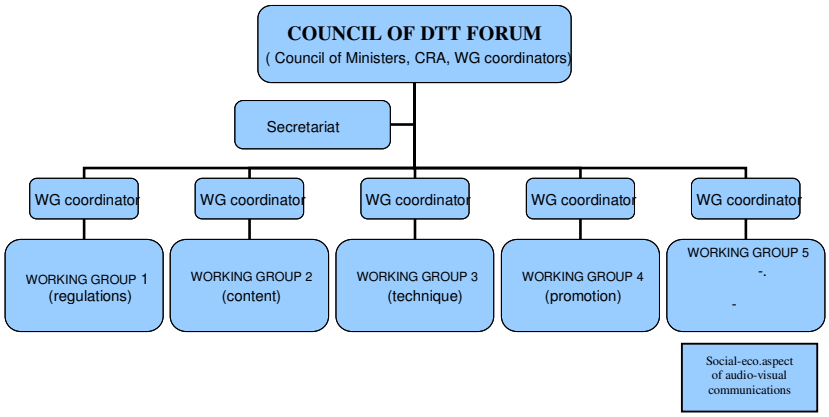
DTT Forum department initiated its work in June 2007. By the decision of the Council of DTT Forum, working group coordinators were appointed in September 2007. First working meetings with the international experts for DTT were held on September 19th, 20th, and 21st, 2007. The department of DTT Forum coordinated working groups, organized meetings and ensured necessary material, making records, and compiling and consolidating work material for the Strategy proposal.

DTT Forum organized a series of conferences, workshops and round table meetings. Its aim was to inform, educate and involve interested parties within the communications sector in Bosnia and Herzegovina in the switch-over process to digital terrestrial broadcasting.
On September 20th, 2007, the round table 'Introduction of DTT in BH' was already held, and it was organized by DTT Forum / CRA and Twinning Light Project (AGCOM). About 80 communication sector experts were present. Furthermore, in order to present the DTT introduction process in BH to wider audience, a press conference was held on September 26th, 2007, organized by the Ministry of Communications and Transport and the CRA. It is important to mention the workshop dedicated to technical aspects of transition to DTT in BH (April 17th, 2008), and the very successful international conference organized by the DTT Forum and Communications Regulatory Agency (May 22nd, 2008 and November 26th, 2008).

In general, during the development of the Strategy proposal, DTT Forum has had more than 100 meetings of work groups, out of which five were plenary, four workshops and two conferences, published 12 newsletters, and together with Communications Regulatory Agency conducted a research within the communications sector and initiated the page dedicated to the process of DTT introduction in Bosnia and Herzegovina: www.dtt.ba. DTT Forum gathered interested parties in the communications sector and worked intensively on promotion of the transition to DTT and on education of general population and expert audience.

DTT Forum consists of the Council of DTT Forum (representatives of Ministry of Communications and Transport of BH and Communications Regulatory Agency, work group coordinators), Secretariat (secretary and Secretary assistant), with five working groups specialized for regulatory, programming, technological and promotion issues and socio-economic aspects of the transition to DTT.

In designing optimal solutions for Bosnia and Herzegovina and the DTT Strategy proposals, the Forum consulted a number of acknowledged international experts in this field, and actively cooperated with similar subjects in the region and Europe.



Council of DTT Forum:
dr Božo Ljubić,
Kemal Huseinović,
Božidar Škravan and
Dunja Mijatović

Secretariat:
DTT Forum secretary:
Emir Vajzović;
Secretary assistant:
Indira Vasković

Picture 7 – Flowchart of DTT Forum BH

Table 6 – DTT Forum BH Working groups

function			WG1 – Regulations	WG2 - Content	WG3 - Techniques	WG4 - Promotion	WG5 – socio-econ.
COORDINATOR			Gratz Dennis (lawyer)	Šurković Elvir (BHRTV)	Škrbić Mirko (ETF Sa)	Gagulić Dražen (Ministry of Communications and Transport)	Husić Melika (Faculty of Economy Sa)
member 1			Beus Antonijo (Art company)	Udovičić Radenko (Media Plan)	Bašić Radomir (PEP JRTVSBH)	Majić Vedran (journalist/PR expert)	Dragičević Slobodan (Chamber of Commerce of the Republic of Srpska)
member 2			Miloš Dalibor (UNIS)	Lazić Branko (RTRS)	Marčeta Vladimir (RTRS)	Plasto Samir (Marketing, design)	Mehić Eldin (Faculty of Economy)
member 3			Matavulj Rada (State Committee for Appeals of the Republic of Srpska)	Đipa Dino (Prism Research)	Ligata Samir (AEM, NTV Hayat)	Smiljanić Zoran (Advertising and PR expert)	Bilal Adnan (UMI/FTV)
member 4			Jugo Dženita (Directorate for European Integration of BH)	Zukić Amir (TVSA)	Borovina Džemo (EP BH)	Ilaria Zinaida (PR Consulting)	Mujagić Aida (Council of Competition of BH)
member 5				Pavlović Ravijojla (Ministry of Communication and Transport)	Tešić Drago (Kosmos Banja Luka)/ Šoljić Ivan (HT Mostar)	Lovrenović Ivan (journalist)	Begović Elvira (ONASA)
CRA	**Jasmin Mušović** (coordinators)	1	Povlakić Emir	Kovačević Radovan	Petrović Siniša	Odobašić Amela	Zorlak Melvin
		2	Mandić Helena	Čulahović Maida	Namgalija Senad	Kuzmanović Nataša	Miljević Nataša
		3	Eminagić Nedžad	Bajraktarević Jasna	Karahodžić Damir	Džemić Jasna	Drakulić Zdravko
		4	Makarević Hasan	Hadžović Suada	Lasta Jesenko		Sarić Nadžida

CONFERENCE CONCLUSIONS
„STRATEGY ON THE SWITCH-OVER TO DIGITAL BROADCASTING IN BOSNIA AND HERZEGOVINA“

In compliance with the Broadcasting Sector Policy and the work plan of the DTT Forum of Bosnia and Herzegovina, the International Conference on 'BH Digital Switch-over Strategy', organized by DTT Forum and Communications Regulatory Agency, was held in Sarajevo on May 28th, 2008.

The conference was attended by more than 130 participants, representatives of RTV stations, academic community, international community in BH, the Council of Ministers of BH, House of Representatives of the Parliamentary Assembly of BH, Communications Regulatory Agency, chambers of commerce, organizations and associations in the communication sector (PEM, UMI, AKOP), private and public companies from the communication sector, equipment producers etc.

Eminent international experts were exposing on this conference, the experts from Communications Regulatory Agency and DTT Forum BH work group coordinators. After the presentations and discussions, certain experiences and best practices with results of DTT Forum BH work groups, following conclusions came out:

1. DTT Forum is a body which creates cooperation, initiatives and gathering of all interested parties in the process of introduction of digital switch-over, and concerning this, DTT Forum of BH should continue successful cooperation with Ministry of Communications and Transport, Communications Regulatory Agency and all interested parties in the communications sector. All this has an aim to propose a strategy for introduction of digital broadcasting of TV programmes in BH.

2. In compliance with the Broadcasting Sector Policy and the best European practice, define the significance of the role of Public RTVS in BH in the process of introduction and transition to DTT, as well as the significance of informing and educating.

3. Make a clear review to the new paradigm in programme content, with new services in digital broadcasting. Explain terms and processes in digital broadcasting of TV station to the others.

4. It is necessary to carefully regulate relations in digital broadcasting between network operators, multiplex operators and service providers of audio-visual content having in mind protection of competition and consumers' protection.

5. The transition period (simulcast) from analogue to digital broadcasting should be as short as possible due to the increased costs of parallel broadcasting.

6. It is necessary to make optimal distribution of resources and assignment of multiplex, and make cost-orientated prices of licences, concessions etc.

7. Give a proposal for technical equipment specification for digital broadcasting towards the industry and end users' protection.

8. Provide respecting of universal service obligation for TV programme receiving, and make and adopt the best model of subvention for the most deprived categories of population in the process of DTT introduction.

9. Define the most acceptable model of digital dividend utilization.

10. Provide a sufficient budget for implementing introduction Strategy for DTT in BH.

11. Enable DTT Forum of BH to efficiently supervise the process of the Strategy implementation, above all through coordination with interested parties, informing and educating the public, coordination between institutions in charge of the Strategy implementation, after the model of the best European practice.

All working groups of the DTT Forum will incorporate these conclusions into their proposals for the development of the Strategy for the introduction of digital TV programme broadcasting.

ANNEX 2: EXPERIENCES AND ANALYSIS OF DTT INTRODUCTION

A. MEMBER STATES OF THE EUROPEAN UNION

Member States of the European Union started experimental broadcasting of digital terrestrial programme at the end of the 90s and the beginning of 2000. Each country had a different approach and predispositions for this process. In line with that, the results after the experimental broadcasting and the transition process have differed. Therefore it is hard to find a common ground for all of them.

But, some things can be common to all of them. The 'Pay TV' Project which some commercial TV stations initiated in certain countries, ended with bankruptcy. One of the main reasons for such development was the fact that users had to buy special cards which they used to decode desired programmes. Because of the need to buy cards in order to be able to view digital programme, the increase in the number of consumers of the digital programme was very low, and it increased suddenly after the broadcast of coded programmes stopped.

There are many positive examples where the process was successful thanks to a significant informative-educational campaign, where some countries invested even more than 6.000.000€. In most cases, special attention was given to households and people with low income, and in that way practical work involved subventions for the purchase or distribution of receivers to the most handicapped social categories. In most Member States of the EU it has been decided that the switch-off of analogue terrestrial broadcasting should end in the period between 2006 and 2010.

Austria - at the tendering for digital broadcasting, the license was given to an operator (formally separated from the Austrian public service) for only one national multiplex who would offer three to four channels. This operator, together with the producers of the programme content, is obliged to offer the mentioned channels for free, along with better picture and sound quality. For given data services, the operator had a freedom to choose. The operator was also instructed that he should provide digital increase of values in inter-services (EPG) and super teletext.

Czech Republic – They initiated in 2004 with an announcement of public tendering for issuing a broadcasting license for digital terrestrial TV. In 2005, they initiated with DTT three programmes which were given licences. The transition process is done in three phases: 1. DTT start and spreading to all broadcasters using existing networks; 2. switch-over to DTT with gradual switch-off of analogue signal and mass use of the digital signal; 3. total switch-off of analogue signal.

Finland - Simulation period lasted from September 2007 when analogue broadcast was switched-off. Before the switch-off of the broadcast analogue signal, terrestrial network had three multiplexers: MUX A, MUX B and MUX C. After the switch-off of the analogue terrestrial broadcasting, the forth multiplexer started running, MUX E. MPEG-4 and HD formats are used. Most of the set-top boxes were CA-slot equipped. Their strategy was based on the fact that the simultaneous broadcast of analogue and digital signal was too expensive, and that TV digital switch-over will save them significant financial assets. The Finnish public RTV service-YLE is the holder of the process, so it got access to the whole multiplex-related infrastructure.

Italy - among other things, operators developed an offer of TV contents on mobile phones where DVB-H technology was used. In Italy, they tested a method of time sharing terms for DVB-T, where certain providers used daytime and other providers used night broadcasting terms.

Latvia - Experimental phase of broadcasting digital television started in November 2007 and it will last until the end of 2008. It was adopted earlier that the MPEG-4 format should be used. Before the switch-off of analogue television, two national MUX and two additional MUX in Riga region will be available. Complete digital switch-over should happen before the end of 2012. Also, a strong informative campaign was planned as the crucial activity for the success of the whole process.

Hungary – The switch-over from analogue to digital broadcasting will end by the end of 2011. Hungarian regulator (National Communications Authority of Hungary - NCAH) invited a tendering for licenses which refer to the introduction of digital terrestrial radio and television network in Hungary. Since 1999 Antenna Hungary uses MPEG-2 compression by tests of digital terrestrial television, but in tender it chose MPEG-4 compression, whose modern technology enables more channels by a multiplexer.

Republic of Slovenia - determined December 31st, 2010 as the deadline for a complete switch-over to digital broadcasting. Slovenia will be covered by eight multiplexers, four out of which will be used for digital TV broadcasting. One multiplexer has been designated for RTV Slovenia, public RTV service. Public tenders are ongoing for other multiplex operator, and for seven DTT broadcasting licenses. Due to the broadcasting price in first MUX, lack of public promotional campaign and low penetration of receivers (STB), some commercial stations have given up participation in this DTT broadcasting phase. Slovenian regulator- Post and Electronic Communications Agency (APEK) announced on November 3rd, 2008 document with minimal demands for DVB-T receivers which are used in Republic of Slovenia. Document relates to receivers (STB) and integrated receivers (iDTV), it is applied to SDTV and HDTV receivers and it will replace previous version of this document. The aim of this document is to present general conditions for receiving, decoding and presentation of content which is distributed on DVB-T platform in Republic Slovenia. Slovenia uses MPEG-4, H.264 standard.

Sweden - was one of the first European countries to initiate digital terrestrial television in 1999. In 2003, the Swedish Government decided to complete digital switch-over. The first phase of the transition started in September 2005, and the transition from analogue to digital broadcasting ended in October 2007. Until 2004 there were four available multiplex, when fifth was introduced in order to start some additional channels. In first six months of digital broadcasting, only about 500 households had receivers (STB). Later there is a higher penetration of STB's. In December 2006 it was decided that the sixth multiplex will be introduced. By the beginning of 2008 Swedish DTT operator Boxer started with distribution of MPEG-4 receivers to new subscribers. Over the next six years Sweden will switch from MPEG-2 to MPEG-4 system.

B. COUNTRIES IN THE REGION

Republic of Croatia - Croatian Radio Television HRT, i.e. Transmitters and connections started trial transmission in 2002 in the Zagreb area with two transmitters in MPEG-2 compression system. On July 31st, 2008, on its Session, the government of Republic of Croatia adopted the Strategy on the transition from analogue to digital broadcasting of television programmes. It is planned that by the beginning of 2011 in the area of the whole Croatia only digital broadcasting television signals will be available. The government of Republic of Croatia determined the complete transition from analogue to digital broadcasting of television programmes in Republic of Croatia as the key strategic objective in the period up December 31st, 2010. Some of the main criteria for the implementation of the Strategy are:

- Conduct the digital switch-over in a way that will not have a negative impact of any kind on the viewers, as the end users of the services, nor to the television producers;
- Determine basic tasks and responsibilities for all key participants in the transition process from analogue to digital broadcasting of television programmes, and determine legal and sub-legal regulations and their status in order to determine guidelines for their adaptation for digital switch-over;
- Systematically plan broadcasting networks for the need of digital terrestrial broadcasting and providing other electronic communicational services, with respecting principles of responsible management and satisfying public interest on the grounds of available technical possibilities;
- Complete transition from analogue to digital terrestrial broadcasting will be done gradually, with the application of regional model;
- MPEG-2 compression system is used;
- Creating conditions for preserving free, universal and public broadcasting service for television programmes, as well as programmes from other television producers on national, regional and local level, creating conditions for an access of independent producers to the digital terrestrial television network content and encouraging pluralism development at open service market;
- Public familiarization with the introduction and the advantages of the digital television, and facilitation of preparation for digital television introduction;
- Establishing successful and sustainable system for planning funds and monitoring expenses in a period of transition from analogue to digital broadcasting of television programmes;
- Establishing supervising system, monitoring and management for the Strategy implementation and determining obligation to inform the Government of Republic of Croatia;
- Joint measure and activity set are monitored and coordinated by the Central State Office for e-Croatia, which manages their implementation.

Republic of Serbia – the pilot project 'Digital broadcasting of RTS programme via terrestrial network of transmitters' started in 2002. During 2005 the first DVB-T transmitter in Serbia was set in motion. Broadcasting is done on the Avala via the 27 UHF channel of RTS. Teletext, two regular TV programmes from TV Belgrade, stereo and 5.1 TV tone, all Radio Belgrade programmes in stereo technique and 4. Experimental TV channel are broadcast there. The broadcasting from the location 'Iriški venac' also started at 31. UHF channel. The system is directed in such a way as to cover Novi Sad city including its surrounding. In 2008, Ministry for Telecommunications and Information Society of Republic of Serbia announced that the aim of the Ministry is that the switch-over from analogue to digital television in

Serbia is finished until 2012 , having in mind interests of citizens, broadcasting organizations, as well as the fact that the great number of neighbouring countries will conclude their digitalization until 2012 This was explained by the conclusions from the Regional Radio-communicational Conference 'RRC-06', held in Geneva, where obligatory agreement on the digital switch-over until June 17th, 2015 was adopted, and having in mind that many European countries, primarily the Member States of the EU, will do that earlier, it is the obligation of Serbia to join them in the further broadcasting development. Also, it is specified that this Ministry, in the cooperation with the Ministry of Culture of Serbia will initiate the work on the Strategy on the digital broadcasting.

Montenegro – the Strategy on the switch-over from analogue to digital broadcasting systems in Montenegro was adopted on April 10th, 2008. The Strategy proposed that the analogue broadcasting is switched-off on December 31st, 2012. 'The broadcasting centre of Montenegro' (RDC), the only telecommunication operator owned by the state of Montenegro, manages the system which counts 125 emission objects and nine objects in a construction stage. In the second quarter on 2008, RDC will set in motion the digital radio relay system of transmission based on the most modern IP platform. This system will enable connection of 38 most important emission locations in Montenegro, with a flow from 155Mb/s to 622Mb/s, depending on the relation. Simultaneous transmission and broadcasting (simulcast) of analogue and digital broadcasting signals is a great financial burden for Montenegro broadcasting, and concerning that an accelerated transition is recommended. The key subjects for the Strategy realization in Montenegro are: the Parliament and the Government of Montenegro, competent Ministries, regulatory bodies for the broadcasting and the telecommunication area, Public company 'Broadcasting centre of Montenegro', educational institutions, broadcasters (commercial and public), receiving equipment (STB and IDTV) providers and the end users.

The Government of Montenegro and the Agency for broadcasting have to be the process holders for finding out modality for modernization and creating conditions for digital switch-over within set terms. In Montenegro, the following broadcast or have the right to broadcast the programmes:
- National public broadcasting service with two TV and two radio-programmes (RTVCG),
- Local public services (3 TV and 14 radio stations),
- 18 commercial TVs and
- 45 commercial radio stations.

The important factor for the success of the transition process at the national level is an efficient informing of the end users concerning complete process, but especially concerning availability of programme contents and equipment necessary for their receiving. After the switch-off of analogue transmitters, a certain number of channels in broadcasting part of the spectrum will be used for DVB-H, and the choice of frequency distribution for DVB-H systems will be adjusted with the EU recommendations.

The Strategy of Montenegro provides system implementation where MPEG-4 compression method is used. Advantages of introducing MPEG-4 standard compared to MPEG-2 are in enabling further improvement of the system in the future, providing twice as much utilized frequency spectrum and offering greater efficiency of distribution network capacities. Using MPEG-4, the demands for the higher bit flow are compensated, which is important for HDTV introduction. The first network with national coverage should be free-to-air network where multiplex signal will be broadcast to the final users without additional costs. That network

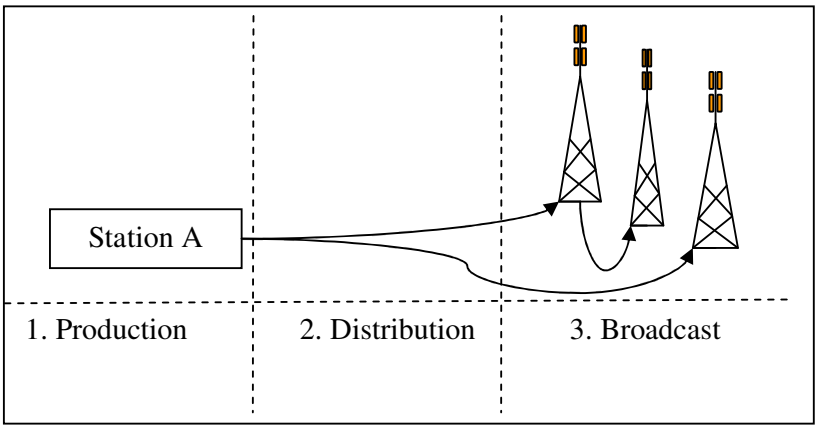
will also contain national public service programmes based on the principle of 'must carry' rules. The cheapest way for users to receive the digital signal is to get the receiver (STB). Only equipment which enables DVB-T signal receiving with MPEG-4 compression is advisable. In Montenegro, VHF frequency band is mostly used for broadcasting national television programme. Concerning the previously mentioned, the initiation of the T-DAB implementation will occur in the later stages of the transition process when conditions are made for the switch-off of analogue broadcasting stations for broadcasting television signals within the VHF frequency band.

ANNEX 3: COMMUNICATIONS SECTOR IN BOSNIA AND HERZEGOVINA

A. FREQUENCY AND INFRASTRUCTURE PLAN

1. Present structure

The chain for broadcasting programmes using analogue platform is done in Bosnia and Herzegovina by segments shown on Picture 1. Until now it was usual that radio or TV station is the owner of all segments which include production, distribution and broadcasting of programme content. Programme production and its broadcasting are regulated by CRA license for terrestrial broadcasting of radio television programme (hereinafter: the Broadcasting license). For the purposes of the distribution, programme supplying, License holders were issued special licenses in radio communication area. (License for RR link for programme supplying and similar).



Picture 8 Basic structure of analogue broadcast programme chain

2. Analysis of using frequency resources

The total number of radio and TV stations in BH is given in the next table:

Table 7 – RTV stations in BH

RTV stations in BH

	No. of stations	No. of frequency licenses
TV stations	45	336
Radio stations	142	334

Public services in BH

	No. of stations	No. of frequency licenses
TV stations	3	416
Radio stations	3	53

The next picture (picture 9) shows the use of broadcasting infrastructure and station programme supply.

Following conclusions can be drawn out of this picture:

1. There is a concentration of emission locations for radio and TV programme terrestrial broadcasting.

2. There is a significant number of microwave links for programme supplying.

Picture 9 - Emission locations and microwave RR links

The overview of infrastructure use for programme supplying is given in table 8:

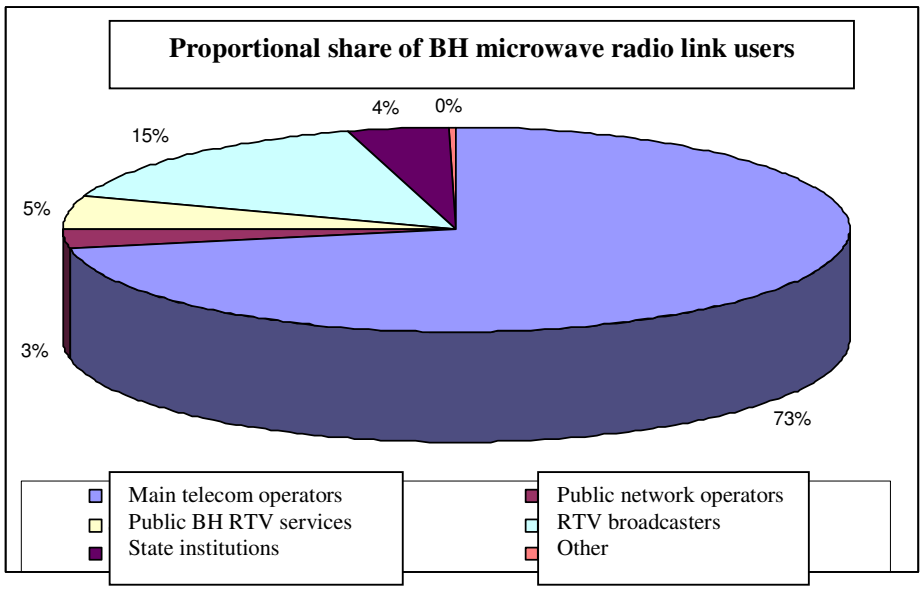
Table 8 Programme supplying- ways and their presence.

Station type	Programme supply	quantity	Sub. total	total	score
FM stations	Repetition	84	173	494	1054
TV stations	Repetition	89			
Public radio system	Repetition	21	321		
Public TV system	Repetition	300			
FM stations	sat link	11	275	560	
FM stations	direct line (cable)	23			
FM stations	RR link	241			
TV stations	sat link	69	207		
TV stations	direct line (cable)	9			
TV stations	RR link	129			
Public radio system	sat link	0	33		
Public radio system	direct line (cable)	0			
Public radio system	RR link	33			
Public TV system	sat link	15	45		
Public TV system	direct line (cable)	1			

Public TV system	RR link	29			

Picture 9 and table 8 point to the following conclusions:

- Repetitions as the way the signal is transported to the emission locations are a dominating part, especially with public RTV services. Such way of programme supplying is not spectrally efficient and significant emission capacities would be freed with its replacement. That would ease the transition from analogue to digital broadcasting.
- There is a great number of RR links as a systems of programme supplying and the Agency should encourage using of this system for programme supplying as the way of overcoming problem mentioned in the previous point. But, this segment also needs a revision through consideration of up-to-now way of using. Also, a great number of links works in the frequency bands which are meant for other use as well (400Mhz, 2GHz 3,5GHz, 10GHz), which will demand an urgent re-planning in the upcoming period.
- Picture 10 shows the percentage distribution of microwave radio link users in BH. It is visible that the number of RR links for programme supplying represents only 20% of total number which is used in the communications sector in total. The implication is that RR links represent significant component in communication market in global and finding out new frequency resources is a serious problem which needs to be considered with analysis of possible scenarios for the digitalization of the transmission system for the Public Radio and Television Broadcasting Service of BH (JRTVSBH). This is of special importance if we know the fact that BH is just introducing the new operators, for example operators of mobile communications UMTS and WiMAX. Also, the fact that the state institutions in BH haven't yet determined their final needs for resources (Ministry of Security and Ministry of Defence of BH etc.) can't be forgotten.



Picture 10

- It is visible from the table 8 that the participation of satellite links and cables as the alternative ways for programme supplying is inadequately

used, therefore the Agency should encourage its more significant participation in the following period.

3. Analysis of the infrastructure use

Significant notice from picture 9 refers to the fact that more stations are broadcasting from the same location, i.e. there is a concentration of emission locations. This should be taken into account upon planning emission locations for DTT concerning that with the usage of these locations; most of the stations will keep the same or similar service zones as they had with analogue broadcasting.

The stations switching-over from analogue to digital broadcasting keep the same broadcasting route, which is important for the beginning of the digital television introduction, because the users with existing antenna systems will be able to receive signal even in the areas of weak coverage. With continuation of the digitalization process, i.e. introduction of more transmitters in SFN zones, orientation of receiving antenna will have no significance because digital signal receiving will be possible even with non-directed room antenna, and in some cases even with antennas integrated in a device itself. From the aspect of programme supplying, better usage of RR link routes and more efficient usage of RF spectrum are possible in these locations.

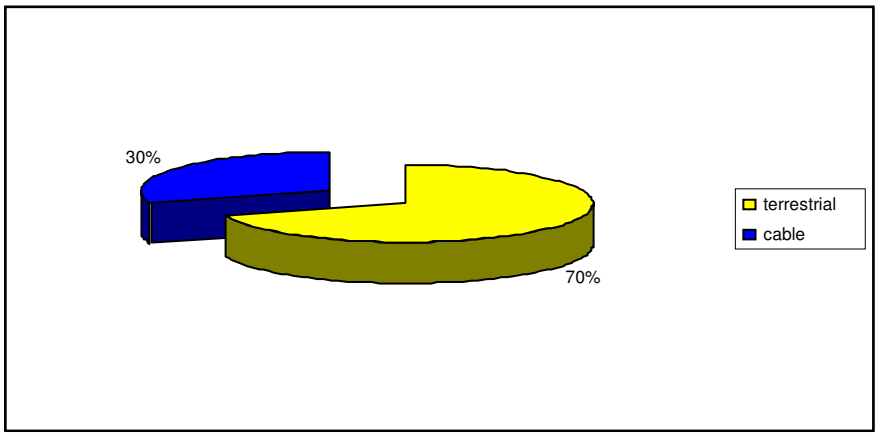
B. COMMUNICATION MARKET ANALYSIS

According to the Agency for Statistics of Bosnia and Herzegovina, there are about 3,9 million people living in Bosnia and Herzegovina[12], i.e. 1.150.000 households[13], out of which 94,9% has a television receiver[14]. Based on the research of BH Communications Regulatory Agency (hereinafter CRA) and the DTT Forum it is estimated that around 70% of households (around 770.000) which have a TV receiver in Bosnia and Herzegovina are set to the terrestrial receiving of TV signal, while 30% (around 330.000) are subscribers of cable platform TV service distributions.

Picture 11 and Table 9: *Participation of different platforms in receiving TV programme (terrestrial and cable)*

Total TV households	terrestrial TV	cable TV
1.100.000	770.000	330.000

[12] Estimation of the Agency for Statistics of BH, http://www.bhas.ba
[13] CRA research 2007
[14] Agency for Statistics of BH 2004, http://www.bhas.ba



Source: CRA research 2008 and DTT Forum estimation

There are estimations about the number of households which have the possibility to receive satellite TV signal (around 45%), but concerning the fact that the broadcasting market in BH is mainly concentrated on the terrestrial or cable systems and their satellite reception is mainly used as an alternative system, their significance in a sense of digital switch-over in Bosnia and Herzegovina is ignorable.

Cable TV share records increase and a significant level of usage in the last couple of years. Most of the cable operators are locally licensed, and offer their services only to a limited community within one town or a region. Only eight operators work regionally and have the licence which enables network spreading for covering few municipalities. It is important to emphasize that cable distributors have an obligation to distribute public RTV service programmes from Bosnia and Herzegovina, established on the basis of article 8. Law on the Basis of the Public Broadcasting System and on the Public Broadcasting Service of Bosnia and Herzegovina. Also, they have an obligation to notify permanent offer for programme distribution for group of licensed terrestrial radio and television stations from Bosnia and Herzegovina whose broadcasting zone is in a zone of system for receiving radio and television signal of telecommunication network through which distribution is done. With this, terrestrial broadcasting TV stations are mostly represented in cable systems.

Concerning relatively small number of citizens (3.842.942)[15], terrestrial broadcasting market in Bosnia and Herzegovina is characterized by presence of its numerous participants. Except for the Public RTV System (BHT1, RTRS and FTV), according to the data from the end of 2008, services are provided by another 45 TV stations, where 15 of them are public and 30 are private TV stations. So far, 15 AVM licensed were issued.

Most of the licensed TV stations have a limited local coverage and broadcasts programme only on a part of BH territory. When it comes to the population coverage with programmes by members of the Public RTV System of BH, only BHT1 covers most of the population in Bosnia and Herzegovina (89,3%), while RTRS covers 93,96% of the Republic of Srpska population, and FTV 89,0% of the population of the Federation of BH.

[15] The last population estimation of the Agency for Statistics of BH from June 30th, 2007.

According to the CRA data, from the aspect of coverage of towns and population which some RTV stations cover, excluding Public RTV services, only two TV stations cover more than 2,000.000 viewers in about 100 cities (OBN and PINKBH), two TV stations from 1,000.000-2,000.000 (Hayat and ATV), from 800.000-1,000.000 two TV stations, and from 600.000-800.000 two TV stations. Other 37 TV stations cover less than 600.000 viewers.

Table 10 Population coverage

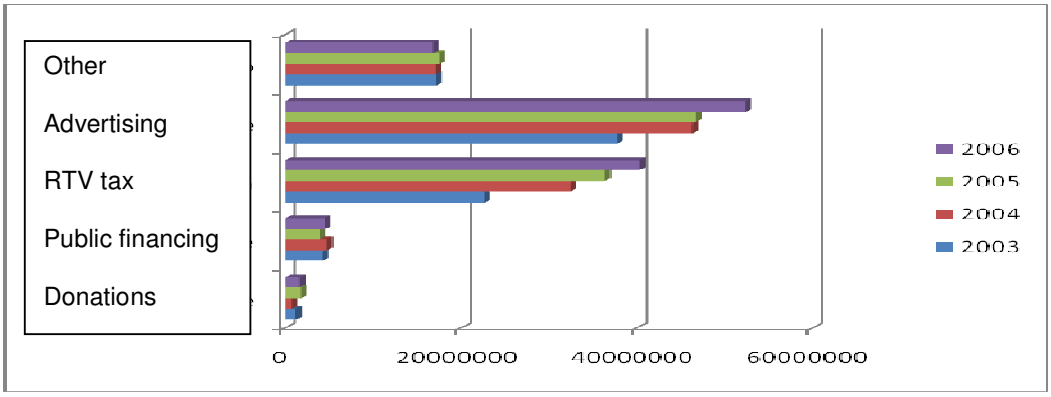
Population number	Number of TV stations
< 10.000	1
from 10.001 to 25.000	2
from 25.001 to 50.000	3
from 50.001 to 100.000	7
from 100.001 to 300.000	14
from 300.001 to 600.000	10
from 600.001 to 800.000	2
from 800.001 to 1,000.000	2
From 1,000.001 to 2,000.000	2
from 2,000.001 to 3,000.000	2
over 3,000.000 citizens	0
TOTAL	45

From the above mentioned it results that not even one broadcaster, excluding Public RTV services, covers the whole territory. A few broadcasters are available at the 70-80% of BH territory. This is why it is considered that a great number of broadcasters will be interested for digital switch-over which could provide them higher coverage, even to the whole territory of BH.

C. ECONOMIC ANALYSIS OF THE MARKET

The total realized incomes of the broadcasters of BH have a continuous positive trend. In 2003 they were 83,000.000 KM. In 2006 they grew to the amount of almost 116,000.000 KM, which is 30% more compared to 2003. The broadcasters' incomes can be divided into few different activities: advertisement (including sponsorships and teleshopping), RTV taxes, public financing, donations and other (which refers only to what televisions orientated to retailing have achieved).

Picture 12 and Table 11: Income structure



	2003.	2004.	2005.	2006.
Donations	1,236.884	783.775	1,771.071	1,683.888
Public financing	4,336.960	4,776.486	3,924.260	4.557.904
RTV tax	22,675.148	32,520.817	36,406.509	40,361.765

Advertising	37,814.751	46,355.724	46,722.160	52,338.531
Other	17,212.630	17,179.168	17,586.240	16,824.227
Total	**83,276.373**	**101,615.970**	**106,410.240**	**115,766.315**

Source: CRA research 2007.

Based on the income overview by sources, following conclusions can be drawn about BH TV market:

1. Advertising, which makes about 45% of the total income, is a dominant source of income. Its share has significantly increased after 2005. The total income that broadcasters made by direct sale in 2006 was more than 27,000.000 KM, while the income made by marketing agencies was about 26,000.000 KM. The result is that 48% of the advertising income was made by the agency mediation, and that 52% of income was made by direct negotiations between broadcasters and investors. Teleshopping and sponsorships make a very small part of the total advertising income, i.e. in 2006 1% of income was made from the teleshopping services, 8% from the advertising which is, regardless of the small share, in increase compared to the previous period. Therefore, the TV advertising market of BH has all the characteristics of developing market, with a positive growth trend in the future.

2. RTV tax makes one third of the total income, and since 2003, its share in the total income has grown per average rate of about 10%. It is important to emphasize that the RTV tax income is intended only for the members of Public Radio and Television System of BH.

3. Public financing, out of which other public broadcasters benefit, is a significant source of income for broadcasting system (4%) and annual growth is very stable in the observed period. Public monetary help and subventions are an important financing source for 15 public stations in direct ownership or under the control of local administration level, municipalities or cantons.

4. Donations are still present on the BH market (1%), which is surprising considering that media has moved to the market orientation almost ten years ago. However, the annual growth rate in 2004 was negative (-37%), afterwards, in 2005 it was positive, and finally in 2006 it was negative again. This shows that such income sources are unpredictable and do not depend on the market situation, so TV companies should not rely on this income source.

5. Other incomes (interests, programme production, surpluses, debt write-off, subventions and active debts return) represent a significant way of fund collection (around 15%) within the sector. The annual growth of these incomes is stable.

When it comes to the market share of some BH broadcasters, three operator groups can be identified:

- Public broadcasting system - BHT1, RTRS and FTV - (A),
- several big operators available on a larger part of the territory - OBN, Hayat and Pink BH -(B) ,

- great number of regional and local (private and public) broadcasters

Additional requests by TV stations for coverage extending, i.e. that, in accordance with wishes, technical and programme possibilities they broadcast in a state territory, entity, region, canton etc., will be considered only after the total switch-off of analogue television, because only then, the necessary part of frequency resources will be available and free.

Hirschmann-Herfindal's index, total income and concentration rate were used as the indicators in this segment. TV stations which belong to the Public RTV System in 2006 made 65,8% of all market income, while three major private operators (Hayat, Pink and OBN) made 19,1% of income within the sector. Remaining 15.1% is shared between other broadcasters (more information about it in picture 13 and table 12).

Picture 13: *Market shares 2003-2006*

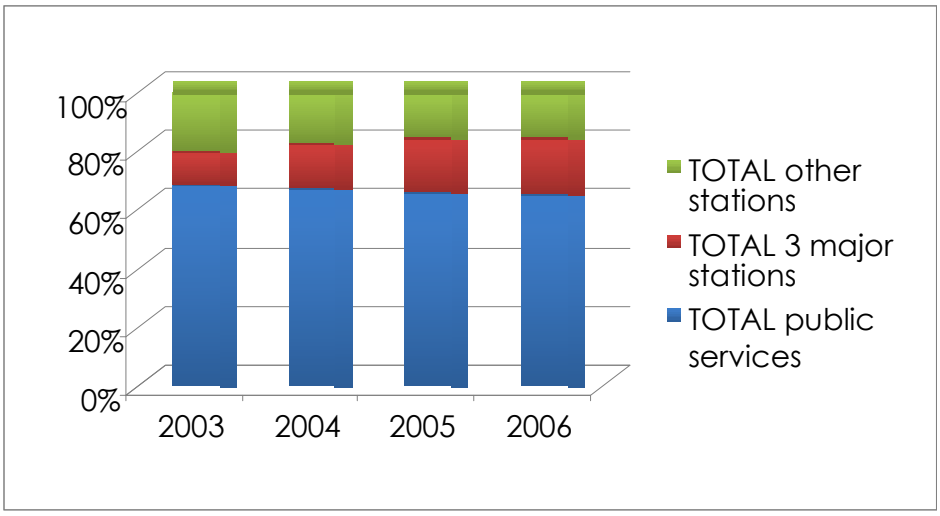


Table 12: *Market share from 2003-2006.*

	2003.	2004.	2005.	2006.
Total Public RTVS of BH (A) %	69	67.2	66.3	65.8
Total 3 private stations (B) %	11	15.6	18.5	19.1
Total others %	19.9	17.3	15.2	15.1

Source: CRA research 2007.

According to the given data, individual items within three groups of operators are slightly changed in the observed period: total market share of OBN, Pink and Hayat television are constantly growing, while Public RTV Service and local stations' share is decreasing in the last four years. Regardless of the change trend, this indicates the strong market domination of Public RTV System in BH.

Table 13: *Concentration rate and Hirschmann-Herfindal index*

	2003.	2004.	2005.	2006.
CRA	69,0	67,2	66,3	65,8
CR(A) + CR(B)	80,1	82,7	84,8	84,9
HHI	1987,19	1813,26	1878,16	

Source: CRA resource 2007.

If Hirschmann-Herfindahl's[16] index has value >1.800, it suggests high concentration on the market and the domination of few TV stations. In the observed case, HH index varies, but it has a constant value above 1.800 and we conclude that there is a high concentration on the BH broadcaster market. Such conclusion can be deduced by only looking at the concentration rate (CR)[17] where you can see that Public broadcasters are market dominators with over 60% of the share, and if you add three biggest commercial operators you get a concentration with over 80%.

[16] Hirschmann-Herfindahl index (HHI) represents a sum of a market share squares multiplied with 10 000.
[17] Concentration rate is a medium for estimating competition level in the market.

The system of public broadcasting has the biggest relative significance. Therefore, Public RTV System can be the initial holder and the promoter of the DTT introduction, which is the case in the surrounding countries. The first obstruction to this is the financial situation of the Public RTV System concerning that all members have (beside already mentioned income) significant losses in the previous years.

The problem of investments in the Public RTV System will be particularly expressed in the initial, i.e. the transition period of digital TV introduction, considering the fact that the public broadcasting system, due to its role as a public service, will need to provide simultaneous broadcasting in analogue and digital system on a wider territory of Bosnia and Herzegovina. Such situation will influence the increase in programme costs, while the broadcasting using two different technologies will demand new equipment, investment in human resources and at the same time usage of old capacities.

Besides, members of the Public RTV System will face significantly stronger competition when DTT is introduced, which can result with a fall of the viewer rating, and with that income fall as well. The Public RTV System of BH will hardly be able to take the holder role of the digital television introduction process without a significant financial support and a systematic approach to challenges set by digital surrounding.

In order to better understand the situation of the broadcasting market in Bosnia and Herzegovina, Communications Regulatory Agency and the DTT Forum have conducted a research during 2008 among communication licensees for terrestrial programme broadcasting.[18]. The research showed the willingness of the licence users to switch-over to digital terrestrial broadcasting, as well as their wish to use the advantages offered in the digital broadcasting.

These indicators, together with availability of frequency resources for the transition period, are giving Bosnia and Herzegovina good preconditions for the successful realization of this process.

[18] More information on communication licensees' research in the broadcasting sector for digital switch-over can be found in *ANNEX 3: Research analysis*.

D. RESEARCH ANALYSIS OF THE BROADCASTING SECTOR OF BH

In order to better understand the situation of the broadcasting market in Bosnia and Herzegovina, the Communications Regulatory Agency and the DTT Forum have conducted a research during 2008 among communication licensees for terrestrial programme broadcasting. The results are presented in tables 14 and 15.

Table 14: *Research results (2008.)*

	QUESTIONS	PUBLIC		PRIVATE		PUBLIC RTV SERVICES
		YES	**NO**	**YES**	**NO**	
1	Do you know that there is going to be a complete switch-off of analogue television in Bosnia and Herzegovina?	13	1	28	0	3
2	Do you know that terrestrial television is going to switch-over fully into the digital broadcasting?	13	1	28	0	3
3	Do you know that the DTT Forum of BH has been established with the task to develop the digital switch-over Strategy in BH?	12	2	28	0	BHT and FTV - YES; RTRS- NO
4	Do you own emission infrastructure (antenna pole) in some of the emission locations you use?	7	7	23	5	BHT - YES FTV - NO RTRS no answer
5	Do your analogue transmitters have the sign 'digital ready'?	2	13	7	21	BHT - YES, 41 transmitters Others-no answer
6	Is the studio technique you currently use completely analogue?	3	11	3	25	FTV - YES BHT and RTRS - NO
7	Do you plan to fully digitalize your studio equipment?	7	5	21	5	RTRS - 2010 BHT - 2015 FTV - using BHT infrastructure
8	Are you interested to participate in the pilot project 'Beginning of digital terrestrial broadcasting'?	8	6	21	7	BHT and FTV - YES RTRS – no answer

From table 14 we can draw some basic conclusions that relatively high number of stations is already introduced with the digitalization process and that they are already preparing for it. Certain TV stations already have digitalized technique and actively participate in this process.

Table 15: *Research results (2008.)*

	QUESTION	PUBLIC	PRIVATE	PUBLIC RTV SERVICES
1	Current coverage with analogue signal of your station is:			
	Local	8	11	
	Regional	5	8	
	More regions	1	5	FTV and RTRS
	BH		2	BHT
2	Once switched-over to digital broadcasting, name what type of coverage you are interested in:			
	(1)BH	2	13	BHT
	(2)Regional	5	13	FTV and RTRS
	(3)Local	7	5	
3	Estimate the year up to which your television would be ready to completely broadcast digital terrestrial television?			RTRS- no answer
	a) 2010	1	8	
	b) 2012	4	9	FTV
	c) 2014	2	6	BHT
	d) 2015	5	2	
	SAMPLE (NUMBER OF TV STATIONS)	14	28	3

Table 15 shows interesting data that most of the stations are local, and that they are all interested for national or at least regional coverage. Still, what worries is the data that yet seven stations think that they will not be ready for digital broadcasting before 2015, which represents a potential problem, or maybe only insufficient information on transition elements to digital broadcasting.

The willingness of the communication licensees to do the digital switch-over and their wish for using the advantages offered in the digital broadcasting is observed in the above mentioned. These indicators, together with the availability of frequency resources for the transition period, and especially after the switch-off of analogue terrestrial broadcasting, give Bosnia and Herzegovina good preconditions for successful realization of this process.

ANNEX 4: RELEVANT LAWS AND REGULATIONS

Law on Communications of BH– „BH Official Gazette“, No.31/03
Law on Competition of BH– „BH Official Gazette“, No.48/05
Law on Amendment of the Law on Competition – „BH Official Gazette“, No.76/07
Law on the Public Radio-Television System of BH – „BH Official Gazette“, No.78/05
Law on the Radio-Television of RS – „RS Official Gazette“, No. 82/05
Law on Procedures of Conclusion and Execution of International Agreements – „BH Official Gazette“, No. 29/00
Law on Consumers' Protection in Bosnia and Herzegovina- „BH Official Gazette“, No. 25/06
Law on Copyrights and Neighbouring Rights – „BH Official Gazette“, No. 07/02
The BH Ministers Council’s Decision on Adoption of the Broadcasting Sector Policy in BH– „BH Official Gazette“, No. 18/07
Law on the Public Service of RTV FBH, in the procedure of the Parliament of FBH

Rules and codes of the BH Communications Regulatory Agency:

Decision on the state contribution for using radiofrequency spectrum „BH Official Gazette“, No. 01/07, page 30.
Code on radio-television programme broadcast – „BH Official Gazette“, No. 31/03
Code on advertisement and sponsorship for radio and television – „BH Official Gazette“, No. 81/07
Rule number 01/1999 Definition and obligations of public broadcasting– „BH Official Gazette“, No. 32/04
Rule 33/2008 on license assignment and conditions for providing audiovisual media services – „BH Official Gazette“, No. 20/08
Rule 36/2008 on license assignment and conditions for distribution of radio and television programmes - „BH Official Gazette“, No.80/08

The specified legal and sub-legal acts present a good starting base which needs to be additionally completed in a way to get a quality legal framework for the introduction of digital broadcasting in Bosnia and Herzegovina.

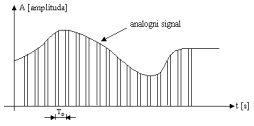
ANNEX 5: TERMINOLOGY AND ABBREVIATIONS

0-9

- **720p** - represents an HDTV standard. Number 720 represents horizontal lines of the shown resolution, while letter 'p' represents progressive scanning, i.e. all lines are plotted simultaneously, whereby you get a sharper picture of a better quality. Progressive scanning is the opposite of standard television which shows line after line;
- **1080i** – an HDTV standard, where number **1080** represents horizontal lines, and the mark 'i' signifies entwined picture presentation 'non-progressive scan'. This refers to the wide screen format 16:9 and the image resolution 1920x1080, or about 2.07 million pixels;
- **1080p** - similar to 1080i standard, but it represents a picture in progressive scanning, which means that the picture doesn't entwine as with 1080i, but all lines are shown at the same time. The picture of 1920x1080 resolution or about 2,07 million pixels is also created in that way.

A

- **Active Picture** - Active portion of the picture that is displayed on the TV screen (does not contain black stripes):
- **A/D** or **ADC (Analogue-to-Digital Conversion)** – The conversion of analogue signal to digital signal;
- **ADC Analogue (Digital Converter)** – a device that converts analogue signal into digital one;
- **Agency (CRA)** – Communications Regulatory Agency;
- **Allocation** – a term used in the planning of RF spectrum;
- **Allotment** – a term used in the planning of RF spectrum; geographical area which a certain channel was allocated;
- **Amplifier** – a device that increases the scope of the signal;

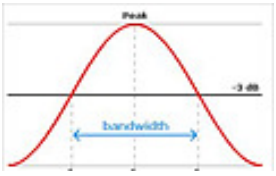


- **Analogue signal** – a signal that varies continually in amplitude or frequency. It is transmitted in the form of continuous waves;
- **Analogue television** - functions within frequency bands of VHF 174-230 MHz and UHF 470-860 MHz, image and sound are transmitted in analogue form in the same frequency band, whereas each station needs a separate frequency field-channel. In order to insure the coverage of a wider area, several different frequency channels are required. The efficiency of using a frequency spectrum is low, obstructions in transmission and reception are high, and the standard formats in practice are SD and PAL systems;
- **Antenna** - a device that serves for the collection and transmission of signals into the receiver. The reception of digital terrestrial television requires a UHF/VHF antenna directed towards the transmitters. TV antenna which will be used for the reception of digital signal is not different from the antenna that receives analogue signal;

- **API (Application Programming Interface)** – application programming surface or screen, provides various software approaches to the operating systems or software library;
- **ATSC (Advanced Television Systems Committee)** – a committee established in 1982 in the USA by the FCC; defines new standards (ATSC standards) for advanced television;
- **ATV (Advanced Television)** - advanced television established on the FCC foundations;

B

- **Back channel** - it represents a channel of a smaller frequency spectrum or capacity that serves to provide communication between the user and the central network. The user receives the television signal, and is, at the same time connected to the central network via another communication channel with a dial-up modem or a telephone line. The possibility of a back channel is enabled through interactive services that allow the user to receive data and give feedback, like order services, or send comments. It serves for communication between the user and a service provider;
- **Bandwidth** – a) The width of the frequency band of the signal determined by the lower and upper cut-off frequency (Hz); b) The quantity of information that can be sent through the network the greater the capacity of the connection, the easier it is to establish greater speed for a larger number of users. It is most often measured in BPS units (Bit Per Second);



- **Bit** (**Bi**nary digi**t**) - the smallest possible unit for information storage;
- **Bit bucket** – a term used for data that have been lost or destroyed;
- **Bit budget** – the total quantity of data (bits) that can be stored on one medium; For example, 650 MB can be stored on an optical disc (CD- Compact Disc);
- **Broadband** – the possibility of transmitting, carrying and receiving broadband frequency signals. It enables the transfer of voice, data and image over one medium;

C

- **Channel coding** - is a technique of decoding data and correcting errors of radio frequency channels. It is used for the protection of data during the transport stage and in the cases of extensive data flow;
- **Closed Caption** - titled text is an assistive technology, designed to enable access to television to persons with hearing disabilities, displaying the audio portion of the television signal as text on the television screen. At the beginning of July 1993, the Federal Communications Commission requested that all analogue television receivers with a screen of 13 inches or more, which are sold or manufactured in the USA, have an in-built decoder for the displaying of titled text. From July 1st,2002, the FCC also required that the digital television receivers has a possibility of displaying titled text;
- **Codec (Coder-decoder)** - a device that serves for the compression and decompression of data for audio and video flows. In telecommunications, *codec* is a device which codes and decodes a signal. The **Coder** converts the analogue

signal into digital (A/D), while the **decoder** converts the digital signal into analogue (D/A);

- **COFDM (Coded Orthogonal Frequency Division Multiplexing)** - is a modulation method that carries signals for digital transmission, protects data packages from errors and creates a protective relationship. It prevents multidirectional digital signal reception, error package, and interference;
- **Collision** – a "collision" or interference occurs during the simultaneous transmission of two or more signals via the same channel;
- **CD/CSMA/ (Collision Detect / Carrier Sense Multiple Access**) – a device that regulates access to an Ethernet network (a technology for local networks (LAN)). It checks the access to a channel and detects collisions. In the case of simultaneous broadcasting of signal, each transmitter waits for some time until the signal is successfully resent.

D

- **DAB (Digital Audio Broadcasting)** - it is a standard for the digital transmission of audio signal in the frequency range from 30 MHz to 3GHz It is intended for satellite, cable and terrestrial broadcasting;
- **Delta Frames** - delta frames or frame differences are created by temporary compression, and contain changes from the previous frame;
- **Digital dividend** - is a part of the frequency spectrum that has been opened up with the complete switch-over from analogue to digital broadcasting, and that may be used for the implementation of other services;
- **Digital added-value** – a new service made possible by digital television;
- **DTT (Digital Terrestrial Television) -** is the implementation of digital technology used in Europe for the broadcasting of digital television signals via a network of terrestrial transmitters. The basic sound and video signals are converted, modulated and coded into digital form and transmitted as such. Digital terrestrial television enables a greater number of channels, better image and sound. An internal or external antenna is required for the reception of digital signal. The coverage of a wider area requires a network which can work as a simple frequency network SFN or a multi-frequency network MFN;
- **DMA (Digital Media Adapter)** - digital multimedia surface (screen) is used to connect different external audio and video equipment. It has the possibility of transferring and displaying digital content to and from other electrical devices such as TV sets. The user can access and share music, pictures, etc. over the network;
- **DMB (Digital Multimedia Broadcasting)** - is the upgrade of standard digital audio broadcasting system. It is intended to send television and radio stations and data to mobile devices, such as mobile phones. They operate via terrestrial, satellite and mobile transmission;
- **Dolby Digital (AC3/Advanced Codec 3/Audio Codec 3)** – is an audio compression technology used in cinemas and home productions, creating complementary effects. It consists of six channels, five channels for speakers of normal frequency (20Hz-20,000Hz) and one channel for low-frequency effects (LFE). Dolby digital is the official standard for digital TV and HDTV;
- **DVB (Digital Video Broadcasting)** - is a package of internationally accepted standards for digital television which consists of more than 270 members with

the task of developing a system of digital television in Europe. The DVB systems are transmitted using different standards, including satellite, cable and terrestrial ones;

- **DVB-C (Digital Video Broadcasting – Cable)** – it is a standard adopted in 1994. The digital signal is transmitted through a cable distribution network;
- **DVB-H (Digital Video Broadcasting – Handheld)** - a handheld broadcasting. The standard has been adopted by the European Union. The signal is emitted via terrestrial network of transmitters, and the reception is achieved via mobile devices**;**
- **DVB-S (Digital Video Broadcasting – Satellite)** - the oldest DVB standard, which started to be transmitted via satellite in 1995.
- **DVB-T (Digital Video Broadcasting-Terrestrial)** - The newest and the most complicated system from the group of DVB standards. The digital signal is transmitted via a terrestrial network of transmitters;
- **DVB-T2** – the next generation of standards of digital terrestrial television DVB-T.

E

- **EBU (European Broadcasting Union)** - European association for broadcasting of radio and television signals. One of its main activities is the stipulating of recommendations for 625-line television systems;
- **ECC (Error Check and Correct)** – a code for error detection and correction. It is added to the data package in the communication channel or data block on the disk. The code detects small errors, and, if they are not too long, it can correct them.
- **EDH (Error Detection and Handling)** - Error detection and handling in case of a serial digital data transfer. It is included in digital equipment and, in case of an error; a signal is sent that activates an error indicator derived by an LED diode.
- **e-Evropa (eEurope 2005)** - The action plan for the development of an information society in Europe – eEurope 2005 has been adopted on June 2002 in Seville, with the aim of developing e-business, e-learning, and e-administration on the basis of secure broadband connection in 3.1.4;
- **Encryption** - Serves for the protection of digital information; here, a key code is required in order to come to an original message;
- **EDTV (Enhanced television/Extended Definition television)** - Extra digital services that have been added to SDTV or HDTV**;**
- **EPG (Electronic Programme Guide)** - it enables a search of television content with the possibility of conducting a search by content, time, channel, category, genre, etc**;**
- **Ethernet (IEEE standard 802.3)** - it is the most frequently used technology for local area networks (LAN) today. The standard was made in Xerox laboratories in the late 1970's.

F

- **FCC (Federal Communications Commission)** - An independent United States government agency, directly responsible to Congress; established in 1934, it

regulates inter-state and international communications by radio, television, wire (telegraph), cable, and satellite.

- **FEC (Forward Error Correction)** -A technique used in the digital signal transmission with the purpose of reducing the number of errors during broadcasting. The transmitter sends additional information (*error correction code*) that enables the detection and correction of errors within permitted limits, without requiring additional data from the transmitter. It is particularly used in situations where re-broadcasting is expensive and difficult to conduct.
- **Fibre Optics** - Thin glass optical fibre placed inside the cover, which transmits optical signals with very few losses;
- **Format Conversion** - The process of switch-over from one format of the digital signal to another digital signal format;
- **Frame** - frame, block. Refers to the transmission of bit data packages in certain codes and format. Often contains instructions and information concerning the addressing and detecting of errors. In the PAL system, one frame (block) has 652 lines;
- **FTA (Free-to-air**) - - Non-coded radio and television broadcasting available via adequate receivers;
- **Frequency** - The number of cycles occurring per second of an electromagnetic wave, expressed in Hertz (Hz);
- **Frequency spectrum** - Frequency spectrum is a range of frequencies divided into several bands;

G

- **GE06** (**GE06 Agreement, Geneva 2006.**) – A layout plan for radio frequencies for digital terrestrial broadcasting of radio and television programmes - Geneva 2006. It was adopted in the Regional Radio-communications Conference (RRC-06) of the International Telecommunication Union (ITU), held in June 2006 in Geneva. It is the basic component of the Geneva 2006 Regional Agreement. In line with the final provisions of this plan, the transition to digital terrestrial broadcasting in the VHF frequency band III and the UHF frequency bands IV and V is scheduled to take place by year 2015.
- **Grand Alliance** - a group from USA, established by the FCC in 1993 in order to make a specification for high definition digital television (HDTV). The proposed format for HDTV is ATSC. The alliance members are: AT&T, General Instrument Corporation, Massachusetts Institute of Technology, Philips Consumer Electronics, David Sarnoff Research Centre, Thomson Consumer Electronics, and Zenith Electronics Corporation.
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H

- **HDTV (High Definition television)** – it was presented to the public for the first time in Tokyo in 1975. Its inventor is T. Fujio. It refers to the broadcasting of a television signal with higher resolution than offered by traditional formats. The use of 1125, 1080 and 1035 lines is intended for interlaced scanning, while 1080 and 720 lines are for progressive scanning. It uses a 16:9 picture format in order to ensure compatibility with cinematographic production. Progressive scanning with 480 lines is also of a high-quality considering it gives a better resolution than interlaced scanning, but still doesn't belong to a high-quality television;

- **HD ready** – a standard proposed by the EICTA (European Information Communications and Consumer Electronics Technology Industry Associations). It qualifies equipment that receives and processes high definition television signals and defines minimal technical preconditions for the displaying of image;
-

I

- **ITU (International Telecommunications Union)** - the International Telecommunications Union, recognized by the UN, responsible for the standardization, allotment of radio frequency spectrum, and development, including the regulation of the use of the broadcasting spectrum and the coordination of state regulations;
- **IMT (International Mobile Telecommunications)**
- **Interframe coding** - In video compression, the coding of differences between frames. It enables a solid compression, for only a small number of pixels differ from one frame to another, so it is not necessary to transmit a complete frame. It depends completely on the frame content. The more similar the frame content, the smaller the difference;
-

J

- **Jitter** - jittering or oscillation in the transmission of signal or the displaying of images;
- **JRTVS BH (Public Radio-Television System of Bosnia and Herzegovina) –** the system of public broadcasting in BH consists of: BHRT (Radio-Television of BH), RTRS (Radio-Television of Republic of Srpska), RTFBH (Radio-Television of the Federation of BH), and the Corporation of Public RTV Services of BH (according to the Law on the Public RTV System of Bosnia and Herzegovina, 'BH Official Gazette', No. 78/05);

K

- **Key frame** - a complete frame that serves as a base for the delta frames;

L

- **LAN (Local Area Network)** - a type of local network that connects computers on a smaller area (floor or building);
-

M

- **MCPC (Multiple Channel per Carrier)** – several channels are combined into one signal before being modulated into a carrier that is transmitted from one location to another, or several distant ones. TDM technique (Time Division Multiplexing) is used for the broadcasting of more channels at the same time;
- **MFN (Multi Frequency Network)** - a network of transmitters on multiple frequencies.
- **MHP (Multimedia Home Platform)** - standard designed by the DVB project for interactive digital television. It enables the reception and execution of interactive Java- based applications on a TV set;
- **MPEG (Moving Pictures Experts Group) –** a group of experts (ISO/CCITT) involved in the defining of standards for the compression of moving pictures data. The first meeting of the group was held in Ottawa, Canada, in May 1988. There are currently about 350 members of this group. The main interests of the television industry are formats MPEG-1 and MPEG-2, while MPEG-4 format is

used for multiple purposes. With the integration of HDTV and MPEG-2 standards, MPEG-3 has become redundant;

- **MPEG-1** - the first MPEG video and audio standard, later used as a standard for Video CD and MP3 audio format;
- **MPEG-2** – the second of many standards, developed in 1994 by the Moving Pictures Expert Group (MPEG). It is presented as a video standard for the coding of sound and video with compression. It is used as a format of digital television signal broadcast via terrestrial, cable and satellite transmitters;
- **MPEG-4** – a standard for coding audio and video digital data. It has been presented in 1998 by the ISO/IEC Moving Picture Expert Group (MPEG) under the formal standard ISO/IEC 14496. It is intended for systems with low capacity and frequency range, such as mobile and video phones, but developed out of a more complex compression of algorithms and data restrictions. It is preferable for it to be used in the future for DVB in order to increase the transmission capacity;
- **MULTIPLEXOR (MUX or MULDEX)** – a telecommunication device that consolidates several input signal information into a single output signal. The multiplexer may combine several variable data bitrates into a constant signal bandwidth;
- **Multiplex operator** - a provider of standardised signal output services for digital radio broadcasting services, including, in addition to television and radio programmes, additional digital content services, electronic communication services and other associated identification signals and information. In some countries, the output to be used for the above mentioned services is regulated by means of permits. The broadcasting of all the above contents, other that radio and/or television programmes, is regulated in some countries by means of a special license for the broadcasting of additional contents.

N

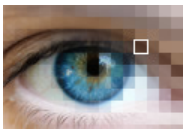
- **NTSC - (National Television Systems Committee)** - a board of experts in United States of America, which proposed national television norms adopted by the FCC in 1953.
- **NTSC (National Television Systems Committee)** - TV standard used in United States of America, Canada, Mexico and Japan (NTSC M standard – 525 lines, 60 Hz). Bandwidth in NTSC system is 4.2 MHz for luminance signal, as well as 1.3 and 0.4 MHz for I and Q component of chrominant signal;

O

- **Opacity** - transparency (sheerness) of frame that allows visibility behind the frame.
- **Optical disc** – a type of media which uses optical technology for the high-quality storing of data with the possibility of keeping large quantities of data on a small space;
- **Network operators** – the network operator transmits a multiplex signal via transmission network as a set of technical procedures, electronic communications and other devices for connecting the signal with the transmission medium.

P

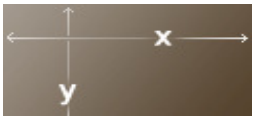
- **PAL (Phase Alternation Line)** - television standard used in the majority of European countries. PAL specifies 786 pixels per line, 625 lines per screen, 25 frames per second, with a primary power of 220 volts. It has been presented for the first time in 1961. It codes colours differently from NTSC.
- **Pixel** - pixel stands short for a picture element. Pixel is the smallest graphical element of an image, specific for bitmap images, unlike image of vector graphics. For it to be converted to digital form, an image must be stored as a sequel of bits (as it is the case with, for instance, digital cameras) for which they must be "translated" into several smaller parts, each of specific colour. These parts are called pixels and their quantity in certain image determines, among other things, the quality of image, but also directly influences the size of a database and its real dimensions (the width and height of the image);



- **PPV (Pay-per-view)** - is a service that allows the television viewers to watch special programmes by paying an additional price;
- **Programme content producers -** licence users whose professional activity is the production of programming audiovisual media contents.

R

- **RTV station (Radio and television station)** - includes any television or radio station that broadcasts programme in a territory of Bosnia and Herzegovina, which owns the broadcasting licence issued by the Agency;



- **Resolution** - resolution represents a number of pixels projected at x- and y-axis. It is stated as a product of two positive numbers (for instance, 1600x1200).
- **RRC-06** - the Regional conference on radio communications for the planning of digital terrestrial broadcasting service in parts of the regions 1 and 3, in the frequency bands 174-230 MHz and 470-862MHz (RRC-06) organized by the International Telecommunication Union and held in Geneva in 2006, when GE-06 Agreement was adopted.

S

- **Sampling** - the process of taking samples of an analogue signal in order to convert them into a structured digital signal.
- **ST61 (Stockholm 1961 Agreement)** – the Stockholm Agreement, signed in 1961, set the plan of distribution of radio frequencies for the purposes of analogue terrestrial broadcasting. It was valid until the Regional Agreement in Geneva 2006 (GE-06) was adopted.
- **SCPC (Single Channel Per Carrier)** - a satellite system that uses a special carrier for each channel, unlike the multiplex allocation of frequencies that unites many channels on a single carrier;
- **SDH (Synchronous Digital Hierarchy)** – it is an international standard for synchronized data transmission using optical cables. SDH equivalent in North America is SONET. Transport modules (STM-N) have transmission speed of N x 155,52 Mb/s, where N can be 1,4, 16 or 64;

- **SECAM (Sequential couleur avec mémoire)** – a TV broadcasting standard used in France, the Middle East, and Eastern Europe. The signals used to transmit colour are transmitted sequentially, a component of colour signal in each line (R-Y or B-Y). SECAM processes 625 lines, a maximum of 833 pixels per line, and 50 Hz picture frequency.
- **Set-top box** - a device connected to an analogue television set which converts digital signal into the analogue through an air antenna. The set-top box enables the television format to receive and decode digital broadcast. It is necessary for viewers who want to receive digital signals using their existing analogue television.

- **SFN (Single Frequency Network)** – it stands for the speed of digital signal flow. The unit of measure is baud (Bd) or symbols/second. Each symbol may present or carry one or more data bits.
- **SR (Symbol Rate)** - symbolizes digital signal flow speed. Measurement unit is Baud (Bd) or symbols/second. Each signal can represent or transmit one or more bit data;
- **Sub carrier -** a supplementary signal that carries additional information;
- **Superteletext** - An improved version of analogue teletext which enables interactive advertising, home shopping;

T

- **Transponder** - an automatic device that receives, amplifies, and retransmits the signal on a different frequency;
- **Transmitter** – a device that generates radio-waves and sends them to an antenna;
- **TS (Transport stream)** - a system for transporting;

U

- **UHF (Ultra High Frequency)** – a radio frequency spectrum between 300 MHz and 3GHz.
- **UMTS (Universal Mobile Telecommunications System)** – is the third generation of mobile telephony. In order to differ from similar network technology, the UMTS is sometimes marked as 3GSM, emphasizing the combination of the 3G technology and the GSM standard;
- **UTC (Coordinated Universal Time)** – an international name which replaced the GMT. Bosnia and Herzegovina is situated in the Central European time zone, UTC+1.

V

- **VHF (Very High Frequency)** – the radiofrequency spectrum between 30MHz and 300MHz;
- **Voice Channel** - the voice channel is used to carry audio data from the base station to the mobile phone and vice-versa;
- **VOD (Video on Demand)** - the broadcasting of signal on demand is an interactive video service where the viewer can order a video or a movie with the possibility of pausing it, rewinding it, etc.

W

- **Widescreen** - a screen that is wider than the standard screen (4:3). Widescreen has 16:9 aspect ratio. This size ratio is used in HDTV systems;
- **WiMAX (Worldwide Interoperability for Microwave Access)** – a telecommunication technology which enables various multimedia applications for users and wireless connection up to 50 km for fixed stations, and 5-15 km for mobile stations. Optical visibility with fixed station is not obligatory.

Z

- **Final documents RRC-06** – a document adopted in the RRC-06 which was ratified and published in the Official Gazette of Bosnia and Herzegovina – International Treaties, No. 9/08. This fully concluded the adoption procedure, which now obligates Bosnia and Herzegovina to act in compliance with the said Agreement (GE06);
- **ZITS** - a popular abbreviation for momentary errors in digital picture.