DIGITAL TERRESTRIAL TELEVISION BROADCASTING IMPLEMENTATION GUIDE

Permanent Consultative Committee II:
Radiocommunications including Broadcasting

Inter-American Telecommunication Commission
Organization of American States

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1. Introduction and Background

This Guide explains the benefits of digital terrestrial television (DTT) broadcasting and is intended to assist OAS member states in their efforts to plan for and implement DTT, by sharing the experiences of those countries that have already undertaken significant efforts in this area.

The implementation guide was prepared, according to the guidelines given in resolutions PCC.II/RES.11 (II-03) and PCC.II/RES.18 (IV-04), to help each administration implement whatever DTT system best fits its needs, taking into special account the social, economic, and industrial conditions of that country. It should be noted that this implementation guide does not mandate the use of any particular DTT standard.

1.1 Benefits of Digital Terrestrial Television (DTT) Broadcasting

In the Americas, terrestrial television broadcasting is one of the most ubiquitous and important mass communications media for delivering news, information, cultural programs, and entertainment free of charge. With a population of more than 800 million, there are currently over 400 million television sets in the Americas, and this number continues to grow. Broadcasts reach more than 90% of households in most countries.

Television is a vital part of the region's communications and information infrastructure. Over the next decade, the region's national television broadcasting systems are expected to be upgraded from analog to digital technology, keeping pace with the technological advances that are reshaping all types of global telecommunications. The transition to digital terrestrial television (DTT) broadcasting is a revolutionary change that will dramatically affect the future of free over-the-air television in the Americas. DTT technology allows each broadcaster to provide a huge wireless information pipeline into every home, delivering up to 20 million bits per second through each 6 MHz broadcast television channel. This capability not only permits the transmission of dramatically sharper images and CD-quality surround sound but also supports a much greater quantity and diversity of TV programs. And it makes possible an entire new array of information services, including interactive capabilities that will help all citizens of the Americas to take fuller advantage of the benefits of the information age, in a more uniform way.

With digital transmission, image and sound quality are improved through significantly enhanced picture and audio presentation capabilities and the elimination of snow, noise and ghost images. Broadcasters can provide one or sometimes two simultaneous programs of high-definition television (HDTV), delivering much sharper, clearer images with six times as much picture information as today's analog broadcasts. Or, depending on the type of programming, broadcasters can offer four to six or even more simultaneous programs of standard-definition television (SDTV) over their single 6 MHz channel. In addition, high-quality audio can be provided with advanced multi-channel sound technology.

In addition to these innovative video and audio services, broadcasters can offer a limitless variety of new information services that can offer new business opportunities, while also providing education, health care and other applications that address pressing social needs. Broadcasters will be able to experiment with a variety of innovative offerings and service packages, improving their ability to respond to the marketplace, while continuing to provide free program services and to meet their public-interest obligations. For example, broadcasters can use DTT to deliver tremendous amounts of Internet content to people who might never own a personal computer. Such applications can be delivered to new digital television sets, or to inexpensive converter boxes that allow the digital content to be displayed on existing analog TVs. In this manner, DTT represents an immediate and effective means of promoting social inclusion throughout the region and bridging the "digital divide," so that all socio-economic segments of society can reap the benefits of this fruitful new technology.

Thus, the conversion to digital television technology represents a quantum improvement in the technical *quality* of television, plus a quantum improvement in the *quantity* of television programming available,

plus a revolutionary improvement in the *information infrastructure* of the nations that implement the technology. In addition, because DTT makes much more efficient use of the electromagnetic spectrum than analog TV broadcasting, at the end of the transition governments will be able to recapture and reallocate significant amounts of spectrum that can support additional innovative wireless services that will themselves address important societal needs and be engines of economic growth for decades to come.

1.2 CITEL's DTT Broadcasting Implementation Guide

Over the past 18 years, a great amount of effort has been expended throughout the region by thousands of engineers, business people and government policy makers toward the successful development and deployment of DTT technology. DTT broadcasting was first developed in North America, and is widely deployed in the United States using the ATSC Standard. ATSC DTT broadcasts are also on the air in the largest cities in Canada, and are expected to begin in Mexico's largest cities and in the U.S. border region no later than 2006. Brazil has adopted DTT policies and expects to define a regulatory and technical framework in the next few months. Many other countries in the region, including Chile, Colombia, Venezuela, Ecuador, Peru, Jamaica, the Bahamas and the Dominican Republic are also evaluating plans and policies for the introduction of DTT broadcasting.

CITEL itself has been actively involved since before 2001 to assist the OAS member states in capturing the benefits of this fruitful technology. In October 2003, CITEL's PCC.II adopted a resolution regarding DTV, which resolved:

1. To encourage Member States to adopt and implement a common Terrestrial Digital Television broadcasting standard.
2. To work together to encourage the successful transition from analogue to digital terrestrial television technology as rapidly as possible, recognizing the economic and social conditions in individual countries.
3. To continue to assist Member States in expediting the implementation of a common hemispheric standard for Terrestrial Digital Television broadcasting.

While this resolution recognized the value of using a common DTT standard throughout the hemisphere and the importance of implementing DTT as rapidly as possible it did not mandate adoption of any standard.

This resolution along with subsequent resolutions related to the development of this Guide,also recognized the fact that different economic and social conditions in individual countries would necessarily affect the nature and timing of an individual nation's transition to digital television. The resolution also suggested the important role that CITEL could play in assisting the OAS member states with their individual transitions. Building on this resolution and on extensive discussions within CITEL, in December 2004 CITEL's PCC.II adopted a further resolution laying out a work plan that centered on the completion of this DTT Implementation Guide, which was intended to allow the OAS member states to learn from each other's experiences in implementing DTT broadcasting. In assembling these experiences, it is explicitly recognized that different approaches and different policies may well be appropriate for different nations. Nevertheless, the variety of experiences that are already available should be very valuable to those nations that are just now beginning to plan for their transitions to DTT.

Accordingly, this Guide focuses first on the national goals that each country might want to consider for its transition to DTT, reviewing the approaches taken by those countries that have addressed these issues to date. The Guide then focuses on the actual policies that each country has adopted, and the reasons why they were adopted. The Guide next focuses on the important topic of spectrum planning for DTT broadcasting, including the principles that various countries have followed in developing their own spectrum plans and policies. Next, the Guide summarizes the national experiences of those countries that have implemented DTT, or are poised to implement DTT, or who have conducted extensive studies of

their DTT options. The final section highlights examples of successful DTT services and applications, along with cost-effective approaches for implementing the technology.

An appendix to the Guide provides an extensive collection of ATSC standards, recommended practices and implementation guidelines to support DTT broadcasting. This collection of electronic documents is intended to collect in one place all of the necessary technical information and supporting documentation for implementing DTT using the ATSC family of standards. In the future, if an OAS member country adopts a different DTT standard, technical and operational information for that standard will also be included as an appendix.

This Guide is intended to be a living document, updated from time to time to include additional information and especially the experiences of other OAS member states as they embark upon the introduction of DTT broadcasting. In this manner it is hoped that the Guide provides a useful tool to the countries of the region in their efforts to bring the tremendous benefits of DTT broadcasting to their people..

2. Goals for DTT Broadcasting

The first section of this chapter summarizes the broad goals that can be achieved with DTT broadcasting, while the second section reviews the specific national goals pursued by the countries that have already addressed these issues.

2.1 Broad Goals of DTT Broadcasting

This section is intended to summarize the extensive range of capabilities of DTT broadcasting technology and the broad goals that can be achieved through its application and is neither related to the specificities of the proposed standards nor strictly related to national experiences on the implementation of this technology.

2.1.1 Improved Technical Quality

Digital transmission itself offers a significant improvement in the technical quality of images and associated sound, e.g., by eliminating snow and ghosts. In addition, HDTV offers six times as much picture information, offering much sharper, clear images, which combined with a widescreen display format and six channels of CD-quality surround sound, represents a quantum improvement in the technical quality of broadcast television services. Rapid decreases in the prices of HDTV displays and receivers have contributed to tremendous consumer interest in HDTV products and services. According to one recent report, almost 30 million HDTV sets will be in viewers' homes by the end of 2005, and that number will reach more than 106 million by 2010.

2.1.2 Increased Quantity and Variety of Services

DTT technology also enables the offering of several simultaneous services of SDTV quality, increasing the quantity and variety of services provided to their viewers. For example, noncommercial broadcasters can use this capability to provide multiple educational programs to schools and homes. With system configurations designed to maximize the bit rate available in a DTT broadcast channel, broadcasters can provide various combinations of such services, for example, one HDTV, one SDTV and one web page.

2.1.3 New Information Services and Social Inclusion

DTT broadcasting enables a limitless variety of new information services, including interactive services. Information services may be integrated with video programs or independent of such programs. A great deal of interactivity in such applications can be provided simply by downloading substantial information from which viewers can choose. Interactivity can be increased further through the use of a return channel through which viewers can request specific content from the broadcaster. Multiple technologies exist to implement the return channel, including, but not limited to, fixed and mobile networks, broadband connections or even a terrestrial return channel if additional spectrum is available.

The use of DTT to provide information services, including interactive services, represents an important opportunity to promote social inclusion, i.e., to provide education, health care, and other important social services to viewers of all socio-economic segments, including citizens who may never own a personal computer.

2.1.4 Service to Hand-Held Receivers and Mobile Services

In addition to reception by fixed receivers with either external or indoor antennas, DTT broadcasting presents the possibility of delivering programs and applications to hand-held devices, characterized by relatively small displays and the necessity of reduced power consumption. Such devices, typically mobile

phones and PDAs, can be equipped with DTT demodulators in order to enable reception of broadcast content anytime and anywhere. As such, these hand-held devices can be considered as a point of convergence between the telecommunication and broadcasting networks. In some cases, services provided to hand-held devices may also be provided independently of the digital terrestrial television service, using additional spectrum.

DTT broadcasting also provides the capability for reception by moving receivers, i.e., in trains, buses or automobiles. Mobility does not necessarily involve low battery consumption and typically requires medium to large displays and therefore should not be confused with services provided to handheld devices. Mobile services are characterized by reception in fast-moving vehicles, which presents substantial technical challenges for the reliable reception of the signal.

Both mobile reception and service to handheld devices require reductions in the bit rate that can be delivered in a terrestrial channel. Thus, depending on the amount of mobile or hand held services provided and the robustness of such transmissions, the provision of such services could detract from the quality and/or quantity of services that could be provided to fixed and portable DTT receivers.

2.1.5 Spectrum Efficiency and Recovery

DTT broadcasting makes much more efficient use of the electromagnetic spectrum than analog broadcasting, and the conversion to digital broadcasting offers the opportunity to recapture and reuse valuable spectrum for other innovative wireless services. For some countries, this opportunity will be a driving force in the effort to hasten the transition to digital broadcasting.

2.1.6 Industrial Development and Economic Growth

The transition to DTT broadcasting represents significant opportunities to promote industrial development, job creation and economic growth, depending on the individual characteristics of each country and the policy decisions it adopts.

2.1.7 Other Goals

A timely and well-planned introduction of DTT broadcasting can be a major factor in a country's technological, economic, and social development. To this end, the following goals should also be considered:

- Adaptability to socio-economic conditions
- Allowance for gradual implementation, minimizing social risks and costs
- Taking advantage of economies of scale
- Protect consumers against premature obsolescence of their DTT products
- Provision of new applications that facilitate access to culture, information, and entertainment
- Promotion of content production and new business opportunities
- Development of solutions that support cultural and educational development
- Promotion of social inclusion, cultural diversity of the country, and the official language through access to digital technology, aiming at democratizing the information

In considering all of these goals, it is of utmost importance that each country establish DTT policies that promote appropriate investments and support business models that will be successful, recognizing the unique economic, social and business conditions that prevail.

2.2 National Goals

2.2.1 Argentina

Television is important to humankind as a medium for the dissemination of information, culture, and entertainment. Since its inception, television has been a constantly developing service. However, for viewers, the introduction of digital technology constitutes a major change, one greater still than the advent of color television.

Digital terrestrial television is a wonderful new communications platform based on digital signal transmission technology. The scale and implications of this change point to a need to adopt solutions that affords optimal benefit to society.

Implementation

Proper introduction of digital terrestrial television is a major factor in technological, economic, and social development. To that end, it should be based on the following premises:

- Promotion of national industrial and technological development;
- Fostering strengthening of the value chain and business generation;
- Adaptability to socioeconomic conditions;
- Allowance for gradual implementation, minimizing social risks and costs;
- Use of the existing universe of television sets;
- Provision of associated new applications that facilitate access to culture, information, and entertainment.

The wide range of technological, socioeconomic, and regulatory policy issues to be considered means that a methodological effort must be made, taking a multidisciplinary approach - in terms of concept, in three stages:

- A first stage, whose objectives are: (a) to define a digital terrestrial television "system"; (b) select the technological platform for the "system"; and (c) establish the timeframe for and means of transitioning from analog to digital television;
- A second stage, in which the relevant technologies and services for the "system" are developed;
- A third stage, in which the "system" is implemented.

In this conceptual framework, the term "system" includes service models, business models, technological platform alternatives, etc.

In keeping with the premises established for introduction of digital terrestrial television, in the first stage, it is essential to coordinate research intended to promote national technological development that affords the following benefits:

- Reduction of technological dependence and substitution of hardware and software imports;
- Strengthening national industry, increasing its potential;
- Promotion of content production and new business opportunities;
- Enhanced capability to link and negotiate with international suppliers;
- Development of solutions that provide support to culture and education.

To that end, alternative service and business models and technological platforms appropriate to national needs must be developed, risks and opportunities associated with each identified and classified, and their technical, economic, and legal feasibility evaluated.

In the second stage, regulatory frameworks in force will be amended, if so required, so as to establish clear rules, taking account of the service's growth and expansion, promoting investment, and generating demand, thereby promoting local and regional development with social inclusion.

Lastly, based on the foregoing, in the third stage, the digital terrestrial television "system" will be implemented.

Conclusion
The focal point of the strategy set out by the Administration of Argentina for a digital terrestrial television system is to afford its scientific and technological sector an opportunity to develop solutions that include development of the sector's industrial complexes and small, medium, and large-scale enterprise, addressing the need to create productive employment and contributing to greater social inclusion.

2.2.2 Brazil

When the new Brazilian federal government assumed office in 2003, the policy for the deployment of terrestrial Digital TV was reviewed and became a government program, with the focus on the importance in the use of this communication medium as a platform for social inclusion and the reduction of inequality regarding access to information, education, and income in Brazil.

Ten (10) Ministries are directly involved in this program, under the coordination of the Ministry of Communications.

Such a position, which is necessary from the human and social point of view, may be translated into "technology at the service of people", requires the inclusion of socio-economic and policy-regulatory factors, besides the technological aspects, which require multidisciplinary view.

The first phase in the deployment of the Terrestrial Digital TV System in Brazil, due to be accomplished in the first half of the year 2005, is defined by the Decree nº 4901, of November 2003, with the following objectives:

- define a reference model for the Brazilian Digital Television system;
- propose the digital television standard to be adopted in Brazil;
- propose the digital television service development model;
- propose timeframe and model for the transition from analog to digital system.

The second phase should continue the development of technologies and services considered significant and selected within the Reference Model. It depends mostly on the definitions in the standard and on the business model chosen in the first phase. In this phase, among other initiatives, the regulation marks will have to be adapted.

Finally, the third phase encompasses the deployment of technologies and services developed. Brazilian government has promoted the adoption of a Terrestrial Digital TV System that respects the social particularities and conditions, providing the opportunity to develop regional solutions, which are mostly suitable, overcoming the urgency of the decision.

Hereafter we present the description of the actions of the Brazilian government and the institutional aspects considered in the Brazilian Terrestrial Digital TV System, the methodological approach applied in the analysis and planning of this system, as well as the achievements at that moment, by the Brazilian government regarding the definitions of the system will be presented next.

Actions, guidelines, and organization of the Brazilian Government to define and deploy the Terrestrial Digital TV System

The Brazilian Administration considers that it is necessary to offer the opportunity for the development of regional solutions that prove to be more adapted to the conditions and particularities mentioned above.

According to the Exposition of Reasons of the Decree nº 4901, Brazil has one of the largest free-to-air TV systems in the world, containing as an outstanding feature the free access to all users. Around 90% of Brazilian homes have a television set, which represents a total of 57 million TV sets. From this total, approximately 90% receive exclusively free-to-air TV signals. The free-to-air television is an important source of information and entertainment for the Brazilian population, wielding a great influence on the national culture and in the citizenship. Due to its importance, the adoption of a terrestrial digital TV system will not be received as a simple technological evolution, but as a new communication platform, whose impacts on the society are still being outlined.

However, the planning and analysis process of the Brazilian system should look for appropriate solutions within the social and economic reality of the country, providing competencies and leveraging the national electronic complex. Therefore, among other factors, the following objectives for the Brazilian Terrestrial Digital TV System can be emphasized:

- To promote social inclusion, cultural diversity of the country, and the official language through the access to digital technology, aiming at democratizing the information.
- To make possible the creation of a universal network for distance learning.
- To plan an analog to digital television transition process that enables the gradual migration of users, with costs compatible with their income.
- To establish digital TV business actions and models suitable for the country's business and economic reality.

In order to perform a detailed analysis of the technological, regulatory, social, industrial, economic, and international competition aspects that support a decision with a holistic vision of the deployment of the Digital TV in Brazil, the Government has decided to involve several sectors of the society, thus creating two Committees (Development Committee and Consultant Committee) and one Steering Group.

The Development Committee officially assumed office on March 10, 2004. It is presided by the Ministry of Communications and composed by Federal Government bodies. It has the duty of establishing the strategic guidelines for the deployment of the digital technology in the sound and image broadcasting service, and set basic guidelines to establish the business models for digital TV, among other aspects.

The Consultant Committee, officially established by the Development Committee on May 20, 2004, is made by representatives from the organized civil society linked to the Digital TV subject, and has the task of proposing guidelines and actions for the Development Committee regarding the Terrestrial Digital TV System.

The Steering Group, in which Anatel (Telecommunications regulatory agency) is part, is responsible for carrying out the actions regarding the administrative and operational management, aimed at meeting the strategies and guidelines established by the Development Committee. The Steering group assumed office on March 10, 2004, and since, it has held weekly meetings to follow the progress of the Terrestrial Digital TV System project.

This organizational and representative structure collaborates so that all aspects of the deployment of the Terrestrial Digital TV are identified and duly considered in the system definition phase, i.e. in the elaboration of the Reference Model.

In what concerns the project execution during the analysis and decision phase, it was divided in various sub-projects that will be performed by several research institutions, coordinated by administrative and technical support entities subordinated to the Steering Group.

These researches are financed by the Fund for Telecommunications Technology Development – FUNTTEL – coordinated by the Ministry of Communications. It is estimated that the first phase of the program will consume R$65 million. From this amount, R$15 million have been assigned to CPqD, which in January 2004, created the Digital TV Corporate Department, formed by 36 researchers, completely dedicated to the Terrestrial Digital TV System project. Eight-six research institutes have already joined in this project.

The Steering Group consolidated the guidelines for the public bidding and selection of the research institutions that will take part of the elaboration of the Reference Model. The group has also discussed crucial aspects for the deployment of the Digital TV system as an intellectual property, the use of a freeware, the creation of regional TV programming, among others.

The hiring of the classified research institutions should take place in August of the current year, and the results will be validated until the end of the year.

The research results are part of a set of gathering data for the analysis of the national ability to develop systems, sub-systems, services, and applications crucial to the required usage for Terrestrial Digital TV. Therefore, concept tests for solutions regarding the various layers that compose a Digital TV system are being requested. These concept tests, together with the technical, economic, and social feasibility analysis will make part of the various options that shall compose the Reference Model. The technologies and services that will be developed for the Terrestrial Digital TV System will be selected taking into consideration the advantages and risks associated to each solution proposed by the Brazilian science and technology in comparison with the existing international standards.

This data gathering set will go with the elaboration of scenarios aiming at drawing a map of conditions of the environment in which the object of study is inserted, including the demand feature, allowing a consistent analysis of risks and opportunities of each proposal.

The set of information obtained through this data gathering and the initial analysis constitutes the input parameter of the second stage of the analysis and decision phase, which is composed by:

- The formulation of business/services models alternatives and technological systems alternatives suitable to the Brazilian conditions for the exploration and deployment of Digital TV.
- The elaboration of guidelines for the review of laws and regulation that act upon television, broadcasting, and telecommunications services, if changes in the current legal framework are identified.
- The elaboration of guidelines to conduct specific policies that promote the diffusion of terrestrial Digital TV in Brazil, including cultural and industrial policies concerning the production chain of Digital TV, and the consumption and production of interactive digital content, which promote the regional development and social inclusion.

The alternative of models, technologies and associated services, policy-regulatory guidelines, long-term macro-economic scenarios, Digital TV value chain detailing, and the usage mapping form the basis that allows carrying out the last phase of decision and analysis, which comprises:

- The validation of technical, economic, and judicial feasibility of the considered alternatives.

- The identification and classification of risks and opportunities associated to the alternatives and guidelines, in which the final result is the proposal of a Reference Model for Digital TV in Brazil.
- Finally, based on the services and technology alternatives, selected in the Reference Model, the development phase of the Terrestrial Digital TV System will initiate.

Conclusion

The current strategy policy of the Brazilian government towards the terrestrial digital TV system bestows a privilege on the opportunity for the scientific and technological community to develop more practical solutions regarding the industrial, social economic, and cultural reality. Besides this opportunity, the government increases the debate on the deployment of terrestrial Digital TV with the effective participation of more significant sectors of the society, by creating a taskforce with the seal of the federal government that, in addition to provide the guidelines, it acts in an efficient way in order to make these guideline to become a reality. To sum up, the respective Development, the Consultant committees, and the Steering Group of the project will be in operation, as well as the release of resources in order to perform the research work, and the method duly designed for the several accredited research institutions to perform in an integrated way in the proposition of the technological and services solutions regarding the Terrestrial Digital TV System to be deployed in Brazil.

2.2.3 Canada

(To be completed)

2.2.4 Colombia

Introduction

Television is a public service with great influence on society, as it educates, entertains, and informs. We are now witnessing a global transformation of this medium where digital television is revolutionizing the production area, as it makes possible to transmit video signals of cinematic quality and audio signals of compact disc quality. It can also transmit a wide array of additional information to end users.

To the extent that it facilitates access to information and communication technologies (ICTs), digital television is also a tool for bridging the digital divide, as it makes it possible to access the world's large information markets, interact with television, and use television devices to connect with different service providers.

Digitization of television enhances the quality of video and sound signals; makes better use of the spectrum, increasing the number of channels that can be broadcast; optimizes operators' broadcasting and reception costs; provides access to a range of new services (associated with independent television transmissions, such as interactive services); and makes available portable and mobile television reception.

Implementation of DTT in COLOMBIA

An objective of the National Television Commission (CNTV), as Colombia's lead public television entity, is to spearhead DTT implementation in Colombia, in coordination with the sector's other players. This entity has responsibility for the stewardship of and reserving of frequency, on behalf of the state, for public television, formulating and implementing state plans and programs for television, and interceding in, managing, and controlling the use of the electromagnetic spectrum used to provide this service, with the aim of ensuring pluralism of information, competition, and efficient television provision, and of preventing monopolistic practices in the operation and exploitation of television.

Since formulation of the 2004-2007 Television Development Plan, the Commission has proposed to establish interagency consultation groups to study, examine, and propose the transmission standard to be selected by the country, production policies for programs in digital format, and the coverages of the digital television system.

As a result, all players require a planning document containing DTT implementation guidelines, which sets out the objectives of the plan, proposals to achieve them, and an implementation method. Said document must permit the different players flexibility in exploiting the service openly (high definition digital television, broadcasting of multiple signals in standard digital format, and value added services, among others) and in accordance with market conditions.

As three different digital television broadcasting systems are available, and as it is important to take decisions in that connection, CNTV has participated in international seminars on the topic and consulted with experts on the DVB and ATSC systems of the United States, Argentina, and Brazil to review the status of digital television in Latin American and of its implementation in Colombia.

The Colombian Association of Engineers (ACIEM) has also recommended that a critical path be designed so that the country is able to gain more in-depth knowledge of digital formats, conduct demonstrations and propagation tests under different operating situations, review and compare selection criteria for the system most appropriate to the country's needs, evaluate financial requirements for operators and investors and, determine, inter alia, the transition period for implementation of the format selected.

Actions and guidelines of the Colombian state for DTT definition and implementation

In light of the foregoing, among the strategies that must be implemented to develop the "*Plan for Implementation of Digital Television in Colombia*" are:

1. Formulation of technological migration policies, contained in a transition plan, that take account of the conditions of current television operators

With the advent of digital terrestrial television, current national, regional, and local open television operators and concession holders, cable television and direct-to-home satellite television operators, and concessionaires of spaces, television broadcasting companies, content producers, advertising agencies, equipment and technology providers, television set producers, and value added service providers, among others, will be affected, and the market will adjust to the new conditions.

It should be noted that growing competition among the different television technologies to achieve larger advertising market share will lead to further advertising fragmentation and television supply segmentation, which will grow more acute with the greater flexibility that digital technology affords. The market will be more open and competitive and operators will find themselves in an environment of convergence of audiovisual media, information technology, and telecommunications.

For digital television operators, new opportunities are emerging to establish new interactivity-based business models and to create new channels, which will be, for a television model based on advertising income, such as Colombia's, mechanisms to promote sector growth. Companies will have more communication channels to reach consumers, which will spur the advertising market through better opportunities to target messages.

The transition plan must define the technical standard, after an evaluation has been made of the costs and benefits of adopting the different alternatives; the process of migrating from analog to digital television, and coexistence of the two; compatibility of platforms (terrestrial, cable, and satellite), and the costs of conversion to digital technology and of programming, among others. Although in the initial phase, operators will have to incur the cost of modernizing their equipment, transmission of programs using

digital technology is less costly as, among other things, it makes more efficient use of transmitter emission power.

2. Ensuring everyone of universal access to television services and, consequently, to information and communication technologies

In Colombia today, analog terrestrial television broadcasting is one of the most widely-known and important communication media, with coverage of over 90%. An average of 83% of homes have at least one television set, and 84.5% of the public customarily watches television. Therefore, updating today's technological systems from analog to digital, maintaining the national network structure, will have major impact on households, as it will enable them to access a vast wireless source of information, and television sets will become multimedia terminals.

According to the latest estimates of the Telecommunication Regulatory Commission (CRT) of Colombia, as of December 2004, Internet penetration was 8.4%, a figure that remains low as compared to that of other, more developed Latin American countries. Therefore, the introduction of digital television is an opportunity to provide access to Internet content to those without personal computers and to continue disseminating information published by the state on its various portals,[1] which strengthens democracy and national identity and contributes to social equity.

The process would be implemented by means of new digital television equipment or low-cost converter boxes that enable digital content to be viewed on existing analog televisions. However, socioeconomic evaluations must be conducted of the ability of households to pay for these and the trends in that regard, options available to promote the acquisition of digital television sets, and media consumption trends in Colombia.

Digital technology will also substantially enhance television's technical quality and expand the supply of content, so that there will be additional opportunities for different societal interests to be represented in the new medium through the implementation of thematic channels meeting specific needs not met by general content television. Accordingly, pluralism of information will become more visible, which is one of the country's public television objectives. It will also promote access to culture, information, and entertainment for all, reducing the digital divide. Another important aspect is that it will make it possible to develop information and communication technology applications in strategic sectors such as education, health, and e-business.

Implementation of a single technical standard might be very useful for users, as they would be in a position to access, with a single piece of equipment, not only all operators' television signals but also the available interactive services.

3. Promotion of industries involved in the DTT value added chain and associated with telecommunication service convergence

The series of industries or branches of economic activity that converge in the television business may today be categorized, in general, as those involved in production (content production industry) and those involved in signal transmission or broadcasting. There is also an electronics industry that provides equipment for signal production and transmission (terrestrial, cable, or satellite broadcasting systems).

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[1] In 2004, in the evaluation of Internet content, Colombia ranked 23rd in the world and 4th in Latin America, mainly because of the amount and quality of the information published by the state.

With the advent of digital television, the industry's value added chain will become more complex, and will comprise, inter alia, the following players:

i. Producers of content (both of analog television and of interactive products for digital television);

ii. Manufacturers of receiving equipment (equipment external to analog television receivers, digital equipment, and integrated analog/digital tuners);

iii. Manufacturers of transmission equipment;

iv. Developers of applications (such as integrated browsers, Electronic Programming Guides, and others that make it possible to interact with programming or to access new services such as telebanking, personalized information, on-line purchasing, advanced teletext, e-mail, interactive games, menu-driven television, etc.);

v. Providers of multiplex and interactive services, with responsibility for packaging in one frequency channel digital television programs, data, and interactive content, and for handling the users' return product. Their work would resemble that of today's Internet service providers;

vi. Advertising agencies and media centrals;

vii. Culture industry producers (movies, books, radio, press);

viii. Current open and closed television concession holders;

ix. Advertisers

Availing itself of the new business opportunities afforded by digital television, the Colombian state will seek to design new support mechanisms for national industry linked to the sector in order to enhance its productivity and competitiveness at the international level.[2]

Conclusions

In view of analog terrestrial television's penetration and importance in Colombia, the introduction of DTT will have major impact on the public to the extent that it enables it to access new services and applications and contributes to providing mass access to the use of ICTs. In addition, the industry's value added chain will be modified and the regulatory framework and spectrum administration will have to be adjusted to the new conditions. Accordingly, the Colombian state, with CNTV's leadership, will continue to define and implement the "*Plan for Implementation of Digital Television in Colombia,*" for which it will develop in detail each of the above-mentioned strategies, determining the studies and technical and socioeconomic evaluations required as some of the activities for which the Plan provides.

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[2] It should be noted that the software industry and related activities expanded substantially in the 1990s and, for that reason, plans should contemplate more than meeting national demand, profiting from the industry's competitive advantages. In addition, for several years, Colombian television productions have been exported with great success, implying that national industry may be able to continue to profit from its competitive advantages while adapting to digital format.

2.2.5 Mexico

a. Digital inclusion: To generate conditions for digital television receivers and decoders to become increasingly affordable to Mexican consumers so that society may benefit from the advantages of this technology.

b. Quality: To offer society a better television alternative with images and sound of greater fidelity and/or resolution than those now provided by analog television.

c. Strengthening of activity: To promote the healthy development of television station licensees and permit holders and related activities by incorporating terms and conditions that promote technical and legal certainty for the transition to DTT.

d. New services: To encourage the incorporation and development of new digital services, both associated with and additional to DTT, without this affecting the quality of the principal service.

e. Optimization of spectrum use: To make rational and planned use of the radio spectrum for the coexistence of analog and digital signals during the transition to DTT.

2.2.6 United States of America

The ATSC Digital Television (DTV) Standard that is now approaching full implementation in the United States is a powerful technology that is transforming the nature of broadcast television service. This new broadcast transmission standard provides broadcasters with many new capabilities to serve the public, such as HDTV and standard resolution pictures, multicasting, data delivery, interactive communication, robust reception modes, and other features. These capabilities provide broadcasters the technical flexibility and options to compete with other digital media such as cable and direct broadcast satellite services. The ATSC DTV standard was developed through a lengthy initial specification process that began in 1987 and its evolution is continuing today, due to the flexibility for extending the digital system to include new capabilities as technology continues to develop. Coincident with the development of the transmission technology, the U.S. Government, though actions by its Federal Communications Commission (FCC) and legislation by the U.S. Congress, has developed public policies under which digital television is being implemented. This section presents an overview of the approach taken in the U.S. for developing and implementing DTV service using the ATSC family of DTV standards.

Currently, the U.S. Government is implementing broadcast DTV service as a replacement technology for the existing analog National Television System Committee (NTSC) technology that has been used for transmission of broadcast television service in the United States since the late 1940s. Under this policy approach, all eligible existing television stations were provided a second channel to be used for DTV service during a transition period from the analog to digital operation. This transition period, which began in 1998, is intended to facilitate an orderly change to the digital television technology while taking account of consumer investments in analog television sets. At the end of this transition period, TV stations will cease analog transmissions so that all broadcast television service will then be in the digital format. The FCC will also recover one of each TV station's two channels at this time.[3] Because operation with the ATSC standard is very spectrum efficient, it is possible for all of the existing TV stations to operate in a much smaller amount of spectrum bandwidth, thereby allowing a portion of the

[3] At this time the FCC is in the process of identifying the channels that broadcasters will use for operation after the transition, and working with individual broadcast stations to ensure that they complete the construction of their DTV facilities and begin operation.

existing TV channels 2-69 to be recovered for new uses. The U.S. Government plan is for all DTV stations to operate on channels 2-51 (the DTV core spectrum) after the transition ends and to recover channels 52-69 (698 MHz to 806 MHz) for new uses.[4]

In developing policies for this change, the FCC adhered to four goals for TV service: 1) to preserve a free, universal broadcasting service; 2) to foster an expeditious and orderly transition to digital television while taking account of consumer investment in NTSC television sets; 3) to managing the spectrum to permit the recovery of contiguous blocks of spectrum, so as to promote spectrum efficiency and to allow the public the full benefit of its spectrum; and 4) to ensure that the spectrum (both DTV channels and recovered channels) will be used in a manner that best serves the public interest. In the context of introducing a DTV standard, the FCC enumerated the following goals: 1) to ensure that all affected parties have sufficient confidence and certainty in order to promote the smooth introduction of a free and universally available digital broadcast television service; 2) to increase the availability of new products and services to consumers through the introduction of digital broadcasting; 3) to ensure that its rules encourage technological innovation and competition; and 4) to minimize regulation.

Government regulations (rules which have the effect of law) and policies (standard practices for implementing regulations) in the United States are formulated and implemented through processes that are strictly controlled by statutory directives. These processes are designed to ensure that all affected parties are provided an opportunity to participate in the development of regulations and that the decisions of appointed agency officials are fairly reasoned and not arbitrary or capricious. The standard process for development of communications regulatory policy in the United States is for the regulatory agency, which in the case of television broadcasting is the FCC, to develop policy proposals, consult with the public (including industry interests) on those proposals, and then adopt final rules.

Under this process, the FCC issues a Notice of Proposed Rulemaking to set forth its proposals and solicit comment, provides a fixed period for submission of comments on those proposals and replies to comments, and then issues a Report and Order that provides a final decision that includes final rules and policies and an explanation of the decision. If affected parties believe that the FCC's decision is in error or that the FCC did not consider some information that was available, they may submit petitions for reconsideration. In cases where petitions are filed, the FCC issues a public notice requesting comment and reply comments on the issues raised in the petitions and, after weighing all of the information submitted in the petitions and pleading, issues a Memorandum Opinion and Order addressing those issues and making any changes in its rules or polices that it might deem appropriate. The U.S. Congress also participates in the policy development process as it deems necessary through statutory directives that either instruct the FCC to establish specific rules or statutory provisions that apply directly to regulated entities such as TV station licensees.

In some cases the FCC also conducts inquiries to gather information prior to the issuance of specific proposals. An inquiry is usually conducted as a formal proceeding in which the FCC issues a Notice of Inquiry that identifies the issues and questions that it intends to investigate and provides time periods for the submission of formal comments/responses and replies. In conjunction with an inquiry the FCC may also undertake independent research with its own resources. In the case of larger issues or major matters involving research and development, the FCC may also establish a Federal Advisory Committee to assist it. An Advisory Committee is a group of individuals from the private sector with knowledge, special expertise, resources or interests in the matter to be investigated that is appointed by the FCC to carry out specific research or advisory tasks. The FCC sets forth a charter for the advisory committee that specifies

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[4] In fact, the frequencies used for those channels have already been reallocated for new uses, including public safety, and commercial mobile (terrestrial), fixed, and broadcasting. During the transition, new services are not allowed to interfere with broadcast television operations.

its functions and responsibilities and chooses its members, including a chairperson. That chairperson then organizes the advisory committee and assigns its members tasks. Advisory committees often have subcommittees with chairpersons under the main committee and working parties that report to the subcommittees.

The procedures described above have all been applied in developing the many policy decisions over the 18-year effort that has brought the U.S. to where it is now in the DTV implementation process. The FCC, with the occasional but important support and direction of the U.S. Congress, has not employed a single comprehensive policy program but rather has tailored its approach to the circumstances of specific stages of technical and policy development. The FCC's approach has been to make some specific decisions to guide development as information and progress indicated was appropriate, and then to make further decisions as additional progress occurs.

When this process started in 1987, it was not about digital television. Rather, in the beginning the subject was "Advanced Television Service" (ATV service) and there were only some vague ideas for improving television service. There was a population of new television technologies that were in various stages of design that sought to improve significantly upon television picture and sound quality. These technologies were all analog and embraced different approaches. Some used different amounts of spectrum and different transmission and reception methods. The FCC began its work in this environment with a Notice of Inquiry in response to a petition for notice of inquiry from a large group of American television broadcasters. This inquiry asked questions about advanced television technologies, spectrum allocations (including which spectrum should be used for ATV services), NTSC compatibility, and transition issues. To assist it in this work, the FCC established an advisory committee, the "Advisory Committee on Advanced Television Service (ACATS) that consisted of 30 members who were leaders of major broadcast television, cable television, consumer electronics, program production, and computer industry firms. The ACATS was charged with evaluating ATV technologies and developing appropriate recommendations to the FCC. At the same time, the FCC issued an Order stating that it would not accept applications for new television stations in 30 television markets in the congested areas of the country. This action was to preserve spectrum that might be needed for ATV operation.

In 1988 and 1989 the FCC took its first steps toward formulating an ATV policy by announcing several key tentative decisions. These decisions were: 1) that providing for the use of ATV techniques for terrestrial broadcasting would benefit the public; 2) that the benefits of this technology could be realized most quickly if existing broadcasters were permitted to implement ATV; 3) that any spectrum needed for a broadcast ATV system would be obtained from the spectrum already allocated to broadcast television; 4) that existing service to viewers using NTSC receivers must be continued irrespective of the actual manner in which ATV services were delivered, at least during a transition period, and that this could be accomplished by transmitting ATV signals that could be received directly by NTSC receivers or by simulcasting NTSC and incompatible ATV signals on different channels; 5) that ATV systems that use more than 6 MHz of spectrum would not be authorized for terrestrial broadcast television service; and 6) that policies to be adopted should be sensitive to the benefits of compatibility between equipment associated with the various video delivery media.

After reviewing the progress of the ACATS on evaluation of candidate ATV technologies, and following the introduction of all-digital candidate ATV systems in 1990, in 1991 the FCC made the following additional key decisions: 1) to select a high-definition television (HDTV) system that employed design principles independent of the existing NTSC system (which would allow the greatest amount of service improvement); and 2) to not give further consideration to transmission systems that required additional spectrum to augment the 6 MHz channels used for broadcast television in the United States.

Subsequent to that decision, the ACATS undertook testing of five competing candidate systems, four of which were all-digital systems. At the end of that process, it was clear that the digital systems were superior to the analog candidate system, but there was no clearly superior system among the digital

candidates. The ACATS Chairman, former FCC Chairman Richard E. Wiley, then encouraged the proponents of the remaining digital systems to work together to proposed a single system that incorporated the best elements of the four competing digital systems. Responding to this suggestion, the system proponents formed the "Digital HDTV Grand Alliance," and under the direction of the ACATS, a single best digital system was developed and tested by ACATS. The FCC oversaw this testing process and the subsequent development of the Grand Alliance system through its staff.

The Advanced Television Systems Committee (ATSC), an existing inter-industry standards body that worked closely with ACATS, documented the Grand Alliance system, and also developed an industry consensus around standard-definition video formats to be included in the system. The resulting ATSC Digital Television Standard was adopted by the ATSC members in September 1995. In November 1995 the ACATS itself approved the ATSC Standard and recommended to the FCC that it be mandated for DTV broadcasting in the U.S. Shortly thereafter, the FCC began an extensive public comment process whereby all interested parties were able to give their views on the proposed standard and the associated policies for the introduction of digital television broadcasting.

In the same time frame, the U.S. Congress enacted legislation that affected the ATV project. This legislation 1) limited eligibility for a second channel for ATV services to entities who were licensed to operate a television station or had submitted an application to operate a television station and were ultimately awarded a license, by October 24, 1991 and 2) specified that the ATV transition was to end December 31, 2006, except that it could be extended in individual markets where less than 85 percent of the households were able to receive ATV service. Following an extensive process for obtaining public comment and opinion, on December 24, 2006, the FCC issued a decision formally establishing the ATSC system as the U.S. DTV standard.

Four months later, in 1997, the FCC issued two additional decisions that set the stage for the start of the U.S. DTV transition. The first decision established the rules under which broadcasters would apply for DTV licenses, construct their stations, and provide service to the public. The second decision specified the second channels for DTV service that individual stations would use and the technical parameters for operation of DTV service on those channels during the transition. The FCC, recognizing that the transition would be a dynamic process and would need oversight and management throughout its progress, also announced that it would conduct a review of the transition every two years and make adjustments in its policies as necessary to promote a rapid and effective transition.

The United States is now approaching the final stages of its DTV transition and there have been many challenges that have been faced and overcome in the period since 1997. In recent years the desire of the U.S. Government to recover TV channels 52-69 for new uses has given rise to greater emphasis on completing the transition as rapidly as possible. The FCC is now working to achieve a rapid conclusion to the transition and to ensure that the benefits and services of DTV broadcasting are available to all Americans. The U.S. Congress is also now considering legislation that would mandate the end of analog television transmissions in 2009.

3. Policies for DTT Broadcasting

3.1 Common Policy Topics

The establishment of national policies for DTT broadcasting should address several general areas such as:

- Eligibility for DTT licenses and criteria for the use of spectrum
- Procedures for awarding DTT licenses and assigning DTT channels
- Terms and conditions for DTT licenses, including whether the licenses should be linked to analog TV licenses, the duration of licenses, the scope of permitted DTT services, and potential public service obligations
- Transition plans and timetables, including plans for the recapture of spectrum
- Potential specification of minimum requirements for DTT receivers and other consumer electronics products, such as minimum performance requirements and basic features such as all-format decoding in order to protect against premature obsolescence
- Protection of broadcast content against and from unauthorized redistribution, that is, the definition of anti-piracy mechanisms.

3.2 National Approaches

(To be completed)

3.2.1 Argentina

(To be completed)

3.2.2 Brazil

(To be completed)

3.2.3 Canada

(To be completed)

3.2.4 Mexico

(To be completed)

3.2.5 United States of America

Eligibility for DTT licenses

This was one of the fundamental issues addressed by the FCC in its earliest rule making proceedings. The eligibility question was decided by the U.S. Congress by law in 1994. That law established that those eligible for a second channel for DTT service are entities that, as of the date of issuance of the DTT licenses (which turned out to be April 3, 1996), were licensed to operate a TV station or held a construction permit for a new TV station. Other entities were not eligible for an initial DTT allotment, i.e., a second channel. However, new DTT stations (not associated with an analog station) are allowed under the eligibility law and many have now been authorized.

Procedures for awarding DTT licenses and DTT channel assignments

The FCC's overall plan was to assign to the operator of each existing analog TV station a second 6 MHz channel for DTT broadcasting. As explained in more detail in Chapter 4, channel assignments were made with an intention to replicate the existing coverage area of the existing analog channel. Broadcasters would operate both analog and digital stations during a transition period, while consumers acquired DTT receivers or digital-to-analog set-top converter boxes to use with their existing analog receivers. At the end of the transition period, broadcasters would cease analog transmissions. Broadcasters were not required to accept digital licenses and construct digital stations, but any station that did not construct a digital station would no longer be able to transmit any television service at the end of the transition.

Terms and conditions for DTT licenses

- **Linked to analog TV license, or separate?**

Because this was viewed as a technological transition, and not an entirely new service, DTT licenses were linked to the existing analog license. Broadcasters didn't have to apply for the right to a channel, but they did have to apply for a construction permit and then for a formal license after they get their DTT stations built and operating.

- **Duration of license, eligibility for renewal**

The existing license terms were not affected, except that at the end of the transition the broadcaster would have to switch to digital transmission. In the U.S., TV station license terms are generally for eight years, and are generally renewed for additional eight-year terms, unless a broadcaster has engaged in certain kinds of egregious violations of its license terms. The duration of licenses and eligibility for renewal are not affected by the transition to DTT.

- **Scope of permitted terrestrial DTT services**

After very careful consideration and review in the FCC's public rule making processes, the Commission afforded broadcasters great flexibility in the use of their DTT channels.

- **Public interest obligations?**

While there has been an ongoing debate about whether the use of additional spectrum and the great flexibility of DTT services warranted additional public interest obligations upon terrestrial broadcasters, neither the FCC nor Congress has imposed any special or additional public interest obligations on broadcasters. Broadcasters do have important public interest obligations, but these are the same as those that have applied with analog broadcasting.

- **Minimum service requirements, hours of operation**

Broadcasters were required at least to match the hours of operation of their existing analog station. For example, if the analog station were operated 24 hours/day, then the digital station would also be required to operate 24 hours/day.

- **Degree of flexibility afforded to DTT broadcasters**

Broadcasters were given almost unlimited flexibility in the services that could be offered over their 6 MHz digital channel. They were required to offer one free-to-air video program service with resolution equivalent to their existing analog service. Beyond this, they could offer whatever other services they chose on the digital channel.

- **Requirements for high-definition or other types of services?**

The FCC did not impose any requirement that broadcasters offer HDTV, and there is no legal requirement for U.S. broadcasters to offer HDTV. However, the U.S. Congress clearly expected broadcasters to offer HDTV, and most broadcasters made crystal clear that they fully intended to offer HDTV whether or not it was formally required. HDTV was the initial focal point of the U.S. transition to DTT broadcasting, and it remains the centerpiece application as deployed in the U.S. to date.

- **Pay services? Spectrum use fees for any pay services?**

Pay services were explicitly permitted by the FCC, once a single, free, standard-definition program had been provided. If broadcasters do use their DTT channel to offer services for which a subscription fee or charge is required in order to receive service, they are required to pay the U.S. government a spectrum use fee in the amount of 5% of gross revenues from any such service.

- **Requirements to carry analog TV programming on digital channels?**

The FCC initially adopted "simulcast" rules that were intended to ensure that there was no programming uniquely available on the analog channel that would create a barrier to the cessation of analog broadcasting at the end of the transition. As a result of its second periodic review of the DTT transition, the FCC decided that these rules were unnecessary for a successful transition, and they were rescinded.

Transition plans and timetables

The basic transition plan followed in the U.S. was to require stations affiliated with the four largest TV networks in the 30 largest cities to implement DTT first, while allowing more time for stations in smaller cities to make the transition. In addition, public TV stations were given an extra year beyond the deadline that applied to commercial stations. The FCC's initial plan applied to approximately 1,600 commercial and non-commercial (public) stations. Transition planning for low-power TV stations and for translators was deferred for several years, but has now been completed. Low power TV stations generally will be allowed to transition to DTV operation on their existing channels. In addition, if they so desire and a channel is available, low power stations may request a "companion channel" for DTV operation during the transition. The FCC further stated that it would establish a deadline at the end of the transition for low power stations that would be after the end of the transition for full service stations.

- **Rationale and timetable for making DTT channel allotments and assignments**

As explained more fully in Chapter 4, each station was given a new assignment for its DTT broadcast channel, along with an antenna height, antenna pattern and maximum radiated power level, in an effort to replicate the station's analog coverage area. Assignments for all 1,600 stations were made shortly after the FCC formally adopted the ATSC Standard and approximately 18 months before the launch of commercial DTT service.

- **Construction deadlines for stations. Vary by size of market?**

Affiliates of the four largest networks in the ten largest cities were required to be on the air by May 1999. (At the request of the FCC, 28 stations in the ten largest cities volunteered to launch DTT service in November 1998, six months ahead of their deadline.) Six months later (May 1999) all stations in the top 10 markets that were affiliated with the four largest broadcast networks were required to provide service,

and in another six months (November 1999) this requirement was extended to the affiliates of the four largest networks in all of the 30 largest cities. All commercial broadcasters were required to be on the air by May 2002 and all non-commercial broadcasters by May 2003. Broadcasters who could not meet these deadlines were allowed to apply for a six-month extension and in some cases a second six-month extension under certain circumstances.

- **Goals and/or deadlines for cessation of analog TV broadcasts and recapture and reuse of spectrum**

The U.S. Congress and the FCC are determined to conclude the transition to DTT broadcasting as rapidly as possible for a variety of reasons, most notably to recapture 108 MHz of invaluable nationwide spectrum that will be made available once analog TV transmissions cease. Broadcasters also want to make the conversion as rapidly as possible in order to eliminate the expense of operating two TV stations in parallel.

The U.S. Congress passed a law affirming the FCC's decision to assign second 6 MHz channels to existing broadcasters for the conversion to DTT. This law required that analog broadcasts cease and that one channel be returned by December 31, 2006, but only in those markets where at least 85% of the population could receive DTT service. (The 12/31/06 deadline derived from efforts in the Congress to present a balanced budget that relied on billions of dollars of revenue from the auction of recaptured TV spectrum. The 85% exception was added to ensure that Congressional efforts to balance the national budget in 1997 did not disenfranchise TV viewers in 2006 in markets where DTT service was not receivable by most of the population.) In 2005, legislation was introduced in the U.S. Congress that would require broadcasters to terminate their analog transmissions in 2009, but such proposals are still before the Congress and have not yet been enacted into law.

Expediting the DTT transition

As noted above, the U.S. Congress and the FCC are determined to conclude the transition to DTT broadcasting as rapidly as possible. In 2002, FCC Chairman Michael Powell established a DTT Task Force within the FCC and announced a plan (the "Powell Plan") for accelerating the DTT transition, urging various segments of the TV industry to take specific actions on a voluntary basis. In addition to the measures described below, the Powell Plan called upon various industry segments to educate consumers and to promote digital television. The broadcast, cable and consumer electronics industry responded positively to this request with various programs.

- **Engendering production of value-added programming**

Under the Powell plan, terrestrial broadcast networks ABC, CBS, NBC and Fox, and programmers HBO and Showtime were asked to provide "value-added" DTT programming during at least 50% of prime-time. Value-added programming could be HD, multicasting, interactive, etc. Most of these entities agreed to meet this challenge. Indeed, many were already in compliance.

- **Engendering program distribution**

Affiliates of top four networks in the largest 100 cities were encouraged to pass through network DTT signals without degradation (e.g., transmit an HD signal if that's what the network provides) by January 2003. 89% of responding stations indicated they would meet this goal.

- **Requirements for carriage of terrestrial broadcasts over other transmission media, e.g., cable, satellite and MMDS**

Cable and direct broadcast satellite (DBS) operators were asked to carry up to five broadcast or other digital services that are providing "value-added" service during at least 50% of prime-time. DBS providers and the ten largest multiple-system cable TV operators agreed.

Engendering distribution of consumer equipment

- **Requirements for DTT receivers and other consumer electronics products**
- **Requirement for all-format decoding**

The FCC considered a requirement that all DTT receivers be able to receive and decode all possible formats that a broadcaster might send, but did not adopt any such requirement, in part, because the U.S. DTT industry adopted this practice on a voluntary basis. The ATSC and the Consumer Electronics Association (CEA) adopted a certification program whereby consumers could be assured that any ATSC receiver with a DTV logo on it would be able to deliver a viewable picture for any of ATSC video formats that a broadcaster might choose to transmit. All-format decoding is essential to permit the introduction of HDTV – later, if not initially. Failure to provide all-format decoding led to a terribly inefficient requirement in Australia to send two digital signals – one for HDTV and another for SDTV. Similarly, in those European countries that have already launched DTT service, lack of all-format decoding will make it impossible to introduce HDTV via terrestrial broadcast without replacing all of the existing receivers.

- **Requirements for reception and decoding capability in all receivers**

Under the Powell Plan, receiver manufacturers were asked voluntarily to include DTT reception and decoding capability in all receivers over 13 inches in diameter after a phase-in period. When this was not accomplished voluntarily, the FCC adopted regulations that phased in this requirement for the largest TV sets first, starting in 2004, and for all sets over 13 inches by July 2007. This rule is now being phased in, and CEA predicts that 34 million ATSC DTT receivers per year will be sold in the U.S. alone by 2007, with a cumulative total of 152 million ATSC receivers by 2009.

- **Potential performance requirements for receivers**

While there are no government requirements for DTT receiver performance, on a voluntary basis (and upon the recommendation of the FCC) the ATSC has adopted a recommended practice giving performance parameter guidelines for DTT receivers.

- **Compatibility with other transmission media, e.g., cable, satellite and MMDS**

The cable and consumer electronics industries have adopted requirements to ensure plug-and-play compatibility that would allow one-way HDTV and other cable services to be received directly on consumer receivers, without the need for a separate set-top box. The FCC codified these requirements into its rules, including a provision that all so-called "cable-ready sets" also include ATSC DTT tuning and decoding capabilities. These industries are now working on extending this agreement to two-way interactive services.

Protecting broadcast television content from unauthorized redistribution

The ATSC has incorporated a broadcast content redistribution control descriptor (commonly known as the "broadcast flag") into its standard. The broadcast flag is designed to prevent the widespread indiscriminate redistribution of high value broadcast content, i.e., programming, over the Internet. The FCC has also established compliance and robustness rules for devices with ATSC demodulators to ensure that they respond to and give effect to the ATSC flag. A compliant device will not pass content to another device unless that device is also a compliant device. Compliance is verified by communications between the two devices. These FCC rules have been overturned by the U.S. Courts as being beyond the FCC's authority, but the U.S. Congress is considering new legislation to achieve these objectives for the protection of broadcast content.

4. Spectrum Planning for DTT Broadcasting

4.1 The Importance of Spectrum Planning for DTT Broadcasting

Developing an efficient and effective plan for making DTT channel assignments in the existing spectrum currently dedicated to analog TV broadcasting is one of the most important and most difficult aspects of planning for a successful transition to DTT, especially in those countries where the television bands are already heavily occupied. The development of DTT channel allotments and assignments is a complex engineering and computational task. Sophisticated models and planning algorithms have been developed by those countries that have already undertaken this task, and these countries are willing to share their experiences and modelling software with other countries in the region.

4.2 National Experiences

The sections that follow describe the spectrum planning approaches and techniques that have been used by countries in the region.

4.2.1 Argentina

(To be completed)

4.2.2 Brazil

The radio spectrum is an important and highly valuable resource that must be adequately managed to meet the established policies. Brazil has prepared a plan for channels to be used by the digital terrestrial television broadcasting, regardless of the digital standard to be chosen by the country. This section details the planning criteria, with the respective minimal usable field strength values and the protection ratio (analogue/digital, digital/analogue and digital/digital), as well as the conditions necessary to provide an optimized use of the spectrum and an adequate distribution of the future digital channels.

Digital television channels, using VHF-H (7 to 13) bands and primarily UHF (14 to 59), while maintaining service areas as equivalent shall replace current analogue channels. During the initial phase, named as “the transition phase”, broadcasting service will be rendered simultaneously through analogue and digital channels. At the end of this phase, analogue transmission will be terminated and a new stage named as “the digital phase” will commence, using only digital channels. If the number of available channels for a specific place exceeds the necessary number of channels for that locality, a selection of the best channels for that locality will be held. In this selection process, UHF digital channels with better coverage area and without co-localized adjacent channels, analogue or digital, will have priority. An agreement was reached, stating that television operating companies will have preference to use better digital channels in comparison to television relay stations. Existing two TV operating companies located in different places, preference for the better channel will be awarded to the most populated place.

Premises for DTV Channel Planning
The relevant principles adopted for the implementation of digital television are indicated below:

- digital TV will replace existing analog TV, using VHF and UHF frequency bands;
- the main objective of planning is to assure that the digital TV stations will have similar service areas as the present analog stations;
- during an initial stage called "Transition Phase", analog and digital channel will be simultaneously transmitted (“simulcasting”);

- DTV planning will be carried out in two steps: "Phase 1" only for cities where there are active full power stations and, in a later stage, "Phase 2" for cities where there are only translator stations and for shadow areas

Channel planning parameters

- **Minimum field strength for outdoor reception**

For planning purposes, the adopted model for outdoor reception considers a typical device located at the border of the service area, comprised of one outdoor antenna at a height of 10 meters over the ground, a transmission line and a digital TV receiver. The minimum field strength for outdoor reception is indicated in Table 3, where factors such as margin due to man-made noise (impulse noise) are considered.

Factor	Low VHF	High VHF	UHF
Mean frequency (MHz)	71	195	608
Antenna height above ground (m)	10		
Antenna gain related to half-wave dipole (dBd)	4,5	6,5	10
Line loss (dB)	1	2	4
Margin due to man-made noise (dB)	6	1	0
Receiver noise figure (dB)	10		
Required C/N (dB)	15 + D (D=0 for 8-VSB, D=2 for COFDM FEC 2/3 and D=4 for COFDM FEC 3/4)		
Minimum Field Strength (dBμV/m)	33 + D	36 + D	44 + D

Table 3 – Minimum Field Strength for outdoor reception

- **Minimum field strength for indoor reception**

For indoor reception, it was assumed a typical antenna located at a height of 1.5 meters above the second floor of a building. The definition of the minimum field strength for indoor reception is presented in Table 4 and takes into account factors such as margin due to man-made noise, margin due to building penetration loss and margin due to receiving antenna height loss.

Factor	Low VHF	High VHF	UHF
Mean frequency (MHz)	71	195	608
Antenna height above floor (m)	1,5		
Antenna gain related to half-wave dipole (dBd)	-2,2	-2,2	0
Line loss (dB)	0	0	0
Margin due to man-made noise (dB)	6	1	0
Margin due to building penetration loss (dB)	8	8	7
Margin due to height loss (first floor) (dB)	5	5	6

Receiver noise figure (dB)	10		
Required C/N (dB)	15 + D (D=0 for 8-VSB, D=2 for COFDM FEC 2/3 and D=4 for COFDM FEC 3/4)		
Minimum Field Strength (dBμV/m)	52 + D	56 + D	63 + D

Table 4 – Minimum field strength for indoor reception

- **Protection Ratios**

The values assumed for protection ratios involving DTV and PAL-M TV channels is based on the results obtained in the laboratory tests of digital TV. The protection ratios presented in Table 5 represent worse case condition involving configurations 8-VSB (ATSC), COFDM 64-QAM FEC 2/3 (DVB-T and ISDB-T) and COFDM 64-QAM FEC 3/4 (DVB-T and ISDB-T). In case of a digital TV channel interfering on a PAL-M TV channel, Grade 3 quality criterion was used.

Interfering channel	**D/U ratio (dB) (Desired channel = N)**			
	Analog into Analog	**Digital into Analog**	**Analog into Digital**	**Digital into Digital**
N-1 (lower)	- 6	- 11	- 26	- 24
N (co-channel)	+ 28	+ 34	+ 7	+ 19
N+1 (upper)	- 12	- 11	- 26	- 24
N-8 and N+8 (FI)	- 12	-25	-	-
N-7 and N+7 (local oscillator)	- 6	-24	-	-
N+14 (audio image)	- 6	-24	-	-
N+15 (video image)	+ 3	-22	-	-

Table 5 – Protection ratio

- **Requirements for co-location**

Two or more transmission antennas for analog or digital TV are considered co-located if they are installed in the same structure or in structures up to 400 meters apart. In this specific case, the analog to digital power ratios shall meet the limit of perceptibility (LOP) determined in the laboratory tests carried out in Brazil, presented in Table 6.

Interfering channel	**D/U power ratio (dB) (Desired channel = N)**			
	Analog into Analog	**Digital into Analog**	**Analog into Digital**	**Digital into Digital**
N-1 (lower)	forbidden	0	- 26	- 24
N+1 (upper)	forbidden	0	- 26	- 24
N-8 and N+8 (FI)	- 12	-10	-	-
N-7 and N+7 (local oscillator)	- 6	-10	-	-

N+14 (audio image)	- 6	-10	-	-
N+15 (video image)	+ 3	-8	-	-

Table 6 – Power ratios for co-located channels

Standard for outdoor antenna

For outdoor reception, it was assumed that the receiving antenna presents a directive gain standard related with squared cosine of the discrimination angle. In the interference calculations, the attenuation of interfering signal is given by $-10x\log_{10}[\cos^2(\theta)]$ dB, where θ is the angle between the line from the reception site to the station to be protected and the line from the reception site to the interfering station. This attenuation never exceeds 6 dB for VHF and 14 dB for UHF.

Requirements for planning

Regarding digital TV channel planning, the following criteria have been established:

- outdoor reception in at least 90% of the time of 70% of the sites at the protected contour of stations, resulting in the requirements presented in Table 7.

Factor	Low VHF	High VHF	UHF
Minimum Field Strength (dBμV/m)	33 + D	36 + D	44 + D
Location correction factor (from 50% to 70%) (dB)	2,5	2,5	3
Protected Contour Field Strength to be predict using F(50,90) (dBμV/m)	36 + D	39 + D	47 + D

Table 7 – Requirements for outdoor reception in sites at the protected contour

- indoor reception in at least 90% of the time of 50% of the locations at Contour 1 (Primary service area) of stations, resulting in the requirements of Table 8.

Factor	Low VHF	High VHF	UHF
Minimum Field Strength (dBμV/m)	52 + D	56 + D	63 + D
Contour 1 Field Strength to be predict using F(50,90) (dBμV/m)	52 + D	56 + D	63 + D

Table 8 – Requirements for indoor reception at Contour 1 (Primary service area)

Coverage requirements for DTV channel planning in Brazil were established in such a way to assure:

a) outdoor reception at the protected contour, for all DTV systems under consideration (D = 0, 2 e 4, according to Tables 3 e 6);

b) indoor reception at Contour 1 (Primary service area), for all DTV systems under consideration (D = 0, 2 e 4, according to Tables 4 and 7);

c) a constant power ratio between analog channel and DTV channel with the same protected contour; and

d) the future conversion of analog TV channels into digital TV channels meeting their specific protection ratios.

The solution that meets the restrictions indicated above comprises a 13 dB ratio between analog channel power and DTV channel power with the same protected contour. It is also applied a 13 dB ratio between any field strength that defines contours from the curves F(50,50). Table 9 summarizes the technical requirements assumed for DTV channel planning.

Band	Class	Analog TV channel				DTV channel				
		ERP (dBk) HAAT = 150m	F(50,50) (dBμV/m) Protected Contour	Protected contour (Km)	Contour 1 (Km)	ERP (dBk) HAAT = 150m	F(50,50) (dBμV/m) Protected Contour	Protected contour (Km)	Outdoor coverage (Km) (D=0,2,4)	Indoor coverage (Km) (D=0,2,4)
Low VHF	ESP	20	58	63	31	7	45	63	64 – 72	37 – 43
	A	10		42	18	-3		42	47 – 54	24 – 28
	B	0		25	11	-13		25	31 – 37	14 – 17
	C	-10		14	6	-23		14	19 – 24	8 – 10
High VHF	ESP	25	64	66	40	12	51	66	72 – 79	44 – 51
	A	15		46	25	2		46	56 – 62	29 – 34
	B	5		28	14	-8		28	39 – 46	17 – 22
	C	-5		16	7	-18		16	25 – 30	10 – 12
UHF	ESP	32	70	53	39	19	57	53	55 – 59	36 – 41
	A	22		40	26	9		40	43 – 48	25 – 29
	B	12		26	15	-1		26	32 – 36	14 – 17
	C	2		14	8	-11		14	20 – 25	8 – 10

Table 9 – Technical criteria for coverage

Estimation of coverage and interference

The protection from interference for analog TV is defined over the area limited by the Protected Contour of the station. For digital TV, the area limited by the Protected Contour, according to Table 9, is also taken for protection purposes.

The following propagation models using database with digitalized terrain have been used in channel studies for new digital channel allotments.

Point-to- Area

- ITU-R P.1546-1 Recommendation [Method for point-to-area predictions for terrestrial services in the frequency range 30 to 3000 MHz]
- Wanted signal: F(50,50) curves
- Interfering signal: F(50,10) curves
- Factors of attenuation: terrain roughness and TCA (“Terrain Clearance Angle”)

Point-to-Point – diffraction in obstacles (maximum of three) modeled as knife edge

- ITU-R P.526 curves [Propagation by diffraction]
- Wanted Signal: k=4/3 (k coefficient of Earth curvature)
- Interfering signal: k=2

Point-to-Point – diffraction in multiple obstructions

- Point-to-point method, considering the curvature of obstacles [Assis, M. S., "A Simplified solution to the problem of multiple diffraction over rounded obstacles", IEEE Transactions on Antennas and Propagation, vol. AP-19, pp. 292-295, March 1971]
- Wanted signal: k = 4/3
- Interfering: k = 2

Interference analyses made from information on people distribution, based on satellite images.

4.2.3 Canada

(To be completed)

4.2.4 Mexico

(To be completed)

4.2.5 Colombia

Spectrum planning and adjustment of the regulatory framework to the advent of digital television

CNTV now has a frequency plan that provides for the possibility of assigning frequencies for digital television. However, policy must be adopted for more efficient use of the spectrum, including the possibility of recovering a portion of it for new uses.

DTT enables more efficient use to be made of the radio spectrum, a scarce public resource. The same information may be transmitted via analog and digital television, but the latter uses less resources or makes it possible to transmit additional programs with the same spectrum resources. It should be noted that digital television must be introduced in Colombia with flexibility so that it can be adapted to future technological developments.

In regulating DTT, the following aspects, inter alia, must be defined:

- Eligibility conditions for DTT licensing;

- Procedures for awarding DTT licenses and distributing television channels, and competition policies;

- Terms and conditions for DTT licensing: whether DTT licenses are to be linked to analog television licenses or independent of them; license duration; public service obligations; free or conditional reception; minimum service requirements; hours of operation of digital television; degree of flexibility

accorded DTT broadcasters; and requirements for high definition or other types of service, among others;

- Programming distribution conditions and content control: requirements for transmission of analog television programming over digital channels; requirements for transmission of terrestrial broadcasting over other transmission media, such as cable, satellite, and MMDS; measures to protect television broadcasting content vis-à-vis unauthorized redistribution; application of copyright provisions; advertising provisions, etc.;

- Conditions of distribution of equipment to consumers (DTT receivers and other consumer electronics associated with the service): minimum technical requirements for decoders of all formats, possible receiver performance requirements, compatibility with other transmission media (such as cable, satellite, and MMDS), etc.;

- Transition schedules: periods for building stations, reserving of frequencies for current analog television operators, period for conclusion of analog television broadcasting, recapture and reuse of the spectrum, period for award and assignment of DTT channels, etc.

4.2.6 United States of America

The radio spectrum is an important and highly valuable resource that must be managed to meet the needs of an increasing variety of new services. In the United States, the radio spectrum must now be managed to accommodate new services as well as provide for spectrum needs of existing services. Careful attention to spectrum planning is therefore essential in the DTT implementation process to ensure both that broadcasters are provided channels that will enable them to reach their viewers and that any spectrum that is not needed for television service can be made available for new uses. The DTT channel planning in the United States sought to optimize both of these considerations.

Channel Planning Task

The plan for implementation of DTT in the U.S. is to replace the existing analog TV transmission technology with the new DTT transmission technology. Because both viewers and stations have value in analog equipment and there is a need to provide time for them to acquire DTT equipment, a transition plan was developed whereby broadcasters would operate both analog and DTT facilities for a period of time. Under this plan, it was necessary to provide broadcasters a second channel for DTT operation during the transition. At the end of the transition period, analog operations will cease and one of broadcasters' two channels will be recovered. The FCC decided early in the planning process that no additional spectrum would be provided for DTT operation, so the DTT channels would have to occupy the same range of channels as the analog channels, *i.e.*, existing TV channels 2-69. The FCC further ruled that service with the DTT transmission system would have to occupy the same 6 MHz bandwidth as analog TV channels. This limited candidate technologies for the U.S. DTT transmission system to the same 6 MHz of bandwidth that has traditionally been used for TV service in the United States. The principal task then in the DTT spectrum planning effort was to provide all of the approximately 1600 existing U.S. TV stations with second channels for DTT operation and to fit those channels into the existing TV spectrum along with the analog channels already there.

Channel Planning Technical Factors

One of the fundamental considerations that must be addressed in developing any plan for occupancy of spectrum by television stations is interference, and more specifically the need to avoid interference between stations. Simultaneous operation of television stations on the same or adjacent frequencies in the same geographic area can interfere with reception of each other's signal with results that are disruptive to

the stations' operations. If the signals of two stations are both present at a receiver at relatively strong levels, the receiver will not be able to distinguish between them and its output will be either degraded or unintelligible. Spectrum planning is thus constrained by interference that can occur between stations. In general, interference will occur if the ratio of a desired signal to an undesired signal (D/U ratio) is below a certain level. Since the strength of radio signals decreases with distance, the closer stations are to each other the greater the likelihood of interference between them. Increasing the number of stations in an area generally results in closer spacing of their locations and an increase in the potential for interference. Interference can be avoided or minimized by moving stations apart, assigning nearby stations to different frequencies perhaps several channels away, and designing receivers to resist interference. Interference can also be minimized by selecting signal modulation methods that are: 1) resistant to receiving interference (have a lower D/U threshold for interference to occur) and 2) benign with respect to causing interference (have a higher D/U threshold for interference to occur).

The performance of the DTT transmission system is an important factor in determining how close stations may operate to each other without causing interference. If a system is more robust with respect to tolerating interfering signals and more benign with respect to causing interference, it will be possible to locate DTT stations closer together and thereby make more efficient use of the spectrum. Essentially, a more robust and benign system will allow more DTT stations to occupy the same spectrum space and to provide the opportunity to recover more spectrum for new uses.

Initial channel planning studies (pre-system selection) by the FCC's engineering staff showed that in order to provide a second channel for existing TV stations it would be necessary to locate those channels on channels left vacant due to the "UHF taboos" restrictions. These restrictions require that channels that are plus or minus 2, 3, 4, 5, 7, 8, 14, and 15 channels away from the channel used by an operating UHF analog station remain vacant in the areas around that station to avoid interference resulting from intermodulation, IF beat, and image products. These are receiver performance aspects that both the FCC and system proponents recognized could be overcome with receiver designs that are improved over those that have been historically used for reception in the "analog only" environment.

Policy Objectives

The FCC's DTT plan addresses policy objectives in four major areas: 1) eligibility/accommodation, 2) DTT service areas, 3) spectrum for DTT operation, and 4) interference. Eligibility and accommodation address who should be allowed to have a second channel and how many of the eligible stations actually can be provided a second channel. The eligibility question was decided by the U.S. Congress by statute in 1994. This statute declared that those eligible for a second channel for DTT service are entities that, as of the date of issuance of the DTT licenses (which turned out to be April 3, 1996), were licensed to operate a TV station or held a construction permit for a new TV station. The FCC decided, based on its research work in developing DTT channels, that with the ATSC DTV transmission system it would be able to accommodate all of the 1605 eligible stations in the continental United States with a channel for DTT service. The FCC also recognized that even using the ATSC DTV system it would be necessary for some stations to accept some interference to their DTT and analog operations in order to achieve full accommodation.

The second objective dealt with the service areas that DTT stations would have during the transition. Two basic approaches were considered: 1) to provide channels that would allow all stations to serve the largest area possible within the allowed station facilities parameters; or 2) to allow stations to replicate their existing service areas. (The service areas of existing analog TV stations vary in size substantially.) Based on the television industry's recommendation, the FCC adopted an approach that provides for DTT stations to replicate the service area of their associated analog station. Stations were also allowed to apply to increase the size of the DTT service area after the initial channels were identified, if the requested increase would not result in new interference to other stations. The FCC further provided for DTT stations to operate with at least 50 kW of effective radiated power, thereby increasing the minimum

service areas of a number of stations. The maximum effective radiated power allowed DTT operations was also established at 1000 kW (1MW).

In the area of spectrum for DTT operation, the spectrum efficient qualities of the ATSC DTV transmission system allowed the FCC to plan for location of all DTT stations in a core TV spectrum of channels 2-51 after the transition. The FCC will therefore be able to reclaim TV channels 52-69 (108 megahertz of spectrum, or 27% of the spectrum currently used for TV service) for new services. In fact, the FCC has already reallocated 84 megahertz of this spectrum to new commercial services and the remaining 24 megahertz to public safety operations.

Finally, the FCC considered the question of how to manage interference between stations during the transition. Given that it would be necessary to allow some additional interference to occur during the transition, especially in the congested areas of the country, the question was how to apportion that interference among DTT and analog stations. For example, it would be possible to minimize interference to analog stations so that viewers would not lose existing service during the transition, with more interference between DTT stations, or to minimize interference to DTT stations so that after the transition fewer stations would desire to change channels to reduce interference. The FCC decided to adopt a neutral approach that favored neither DTT nor analog service with respect to interference. This approach sought to minimize interference to all stations, both analog and DTT. Again, the spectrum efficient qualities of the ATSC DTV transmission system made it possible to minimize interference to all stations during the transition.

Channel Planning Parameters

In the U.S. DTT channel planning effort, the FCC performed allotment optimization and interference analysis using the measured performance characteristics of the ATSC DTV system, a set of system-independent technical planning factors recommended by the Advisory Committee on Advanced Television Service (an industry advisory committee to the FCC that included members of the broadcast, cable, broadcast equipment, consumer electronics, and computer industries), and the technical operating facilities of existing analog TV stations. The ATSC DTV system performance characteristics used include: 1) the signal-to-noise (S/I) ratio defining the outer limit of service, 2) co-channel D/U interference ratios for DTT-to-DTT, DTT-to-analog, and analog-to-DTT signals, 3) the upper and lower adjacent channel D/U interference ratios for these same signal relationships, and 4) taboo D/U interference ratios for DTT-to-analog on channels +/-2, +/-3, +/-4, +7, +8, +14, and +15 from a desired channel.[5] The system-independent technical planning factors describe DTT characteristic propagation models and service area planning factors.[6] The technical operating facilities of existing analog TV

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[5] The ATSC DTV system performance characteristics used in developing the FCC's initial DTT Table of Allotments are set forth in Appendix A, Table II of the FCC's *Sixth Report and Order* in MB Docket No. 87-268, 12 FCC Record 14588 (1997). These characteristics also appear in relevant parts in Section 73.623(c)(2) of the FCC rules, 47 C.F.R. §73.623(c)(2). The analog-to-DTT and DTT-to-DTT taboo D/U interference ratios were so low that they were considered not an important factor in the evaluation of allotment changes and therefore were not included in the rules. Note also that the DTT-to-analog UHF taboo relationships used in the allotment planning process (and now for modification of the initial DTT allotments) are much less stringent than those implied in the analog-to-analog taboo channel spacing distances set forth in Section 73.698 of the FCC rules, 47 C.F.R. §73.698.

[6] The system-independent technical planning factors are set forth in Appendix A, Table I of the FCC's *Sixth Report and Order*, *supra*.

stations include channel number, geographic coordinates (latitude and longitude), antenna height above average terrain, antenna pattern, and maximum effective radiated power (ERP)).[7]

The FCC also adopted a specification for mandatory attenuation of out-of-band emissions from DTT stations. This specification requires that: 1) in the first 500 kHz from the authorized channel (band) edge, transmitter emissions must be attenuated no less than 47 dB below the average transmitted power, 2) more than 6 MHz from the channel edge, emissions must be attenuated no less than 110 dB below the average transmitted power, and 3) at any frequency between 0.5 and 6 MHz from the channel edge, emissions must be attenuated no less than the value determined by the following formula:[8]

Attenuation in dB = -11.5(Δf +3.6); where Δf = frequency difference in MHz from the edge of the channel.

Algorithms and software tools for channel planning

The development of DTT channel allotments is a complex engineering and computational task. To handle that task, the FCC developed an operations research methodology and implementing computer software for optimizing the allotment of DTT channels. The operations research methodology and computer software use an optimization technique known as "simulated annealing."[9] This technique employs a system of penalties that attach to conditions that fall short of specified objectives. The simulated annealing method seeks to minimize the sum of these penalties, or "costs," to achieve an optimum condition.

The development process generated a number of candidates DTT Table of Allotments using the simulated annealing technique and software.[10] The different Tables reflected the effects of alternative different allotment policy decisions that were under consideration as well as new technical information affecting the values of the various penalty functions. The approach used for specifying the operating facilities of DTT stations assumed the same transmitter location and antenna height as their associated analog stations. ERP levels and antenna patterns were then calculated and assigned to allow DTT stations to replicate the same service areas as their analog stations.

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7 The current data base of analog TV station technical facilities is available on HYPERLINK "http://svartifoss2.fcc.gov/prod/cdbs/pubacc/prod/cdbs_pa.htm" http://svartifoss2.fcc.gov/prod/cdbs/pubacc/prod/cdbs_pa.htm. Note that this data base incorporates changes to the data base used in developing the initial DTT Table of Allotments in 1997, and includes modifications of existing stations and new stations.

8 The attenuation *requirements* are based on a measurement bandwidth of 500 kHz. The FCC's DTT out-of-band emission attenuation requirements are set forth in Section 73.622(h) of its rules, 47 C.F.R. §73.622(h).

9 *See* David S. Johnson, Cecilia R. Aragon, Lyle A. McGeoch and Catherine Schevon, "Optimization by Simulated Annealing: An Experimental Evaluation, Part II (Graph Coloring and Number Partitioning)," *Operations Research*, Vol. 39, May-June 1991. In addition to the simulated annealing software, the FCC also obtained software that incorporates a method known as "Lagrangian Relaxation." This method and its software implementation were developed by Decision-Science Applications, Inc. (DSA) under contract to the FCC. The DSA DTT allotment software is an extension of earlier work by DSA that produced the computer software used by the FCC to develop new FM radio allotments in the early 1980s. The DSA software complements the simulated annealing software, and partial allotment solutions developed through either software package can be used in the other so that the two packages can be used together. The FCC's DTT allotment software is available on request to the FCC's Office of Engineering and Technology.

10 "Allotments" are channels at specific locations on which stations are allowed to operate TV service. The "Table of Allotments" is a listing of all the allotted channels used for TV service. In the FCC rules, there currently are separate Tables of Allotments for DTT and analog channels.

Once a candidate DTT Table of Allotments was defined, the channel allotments identified on that Table were evaluated for their service area coverage. These coverage areas analyses involved both service area predictions and interference effects. A second computer model was developed that permitted the rapid computation and analysis of service area coverage provided by the existing analog stations and candidate DTT stations, both on an overall cumulative basis and for individual stations. Interference was evaluated using the Longley-Rice point-to-point radio propagation prediction model.[11] The service area of an individual analog station was defined as the area within that station's Grade B service contour, reduced by any interference; and was computed based upon the station's actual transmitter location, power, and antenna height.[12] The service area of a DTT station is defined as the area contained within the station's noise-limited service contour, reduced by the interference within that contour. As indicated above, DTT coverage calculations used locations and antenna heights identical to those of the replicated companion analog station and power generally sufficient to achieve noise-limited coverage equal to the companion station's Grade B coverage.

The FCC also found that there were instances where the allotment of channels in specific local situations could best be resolved on a case-by-case basis. The allotment software therefore was designed to allow specific local designs to be merged into complete Tables and, where necessary, accept changes in other allotments to preserve a balance of the specified policy considerations. This capability allowed the FCC to incorporate, where feasible, allotment/pairing agreements reached by broadcasters in negotiated settlements. In evaluating the feasibility of local agreements, the FCC considered whether incorporation of given agreements would still allow it to meet its specified policy goals.

U.S. DTT Table of Allotments

Using the above parameters, station data, and parameters, the FCC staff worked with the U.S. broadcast television industry and others to develop a final DTT Table of Allotments that incorporated the FCC's policy decisions. In a number of cases this Table included the allotment requests of individual licensees.

The final DTT Table met the FCC's primary objective of full accommodation of all eligible broadcasters. The Table provided 1605 new DTT allotments in almost 900 communities in the continental U.S.[13] The DTT Table also fulfilled the FCC's goals of service replication/maximization. In general, each existing broadcaster was provided with a DTT allotment that is capable of providing digital TV coverage of a geographic area that is comparable to its existing analog coverage. During the transition period, over 50% of all existing broadcasters received a DTT allotment that allows them to fully replicate their existing service area and more than 93% received an allotment that allows them to replicate at least 95% of their existing service area. The DTT Table also met the FCC's objective of minimizing new interference to analog service. For example, 98 to 99% of all analog stations receive less than 10% new interference (in terms of both area and population served) from DTT operations.

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11 Computer code for the Longley-Rice point-to-point radio propagation prediction model is published in an appendix to the U.S. National Telecommunications and Information Agency's Report 82-100, *A Guide to the Use of the ITS Irregular Terrain Model in the Area Prediction Mode*, authors G.A. Hufford, A.G. Longley and W.A. Kissick, U.S. Department of Commerce, April 1982. Some modifications to the code were described by G.A. Hufford in a memorandum to users of the model dated January 30, 1985. With these modifications, the code is referred to as Version 1.2.2 of the Longley-Rice model. Additional information on how the FCC evaluated DTT and analog service and interference is provided in Appendix B to the *Sixth Report and Order*.

12 The Grade B contour of analog TV broadcast stations is defined in Section 73.683 of the FCC rules, *see* 47 CFR §73.683.

13 The DTT Table also included allotments for non-continental U.S. states and territories, including Alaska, Hawaii, Puerto Rico and the Virgin Islands.

The DTT Table further met the FCC's objectives for efficient use of the spectrum. Analysis of the final Table indicated that it will be possible to provide all eligible broadcasters with access to a suitable DTT frequency within the spectrum area ultimately designated for digital TV, *i.e.*, existing TV channels either 7-51 or 2-46. The DTT Table contained only 68 instances where both the analog and digital channels are outside of channels 7-51, and 89 instances where both channels are outside of channels 2-46.[14] Even in these cases, however, suitable channels within the core area will become available when analog operations cease and channels are recovered from other stations.

[14] The number of instances where TV stations have both channels outside the core TV spectrum has since been reduced to 24 as a result of channel changes requested and arranged by individual licensees.

5. National Experiences and Approaches to DTT Planning and Implementation

Administrations are encouraged to provide information regarding their experiences and approaches for developing the DTT standard, including testing carried out in the country.

5.1 Argentina

(To be completed)

5.2 Brazil

The Brazilian Digital Television System Project (SBTVD) was established with the purpose of analyzing exploration and deployment alternatives that can be fruitful for the advent of Digital Terrestrial TV (DTT) in Brazil. Instead of taking a decision about one of the three international standards available and importing service/business models, the Brazilian government opted for a broad, consistent analytical approach. First of all, the government decided that the evolution of analog television into the digital system should be developed by aiming at real benefits for the society. Among these benefits, it is possible to highlight the promotion of social inclusion, the creation of a widespread distance teaching network, and a gradual transition, compatible with users' purchasing power. Following that, it was established a formal structure of decision and execution concerning the necessary actions for obtaining the Reference Model of the DTT system.

Therefore, the Development Committee[15], the Consultative Committee[16] and the Steering Committee[17] were created, and the FUNTTEL[18] was defined as its main funding source. Lastly, the Fundação CPqD[19] was indicated to act as an integrator of the projects that will compose the Brazilian Digital Television System and to support the Steering Committee by providing technical assistance as well as elaborating technical reports; and the FINEP[20] was indicated to support and subsidize the actions of the Steering Committee in relation to registering, selecting, and contracting proposals (cooperation agreements) from the convened research institutions.

The Steering Committee, along with Fundação CPqD and FINEP, consolidated the guidelines for the public call and the choice for research institutions. Along the year 2004, 18 public notices were published to contract research projects referring to the subsystems that should compose the SBTVD. The processes

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[15] The Development Committee officially assumed office on March 10, 2004. It is presided by the Communications Ministry and composed by other nine ministries. It has the duty of establishing the strategic guidelines for the deployment of the digital technology in the broadcasting service, and set basic guidelines to establish the business models for Digital TV, among other aspects.

[16] The Consultative Committee, officially established by the Development Committee on May 20, 2004, is made by representatives from the organized civil society linked to the Digital TV subject, and has the task of proposing guidelines and actions for the Development Committee regarding the DTT System. Currently it is composed by 23 institutions and is open to the participation of new members.

[17] The Administrative Group is ascribed to execute actions concerned with the operational and administrative management and destined to the fulfillment of strategies and guidelines established by the Development Committee. It is composed by representatives of nine ministries, of the Brazilian National Telecommunications Agency (Anatel), and of the National Institute of Information Technology (ITI), being installed on March 10, 2004, and since then it holds weekly meetings to develop the DTT System project.

[18] Fund for Telecommunications Technology Development.

[19] A Foundation for Telecommunications Research and Development. Started its action in 1976 as a R&D Center linked to the Telebrás System (Brazilian Telecommunications). As Telebrás was privatized, in 1998, this Center became a private, non-profit foundation.

[20] Financing Agency for Studies and Projects. Public enterprise linked to the Ministry of Science and Technology. It is aimed at sponsoring and financing the innovation and scientific/technological research in Brazil.

of analysis and elaboration of the Reference Model as well as the management methodology of the project were also analyzed and homologated by the Steering Committee during that year.

The decision-making process is based on the analysis of multiple factors that may influence and direct the analog-digital transition. In this sense, the analytical approach has a holistic character and the elaboration of the Reference Model is developed within a sequence of three stages: (i) data gathering plus the construction and the analysis of scenarios; (ii) proposition of alternatives for exploration and deployment models of DTT in Brazil; and (iii) analyses of both viability and risks that the alternatives at issue may bring to the actors that are involved in the process.

The first stage traces a map of the conditions that circumscribe the analytical environment, which is structured in three dimensions: socioeconomic, technological and policy-regulatory.
Within the socioeconomic dimension, these conditions correspond to the long-term macroeconomic scenarios and to the mapping of the supply and demand associated with the new media. It is important to consider that the environment which will accommodate project results may undergo significant transformations as the Brazilian demographic demand and TV capillarity are goals which are intended to be achieved. In this concern, the long-term economic vision provides the exploration scenarios that define the environments and the conditions from which it is possible to analyze the risks and the viability regarding the exploration/deployment model alternatives, in addition to the impact caused by policies and actions on the established objectives. The supply is analyzed based on the value chain related to the sector – from production to reception of content. The demand characterization is based on primary data surveyed among the citizens.

The technological dimension consists of an overview of the main business/service model alternatives, in addition to a detailed study of the technological systems that may make them feasible. The analyses that compose this study take the usability aspects as well as the technological alternatives that may enable the service models into consideration, in addition to interoperability issues with other telecommunications platforms.

The policy-regulatory dimension includes the analysis of current status regarding industrial policies and regulatory framework, by identifying policies that are directly linked to the value chain of the television sector and by analyzing the group of laws and regulations that belong to this sector and to the telecommunications one.
The second stage includes the elaboration of a few groups of exploration and deployment models that will be selected to compose the Reference Model. These models correspond to the alternatives collected in the technological dimension panorama – organized according to the value chain scenarios that were outlined in the supply mapping – and to the analog-digital transition alternatives.

In the last stage, the viability analysis of these alternatives is developed according to the perspectives of the multiple agents that compose the value chain of the sector, whose key variables have their performances evaluated by simulation. The information obtained through this method constitutes inputs for the identification and classification of risks and opportunities associated with model alternatives. Based on this classification, it will be possible to point out the Reference Model that is more suitable for the Brazilian needs. Having this classification as a starting point, the Development Committee will prepare a report about the chosen Reference Model, which will be sent to the Presidency of the Republic.

This report is supposed to describe the service exploration method (including the transmission standard), the deployment model and the recommendations for the formulation of industrial policies as well as of regulatory adjustments.

The following are among the studies that have been evaluated and approved by the Steering Committee in 2004:

- The long-term economic vision: Based on three macroeconomic scenarios and on the evolutive delineation of the income structure of the Brazilian population for each of these scenarios. Such delineation, in combination with demand expectations, will allow estimating the diffusion of Digital Terrestrial TV in the Brazilian market and subsidizing the viability and risk analysis related to the alternatives of exploration and deployment of the new television model in Brazil.
- Demand mapping: Presenting a set of information that characterizes the Brazilian consumer market regarding the acquisition and usage of digital television. This is a complementary collection of data performed on the supply side (as viewed from the value chain perspective), based on the analysis of data obtained from primary and secondary sources, either in a quantitative or qualitative nature. From a general point of view, this mapping presents two panoramas: One of them deals with the television reception as it is known nowadays; the other is concerned with demand and use expectations for the Digital TV.
- Value chain mapping: Identifying the participation and the inter-relation of different actors involved and characterizing the value flow along the entire productive process. This study was based on a market data survey, in-depth interviews with representatives of the related segments and on the identification of dynamic relations regarding the main actors involved. The pieces of information obtained with this mapping have great significance for the analytical process and decision support, once the assessment of consequences of the changes that may arise from the migration into the Digital TV depends on the understanding of how each participant of the sector acts and how their business models are structured.

Currently, a significant debate involving the entities related to the television sector and to the digital technology is in place. The objective is to obtain, in a transparent manner, feedback and validation of premises and inputs that will be used by the authorities involved in the decision.

Besides all these studies, the overview of Digital Terrestrial TV (DTT) exploration and deployment experiences around the world provides a starting point for the elaboration of model alternatives to be evaluated in the forthcoming stages of the analysis regarding the Brazilian Digital Television System Project (SBTVD)[21]. The study that leads to this panorama constitutes an analytical procedure aligned with the third consideration (paragraph c)[22] expressed in Resolution 18, which was approved in the IV Meeting of CCP II/CITEL, in Buenos Aires, Argentina, December 6 to 9, 2004. The main conclusions resulting from this study are summarized in this contribution.

The following countries compose the survey: Germany, Australia, South Korea, Spain, the USA, Finland, the Netherlands, Italy, Japan, the United Kingdom, and Sweden. In these countries the experience is currently under way and they have either a meaningful geographic and populational influence or relevant particularities.

The exploration models correspond to support and utilization alternatives for the new television system, resulting from the combination of services and related business models, in addition to the underlying technological systems. The world overview of exploration models gathered the main types of services and

[21] A general view of the analysis activities is presented in the report/contribution "The Approach of the Brazilian Digital Television System Project", presented in this meeting of PCC.II/Citel.

[22] Those countries that have not yet begun the transition to DTT broadcasting could benefit from understanding the policies and experiences of those that have gone ahead.

information on how they are grouped and formatted in some countries, as shown in the synoptic chart[23] presented below.

Services	Germany	Australia	South Korea	Spain	USA	Finland	Netherlands	Italy	Japan	United Kingdom	Sweden
Monoprogramming											
Multiprogramming											
Interactive											
Without return channel											
With return channel											
Mobility/Portability											
Multiservice											
Business Models											
Free-To-Air TV											
Pay TV											
Pay-per-View											

Five categories comprehend the services presented in the chart: Monoprogramming, multiprogramming, interactive services, services based on mobility/portability, and services based on multiservice environment. Based on this classification, it is possible to map all the types of applications for DTT that are in use in the countries where this platform was already commercially launched.

The monoprogramming consists of the broadcasting of only one programming (contents of video and audio in association) within a frequency that is assigned exclusively to the broadcaster. The configuration of monoprogramming that is most broadly known is the one currently adopted by broadcasters, in which the service is mixed up with the infrastructure that supports it, i.e., the frequency channel. Within the DTT environment, the non-mandatory option, chosen by the countries that adopt the monoprogramming, has been using it for transmissions with high definition (HD) image quality. The multiprogramming consists of supplying multiple, simultaneous, television programmings through one frequency channel of the digital platform. Due to the codification and the compressing of video/audio signals and data, it is possible to broadcast from four to six simultaneous programs, in standard-definition, in the spectral band where formerly in the past only one program could be broadcast. The interactive services allow a greater participation of the user when choosing and formatting the contents. This brings a new universe of applications to the world of television, as well as new possibilities that are similar to the ones of the Internet. The services based on mobility/portability allow the reception of DTT signals by the user in different movement conditions: still, walking or inside a vehicle in high speed. The service allows the reception from different types of terminals with integrated antennas, i.e., through television sets in vehicles and through TV receivers integrated in cell phones. Finally, the multiservice environment represents the configuration that can congregate several broadcasting and telecommunications services, simultaneously, in the same DTT platform. Such services can be the ones of the above-mentioned categories and the telecommunications-related ones.

[23] This chart and the next ones are based on several data sources, among them: Bajon et al., 2003; Fontaine et al., 2002a and b; Keen at al., 2000; Screen Digest, 2004a and b; Bunch, 2004; DBA, 2004a and b; DCITA, 2004; ATSC Forum, 2003; FCC, 2004a and b; Digita, 2004; European Commission, 2004; Tsubata, 2004.

In relation to the analysis of exploration models, it is possible to point out a few tendencies and features that are common in the experiences of the countries at issues, such as:

- The multiprogramming in standard-definition is the basis for the service models adopted in Europe, whereas in the other countries (the USA, Australia, Japan and South Korea), the monoprogramming in high definition prevails. However, the monoprogramming-based countries somehow make use of the multiprogramming due to issues and assignments of the public broadcasting stations. In Australia, there are broadcasting stations that use it permanently. In the USA and in Japan, only at some specific times of the programming, alternated with monoprogramming.

- The most significant part of the programming grid is still made of contents with standard-definition, even in countries that adopt monoprogramming. Exceptions are NHK in Japan (90% of its production made in high definition), plus ABC and NBC in the USA (with almost the entire prime time programming in high definition).

- In relation to interactive services, the first step is to provide only applications that are based on local interactivity, such as the electronic programming guide and the extra materials related to the programs. Few countries have increased the supply of services of this nature by using an interactivity channel, which is external to the broadcasting platform, for instance, with an ADSL infrastructure (Japan and South Korea).

- Mobility/Portability-based services are still on test stages in most countries. Among the ones with a commercial deployment forecast for 2005 are Japan, South Korea and Finland. Finland already had allocate a frequency channel dedicated to mobility.

- In practically all the countries studied, the business model has been anchored by the free-to-air TV model, since it has allowed greater DTT penetration speeds. The exception is the Netherlands, where it is based on pay TV.

The next chart presents the underlying technologies that support the service and business models in the different investigated countries. The following features can be highlighted:

- The broadcasting standard DVB-T provides technological support for the terrestrial digital transmission platforms, in commercial operation, in a greater number of countries in comparison with the other standards. Meanwhile, the sums of populations of the countries which are now serviced by ATSC and DVB-T reach similar values. The ISDB-T is used only in Japan.

- The types of middleware used to support the interactive services are linked to the transmission standards, i.e.: ATSC either uses or is now migrating to ACAP [24]; DVB-T uses MHP; and ISDB-T uses ARIB STD B-24.

- As far as the mobility/portability based services are concerned, the countries that chose the ATSC standard are supposed to use another transmission standard in an additional frequency channel, which is exclusive for mobility/portability. South Korea has developed its own standard, the

[24] The deployed DTT receiver base in USA makes use of the middleware DASE, imposing a legacy problem in the event of a migration to ACAP. The same sort of problem occurs in United Kingdom with the middleware MHEG-5 in the event of a transition to MHP.

DMB. DVB-T and ISDB-T allow the implementation of these services in the same frequency channel or in an exclusive channel.

Technology	Germany	Australia	South Korea	Spain	USA	Finland	Netherlands	Italy	Japan	United Kingdom	Sweden
Transmission/Middleware											
ATSC/ACAP											
DVB-T/MHP											
ISDB-T/ARIB STD B-24											
Return Channel			**ADSL**			**STFC**		**STFC**	**ADSL**		
Transmission for Portables											
T-DMB											
DVB-T											
ISDB-T											

The deployment models basically correspond to a transition plan that sets guidelines on how and on which speed the exploration model will be implemented in the country. In this concern, the following chart constitutes a synthesized panorama that lists the start dates and the previewed end dates of deployment, the network operation modes and the current situation of the countries that are contemplated in this survey.

	Germany	Australia	South Korea	Spain	USA	Finland	Netherlands	Italy	Japan	United Kingdom	Sweden
Launching Date	2002	2001	2002	2000	1998	2001	2003	2003	2003	1998	1999
Licensing Type											
Service											
Frequency Channel											
Network Operator											
National Presence	70%	75%	73%	80%	100%	94%	90%	70%	38%	82%	90%
Penetration (1st quarter 04)	28%	10%	11%	1%	7%	37%	25%	5%	11%	27%	67%
Switch-Off Start	2003 to 2010	2008	2010	2012	2006	2007	-	2006	2011	2006 to 2010	2005 to 2008

According to the worldwide deployment model overview presented in this report, it is possible to note that:

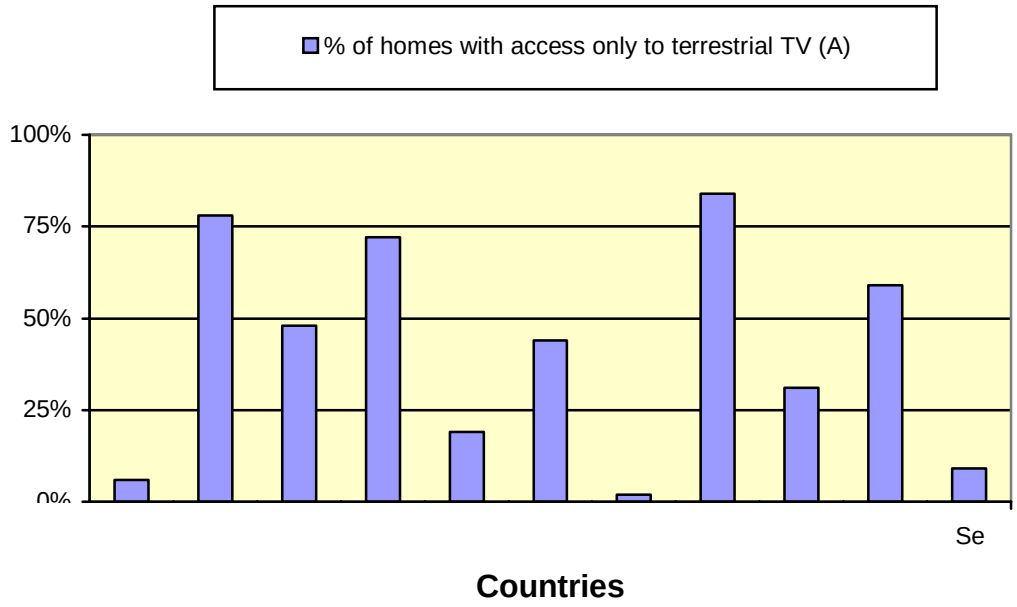
- Most analyzed countries are now reconsidering their analog transmission switch-off dates, mainly motivated by the penetration indexes they have reached – which are beneath the expectations.

- The type of licensing procedure that leads the programming allocation in a frequency channel vary according to the effective legislation in each country.

- In every European country analyzed, the network operator is present. In addition to Europe, its existence can also be noticed in Australia.

- The roll-out always starts at the main urban areas. In European countries, where the network operator is present, the roll-out occurs in a more comprehensive way – in a geographic perspective.

As shown in the following figure[25], the fraction of homes that rely exclusively on the free-to-air terrestrial television transmissions as a means of reception varies a lot depending on the analyzed country. In countries such as Australia, Spain, Italy, and the United Kingdom, more than 50% of the homes have the open terrestrial TV as their exclusive means of reception. In Germany, in the USA, the Netherlands, and Sweden, this fraction is inferior to 20% due to the high penetration of cable TV and satellite TV distribution platforms.



Finally, it is important to state that lessons learned from the world experience can be used to delineate the elaboration of alternatives for exploration and deployment models, so that they can be adjusted to the needs and singularities of the Brazilian scenario. It is also important to remember that the alternatives outlined in this way will be object of viability and risk analyses. The ultimate objective should be pointing out the model which best satisfy the criteria established by the SBTVD Project.

[25] Sources: DBA, 2004c; Gentile, 2004; MIC, 2004; NAB, 2004; Ofcom, 2004; Screen Digest, 2004b.

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5.3 Canada

Introduction

Television broadcasting is gradually converting to digital. Although most of what is currently transmitted on DTV channels is programming converted from analogue television; clear signs are indicating that the transition is well underway in Canada.

With more programming available in high definition (HD), a large number of Canadians are buying HDTV capable receivers and are increasingly spending on cable and satellite DTV television subscription services.

The producers are also spending large sums of money to buy digital television hardware to be able to produce HD programming knowing full well that any analog material will have a very short shelf life.

Status of DTV in Canada

Initially, the adoption of DTV had been fairly slow in Canada, however the pace has been accelerating this year and implementation will become more widespread as more programming material in HDTV becomes available, and prices for consumer receivers and professional equipment decrease.

It is estimated that there are more than one million HDTV capable sets in Canada. The number of Canadian households subscribing to digital television (DTV) services has passed the 4-million mark in the second quarter of 2004, making the production of HDTV programming attractive and therefore accelerating the roll-out of HDTV services.

According to Decima Research, among households that subscribe to a TV service, about four in ten now receive a DTV service such as digital cable or satellite TV. This survey also found that 63 per cent of

Canadians know about HDTV and twenty-one per cent of those who knew about HDTV had already purchased an HDTV-ready television.

In January 2003, CHUM Broadcasting started the first commercial DTV emission in Canada. Today, DTV stations are broadcasting over the air in the major centers of Montreal, Toronto and Vancouver. Currently, Canadian satellite services and many cable services provide HD packages with as many as 20 HD channels. These include specialty television program services such as Discovery Channel, Television Sport Network and The Movie Network.

The Canadian Broadcasting Corporation (CBC), the national public broadcaster, started to operate its first digital transmitters in early March bringing High Definition television signals to the airwaves in Toronto and Montreal. At the same time, CBC has started to provide an HDTV feed for cable and satellite providers. The CBC has also applied to broadcast regulators for licenses for digital stations in Vancouver, Ottawa, and Québec City. CBC expects that stations in these markets would be operating within 24 months.

Canadian broadcasters are also grappling with the issues that relate to the aspect ratio of HDTV. In addition to the increased resolution, a major cause for concern is the transition of content from the traditional television screen format of 4 × 3 to the wide cinema like screen format of 16 × 9. Although content providers and broadcasters are increasingly producing original content in widescreen format, they need to reformat the content for the established base of 4 × 3 analog television sets.

New ATSC Technological Developments for DTV Broadcasting

As the transition to digital television is accelerating television sets manufacturers are actively pursuing improvements in the performance of ATSC receivers. This effort has resulted in significant improvements to ATSC technology. Improvements have been made to the hardware and to the knowledge of how to best use the ATSC technologies. Last year has seen ATSC develop additional standards and recommended practices to promote the introduction of HDTV services.

The cost of professional and consumers hardware has significantly decreased. While consumer receiver prices have decreased, their performance has improved considerably. Noteworthy are the better performance of 5th generation receivers in handling multipath: the equalizer windows is significantly larger, and as a result the ability to handle large echoes and long pre-echoes has improved.

Better receiver performances have made distributed transmission (multiple synchronized transmitters, on-channel gap fillers, coverage extenders…) a practical option. Field testing of these features is currently underway in Ottawa.

A number of countries including Canada, Korea and the USA have collaborated to develop the technical know-how necessary to implement distributed networks. Experimental networks have been implemented and evaluated, these field tests have shown that distributed transmission provides a more uniform signal level over the target area and can generate less interference than the conventional scheme of using high power emissions from a single tower.

In July 2004, the ATSC adopted A/110 "**Synchronization Standard for Distributed Transmission"** which defines a standard for synchronization of multiple transmitters emitting trellis-coded 8-VSB signals in accordance with ATSC A/53 Annex D (RF/Transmission Systems Characteristics). It specifies mechanisms to transmit synchronization signals to several transmitters using a dedicated Packet Identifier (PID) value, including the formatting of packets associated with that PID and without altering the signal format emitted from the transmitters. It also provides for adjustment of transmitter timing and other characteristics through additional information carried in the specified packet structure. Techniques are also provided for cascading transmitters in networks of synchronous translators.

Amendment No. 1 to the ATSC Standard A/53C "**ATSC Digital Television Standard"**, was adopted last July. This amendment defines optional sub-modes of operation that trade-off data rate for performance. These modes facilitate receiver operation in difficult propagation conditions while they maintain the quality of the main service.

ATSC also adopted several standards that facilitate the introduction of new broadcast services, (conditional access, Metadata, interactivity and download of software), and introduced voluntary guidelines to facilitate the introduction of DTV that cover receiver performance and design of multiple synchronized transmitter networks.

The technical know-how and the greater availability of hardware will undoubtedly help ensure that the consumer and the Canadian broadcasting industries profit from the transition to DTV

Market Driven Transition

Canada has chosen to adopt a market driven approach to the DTV transition with no firm date for DTV stations to be on the air, nor a date to terminate analog emissions. However, the DTV transition policies were purposely designed to encourage the transition of the Canadian broadcasting system from analog to digital and high definition technology. For example, the 'must carry' rules mean that cable and satellite providers serving a given city will begin to carry the new HD services when the local stations go on air, in digital.

With over a million HDTV capable television sets in Canada, the wide availability of HD subscription services and DTV stations broadcasting in major cities, the market driven approach is producing tangible results.

It is important to know that HDTV is a subset of digital television. All HDTV is digital television. But not all digital television is HDTV. In particular, SDTV stands for standard-definition TV, and EDTV, for enhanced-definition TV. Those are affordable alternatives to HDTV. They, too, provide crisper pictures and superior sound compared with analog.

The main cost of HDTV is currently associated with the cost of the display screen specially the large screens of home theatre. The cost of the electronics that treats the RF signal has decreased enough to be only slightly higher than the price of analog sets. The following two examples illustrate how affordable DTV can be.

RCA has introduced very affordable Standard Definition Television (SDTV) models in the 27-inch screen size at suggested retail prices below $ 300 US. Thomson also is planning to introduce a Digital-to-Analog RCA converter box carrying a suggested retail price of under $125 US, half the cost of similar converters.

The CRTC Broadcasting Policy Monitoring Report released in December 2004, showed that the Canadian television industry enjoys strong revenue growth. Industry revenues continue to greatly exceed the rate of inflation. The huge revenue streams combined with the huge amount of dollars flowing into Canadian programming funds will help to support the conversion to DTV and to increase original Canadian high definition content.

Spectrum Planning for DTV

With no firm date for the shutdown of analog service, Canadian consumers can expect to continue to receive analog service until digital penetration is significant. For an undetermined period of time, both analog and digital television broadcast services will co-exist in the VHF and UHF bands. Eventually, the DTV services will replace existing analog terrestrial television services.

A Transition Allotment Plan, prepared by Industry Canada, has assigned a new digital channel, to each existing analog station; this new channel provides a comparable coverage to the one existing for the

analog station. After the transition, when all analog emissions are terminated, there will be an opportunity for broadcasters to improve their transmitting parameters.

Canadian Broadcasters believe that, it is vital to provide service to indoor and portable television receivers in urban areas. Doing so requires a better signal distribution. Field tests have shown that distributed transmitter networks provide a more uniform signal level over the target area and at the same time create less interference. Therefore broadcasters are interested in implementing distributed transmitter networks. Although the Transition Plan has been based on the assumption of high ERP transmitted from a single tower, Industry Canada has agreed to consider individual application for distributed transmitter network. A broadcaster wishing to implement such a network will have to demonstrate that the resulting interference does not exceed the level of interference that corresponds to the parameters used in the plan.
Industry Canada has revised the initial Transition Plan published in 1998 to assign the channel pair 63/68 for public safety services.

Industry Canada is currently developing a plan for Post-Transition DTV. The plan will reduce the use of low VHF channels due to increasingly higher level of man-made noise in that band and restrict the use of higher UHF channels 52-59. The channels 60-69 will no longer be used for television as this portion of the band will be reassigned to other services such as public safety and commercial mobile.

Conclusion
Several trends and technical developments are contributing to accelerate DTV implementation in Canada, the decreasing cost of receivers, widespread use of DVD players that have raise consumer expectations, competitive pressure from the US based television networks which are constantly increasing HD content, and favorable carriage rules applicable to broadcast distribution undertakings (Cable and Satellite). All these factors are propelling Canadian television viewers into the digital era.

The choice of the ATSC standard has helped in bringing equipment cost down and Canadian broadcasting has benefited from the experience of American broadcasters.

5.4 Guatemala

Aware that the transition from analog to Digital Terrestrial Television Broadcasting is only a matter of time, the Administration of Guatemala has decided to plan activities beginning in third quarter 2005 with a view to contributing to some of the items contained in the DTT Implementation Guide adopted in Buenos Aires.

Accordingly, the Administration is planning and will promote to the extent of its possibilities working meetings and forums for discussion of the topic from key perspectives, such as the governmental, economic, operational, commercial, and regulatory.
By such means, an attempt will be made to gather sufficient information to enable a report to be presented to the Administrations of CITEL at the meeting of PCC.II that presents a realistic portrayal of the current situation in our country in this regard, together with the views of broadcasters. These activities are intended to address the following items:

- Evaluation of the country's special needs and objectives in connection with DTT broadcasting;
- How to expand the quantity and variety of TV broadcasting services, including new and revolutionary information services;
- Alternative solutions to address urgent social problems in areas such as education, health, and public safety;
- Achievement of efficient use of the television broadcasting spectrum, including the possibility of recovering spectrum for new uses;
- Policies at the regulatory level for DTT system licensing;
- Situation of existing broadcasters and new entrants;

- Procedures for granting DTT licenses and channel assignments;
- Possible transition plans and schedules;
- Minimum applicable parameters in planning channels associated with DTT systems.

Conclusion
As the Digital Terrestrial Television Broadcasting (DTT) Implementation Guide must be updated on an ongoing basis and expanded to include new information on the experiences of the countries of the Region, Guatemala will make its best efforts at upcoming meetings of PCC.II to contribute to accomplishing that objective.

5.5 Mexico

This document sets out the basis used in Mexico's decision to adopt the ATSC Standard to introduce digital terrestrial television (DTT) in the country, together with some of the elements taken into account in establishing state policy for the transition to this technology.

Accordingly, with a view to presenting information on the work being done in Mexico, this presentation has been divided into the following sections:

1. Background
2. The process of formulating the Digital Terrestrial Television Policy (the Policy)
3. Elements for selection of the ATSC Standard
4. Elements for formulation of the Policy
5. General characteristics of the Policy
6. DTT policy

Background
The objective of adopting the Standard and establishing the Policy in Mexico is to promote the transition from analog television to digital television by clearly establishing the rights and obligations of television operators with regard to the transition as a dynamic process that takes account of feedback with a view to the short, medium, and long term and to promoting the public interest.

In Mexico, in 1999, the Digital Broadcasting Technologies Advisory Committee [*Comité Consultivo de Tecnologías Digitales para la Radiodifusión*] was established, a mixed government/industry group, to examine such topics and propose the alternatives best suited to the country. To be noted are the experimental transmissions made in Mexico City and Tijuana, and the monitoring of implementation and analysis in other countries, among them, the United States, Canada, Brazil, France, the United Kingdom, and Japan.

In that connection, the difficulties involve generating conditions of legal certainty and strengthening economies of scale for the transition to digital television in Mexico in order to take advantage of the potential of this technology and its convergence with telecommunications, with a view to the public interest.

The Policy is an innovation in communications as, in the area of television, the new technologies, first black and white and, later, color television, were implemented as an impromptu process, without the planning necessary to foster the implementation of this technology with a view to public benefit through the gradual growth of services and profiting from the economies of scale that may be generated at the global level.

The Policy is also designed as a dynamic process that takes account of feedback as the process evolves and profits from competition within the sector in an environment of clear rules for and transparency in its application, limiting the discretion of the authority.

The Process of Formulating the Digital Terrestrial Television Policy (the Policy)

The Policy was designed taking account of principles of quality, as its formulation was planned, as were the elements of radio spectrum planning and determination of station coverages. Therefore, short, medium, and long-term goals were defined. The Policy is also dynamic as it provides for feedback and monitoring of implementation, so that the action stage is based on that process.

The process of formulating the Policy took as reference work done since 1996, particularly with regard to the first digital planning efforts, international agreements and, particularly, the establishment of the Digital Broadcasting Technologies Advisory Committee.

Digital broadcasting technologies are among the topics of highest importance to the broadcasting sector in terms of its medium and long-term development. Therefore, one objective established in the Communications and Transportation Sectoral Program 2001-2006 is to:

> Promote the introduction of digital broadcasting technologies and the incorporation of new services so as to enhance the quality and diversity of radio and television and promote convergence with telecommunications.

To that end, two strategic lines for digital television have been defined and implemented:

- To plan at the national level broadcasting frequencies and channels in order to identify service opportunities, as well as technical availability in order to determine analog and digital growth capacity in the FM, VHF, and UHF frequency bands.

- To promote the introduction of digital broadcasting technologies as a means of enhancing the quality of the service and promoting its convergence with telecommunications.

Operating tests were therefore conducted using the three available standards, which yielded concrete technical data applicable to Mexico, thereby making it possible to evaluate the arguments of the advocates of the standards and of other experimental work done elsewhere in the world. To be noted in that connection is document **PCC.II/487/02,** "Executive Summary of Signal Transmission Tests for Digital Television (DTV) in Mexico City," presented by the delegation of Mexico at the IX Meeting of Permanent Consultative Committee II: Broadcasting, held **July 15-19, 2002,** in Fortaleza, Brazil.

Digital channel assignment was also examined to determine the feasibility of application of digital television in Mexico, taking special account of channels required on the border with the United States.

Therefore, a study on radio spectrum planning is available, which serves to establish the Table of Additional Channels for the Transition to DTT, indicated in Section 3 of the Policy, so that, for the first time in the area of television, the availability of television channels for the implementation of digital television will be made public.

Lastly, as mentioned above, advances in digital television in the world are being monitored. Accordingly, the process is ongoing and is based on information on the transition to digital television in the world, a process being implemented by highly qualified professionals.

Taking account of these elements and of instructions from the President of the Republic, efforts were stepped up to reach consensus with the television industry in order to be able to formulate a specific and detailed policy consistent with the existing legal framework.

Such consensus was set out on March 26, 2004, as the Digital Television Policy Recommendation presented to the Secretary of Communications and Transportation by the Digital Broadcasting Technologies Advisory Committee together with guests from the Cultural and Educational Radio and Television Broadcasters Network [*Red de Radiodifusoras y Televisoras Educativas y Culturales*] and the National Chamber of the Radio and Television Industry [*Cámara Nacional de la Industria de Radio y Televisión*].

This document was the basis for adoption of the ATSC Standard and the establishment in Mexico of the Digital Television Policy, meeting the corresponding legal requirements and published on July 2, 2004, for use as applicable.

Elements for Selection of the ATSC Standard

In accordance with the results of the studies and evaluations of the digital standards analyzed by the Committee, ATSC Standard A/53 is the Standard recommended for digital terrestrial television transmissions in Mexico, as it has the following characteristics:

a. The capacity to achieve reliable high definition transmissions on 6 MHz channels, the same bandwidth now used to carry analog television transmissions;
b. Efficiency of transmission of signals, making it possible to maximize coverage of the population with the least possible power in order to replicate with digital technology the current coverage area at the least cost;
c. Profit from potential economies of scale in global production of receiving devices to take advantage of cost reductions so that society may reap the benefit;
d. Availability of receiving devices on favorable terms of quality, diversity, and price;
e. Potential development of new services and of mobile and portable applications; and
f. Optimal conditions for receipt of signals originating in national territory which, owing to their location, might be captured abroad.

Elements for Formulation of the Policy

The Policy **provides for planning until 2021**, with precise short, medium, and long-term goals, as may be noted in its Section 4.

So as to better understand the periods required to implement this type of technological transition, it is relevant to examine the time that other broadcasting technologies have taken. To that end, the following experiences are set out below:

a. AM radio: began in the United States in 1921. By 1925, penetration was 10%; in 1932, 60%, and in 1945 had reached 90%. In the Mexican case, its evolution was similar, it becoming in the 1940s one of the most important communications media in the country. It took 24 years for the technology to be considered implemented.

b. Television: began in the U.S. in 1945, commercially in black and white. In the 1950s, penetration rose from 5% to 90%. It began commercially in Mexico in 1950, and it was not until 1970, when color television was available, that television displaced AM radio on the advertising market.

   Color television penetration in the United States began in 1955, and in 1970 had reached only 35%. Since that time, its growth has accelerated to reach 90% in 1990. It took 15 years for black and white technology to be considered implemented, while color took 25 years.

c. FM radio: began in the United States at the end of the 1930s with experimental transmissions. By the mid-1960s, commercial transmissions had consolidated their position, rising from 48% in 1966 to 70% in 1970, and reaching 90% in 1975, supported largely by the development of transistor receivers. In Mexico's case, FM radio also began with experimental stations in the 1950s and, in the 1960s, its commercial development began. By the mid-1980s, the FM industry had displaced the AM industry on the advertising market.

   Although the date of launch of commercial FM radio stations is unclear, it may been noted that their growth from 48% to 90% is similar to that of black and white television.

The penetration of new technologies have S-shaped growth curves, beginning slowly, reaching a inflection point, and then growing rapidly until reaching levels of some 90%, beyond which growth slows.

Of the processes described above, it may be noted that although it took 15 to 25 years for broadcasting technologies, developed prior to 1950, to reach 90% penetration levels, since the 1970s, the speed of penetration of society, by electronics-related technologies, has increased.

From the foregoing it may be noted that these processes were impromptu and took place without the planning necessary to promote the development of this technology for the public benefit by means of the gradual growth of services and profiting from the economies of scale that may be generated at the global level, as established in the Policy now formulated.

The transition to digital television is at different stages, particularly in developed countries. By way of example, we mention the following:

a. In the United States of Americas, beginning in 1996, the year the ATSC Digital Television Standard A/53 was adopted based on the principle of preserving and promoting free universal service and the availability of high definition transmissions, two years were planned for voluntary transition, three for mandatory transition, eight for replication of coverage, and 10 to end analog transmissions. To achieve this, the FCC guaranteed each licensee, during the transition process and on a temporary basis, one additional channel for each analog channel.

   It should be noted that this process is also taking place to promote efficient use of the spectrum and its rapid recovery. Therefore, provision is also made for television channels, which now run from 2 to 69, to be limited at the end of the transition to from 2 to 52. The resulting spectrum will be redeployed for other public and private telecommunication applications. This has meant that one of the characteristics of this process in the United States is the freeing of broadcasting spectrum for use in other radiocommunication services.

   Throughout the foregoing process, the regulator, together with industry, has conducted reviews of the transition process, reflected in other actions to accelerate the technological penetration of telehouseholds. It should be noted that, at the outset of the process, the FCC provided for replication by digital transmissions of analog coverage. However, as the process evolved, it took the decision to make this requirement flexible to take account of each licensee's particular characteristics, migrating from replication of coverage to market presence.

   In that connection, to be noted is the decision adopted by the FCC on August 8, 2002, which established the obligation for all new receivers larger than 13 inches to be capable of receiving digital signals by July 1, 2007. Gradual implementation of this began in 2004. According to data provided to the FCC by equipment manufacturers, it is estimated that prices will tend towards equality with current receiver prices, which will be achieved by 2008.

b. In the United Kingdom, the DVB-T standard was adopted and the regulator, the Independent Television Commission (ITC), in 1996, established a hybrid paid/free television model.

This model emphasized generating a large number of signals that could be captured using a decoder subsidized by the service operator that received payment from the user. It was therefore considered that, with the launch of digital transmissions in 1999, analog services might end between 2006 and 2010.

However, on May 1, 2002, despite having achieved penetration of 1.13 million subscribers in three years, the paid service operator was declared bankrupt as a result of matters related to the high level of competition from paid television. It was therefore necessary for the ITC to redefine its model as free television broadcasting, and to strengthen its signal in order to move from the requirement of eight programs per channel to four programs per channel, reducing the number of signals to be transmitted and basing itself on the BBC.

c. In Canada, the ATSC Standard A/53 was adopted in 1997, and, on June 12, 2002, the Canadian Radio-television and Telecommunications Commission (CRTC) established a policy of market-driven voluntary transition consisting of the award of new licenses to operate digital stations, according priority to current licensees but in which, in the future, third parties may participate.

No time has been set for this, nor has a date for completion of the transition to digital. The CRTC's policy emphasizes the achievement of high definition transmissions, but transmission of several signals on the same channel (multicasting) may be permitted in particular cases.

d. In France, on August 1, 2000, a legal framework for migration was established in the 1986 Audiovisual Act as amended. Accordingly, provision was made for awarding new programming licenses based on specific frequencies, and for the possibility of free and paid service. The goals proposed by the Higher Audiovisual Council [Conseil Supérieur de l'Audiovisuel (CSA)] were to increase diversity, originally six programs per 8 MHz channel; promote reception on portable equipment and fixed interior equipment, and, as in most European countries that have chosen the DVB-T Standard, to emphasize interactive services with an interface between digital programming and the Internet.

The licensing selection process was conducted from July 24, 2001 to October 23, 2002. The CSA signed the corresponding agreement with the winners in 2003. It provides for a combination of free and paid channels. These channels will be additional to the public channels, and it is expected that the service will be successful, either because users will be attracted by the low cost of the paid channels or by the new free services.

As of June 9, 2004, the CSA considered that the launch of DTT transmissions would be, for the free channels, between March 1 and April 1, 2005, and, for the paid channels, between September 1, 2005 and March 1, 2006. It is therefore considered that DTT in France will achieve 80% coverage of the population. It should be noted that the regulator is considering the possibility of implementing local stations and of achieving universal service with the support of digital television via satellite.

The expectation is therefore to achieve true coverage of 50% of the population (approximately 31 million people) in 12-18 months through the operation of 29 transmission sites, selected based on population density and propagation conditions. It will subsequently be necessary to implement 81 additional sites, for a total of 110, with a view to achieving true coverage of 80% of the population. Note that it is anticipated that the success of the first stage will determine the time the second stage will take and that the goal of 2 million subscribers to this service will be achieved in five years.

Along with these efforts, unquestionably to be noted is the major process undertaken by Brazil by conducting field tests and different evaluations of the impact of decision to select the DTT standard, as well as the experiences of other countries, notably Spain, Australia, and Korea.

In this area, Mexico's decision regarding the digital television standard and implementation of this technology are a process that has been discussed in the region's forums, particularly **CITEL**, which is the leading telecommunication forum in the Hemisphere, where governments and the private sector meet to coordinate regional efforts to develop the Global Information Society in accordance with the mandates of the General Assembly of the Organization and those decided by the Heads of State and Government at the Summits of the Americas. For this forum, the Policy serves as a reference point for implementation of digital television in the countries of the region, principally Latin America.

The foregoing is particularly important with regard to the Policy's **scope** as it refers to strengthening of **economies of scale** that promote the development of the country's industry so that it develops digital television content, particularly high definition, and for the development of suppliers of equipment, principally, receivers for the general public. By means of such economies of scale, it is anticipated that, by 2007, the price trend will be such that the price of digital television receiver will be the same as that of an analog television today.

It should also be noted that television coverage is currently 96% of the country and that most of the population depends on television as the main information and entertainment medium. The television industry in Mexico also now holds 462 licenses and 279 permits, and has many supplementary pieces of equipment to enhance the efficiency of the service provided within its coverage area.

The DTT policy was formulated taking account of such elements and of economic, social, legal, and technological aspects.

General Characteristics of the Policy

The Policy established is based on two principal, interacting thematic areas: first, **service to the public** and**,** secondly, generation of the conditions of **legal certainty** necessary for the transition, with a view to the long term.

To be noted in connection with **service to the public**:

a. The Policy establishes the need to ensure the continuity of analog service during the transition. To that end, **second channels** will be temporarily assigned for transmission of digital television by simulcasting. Note that the DTT will retain its fundamental characteristic of being provided to the public **free of charge**.

b. The Policy recognizes that transition is a long process to be implemented taking account of four main aspects:

a. **Availability of receiving equipment**. For this aspect, it is essential that economies of scale be achieved to ensure the availability of receivers at prices the public can afford. In that connection, a first effort is to acquire new digital receivers in the usual way at prices competitive with current prices of analog television sets. It also recognizes that evaluation and improvement of receiver technologies is under way, which will promote the availability of products attractive to the consumer.

b. **Supply of services**: Transmissions must begin in different areas of the country so that the service is available to the public and people benefit from the advantages DTT receivers can offer. The Policy therefore provides for gradual transition to DTT, beginning with transmissions

in the largest cities and those near the border with the United States. To that end, six three-year periods have been established for the transition, beginning in 2006.

c. **Transmission quality**. One element that digital technology makes available is enhanced transmission quality, both by eliminating analog artifacts, such as the undesirable effects of multipath interference, and in enhancing resolution and image and sound effects, leading to high definition transmissions. To that end, the Policy establishes requirements for gradual implementation of high definition transmissions and to ensure that this characteristic is not limited by the introduction of new services.

d. **Technological convergence.** Another advantage of digital technology is that it provides the alternative of incorporating new services as a result of technological convergence. In this area, the Policy establishes the possibility of incorporating such services on a basis competitive with telecommunication services.

In addition, as noted above, it is considered that the second essential element is **legal certainty**, with conditions of transparency and full rule of law, generating security for investments, projected to be in excess of US$2.5 billion.

For this aspect, the very process of establishing the DTT policy emanates from the search for consensuses with industry to achieve balance with the needs inherent in public service and adherence to the provisions of the legislation in force. Therefore:

a. **Clear and transparent rules** have been established for application of the Policy in the transition to DTT. To be noted in that connection is the gradual nature of the DTT implementation process, in six three-year periods, which may begin with presence to then move to replication of coverage. The Policy also provides for differentiation regarding migration of commercial and non-commercial stations, as the latter will be able to begin some time after the former.

a. To be noted as part of these rules is that parties interested in participating in the transition to DTT are to apply for renewal of their license or permit so that it establishes the specific terms and conditions for transition, which are published as an annex to the Policy document. In the renewal process, a review will be made of fulfillment of the foregoing obligations and the use that has been made of the radio spectrum, as established in the Act. Based thereon, licenses or permits will be renewed for those interested in participating in this transition **until December 31, 2021**, the end date of the sixth transition period.

b. The SCT will publish via the Internet the **list of** television licensee and permit holder **stations in accordance with the period when they are to have digital signals**, taking account of the information in the 2000 census conducted by the National Institute of Geography and Information Technology (INEGI), as provided in Section 4 of the Policy.

c. The SCT will publish via the Internet **the Table of Additional Channels** for the Transition to DTT, which will identify the channels available for the DTT transition process, as may be gathered from the provisions of Section 3 of the Policy. Note that this publication does not imply the assignment of the channel to any licensee or permit holder, but rather that spectrum has been reserved for implementation of DTT, that is, the channel is only assigned to the interested party on a temporary basis when it puts it into operation.

d. The Digital Broadcasting Technologies Advisory Committee will issue by April each year, **a report** on the immediately preceding year, which will be **published** by the SCT **via the Internet** in accordance with the guidelines of the Federal Transparency and Access to Public Governmental

Information Act, as established in Section 5 of the Policy. This report will serve as feedback should adjustments need to be made to any aspect of the Policy.

e. In addition, as the Policy has been published in the *Diario Oficial de la Federación* as a secretariat agreement, **publicity and transparency** is guaranteed in its application. Similarly, the first result of the Policy is generation of a certificate of renewal of license or permit, which ensures the legal certainty required for the process, lending stability to the benefits emanating from it.

DTT Policy

The Digital Television Policy has taken shape as a Secretariat Agreement, published in *the Diario Oficial de la Federación* on **July 2, 2004,** and has met the legal requirements of transparency and regulatory enhancement required for these types of publication. The said document is presented below, without its preamble and annexes, which are available at the website of the Secretariat of Communications and Transportation: http://www.sct.gob.mx

AGREEMENT

ONE. The ATSC Standard A/53 is adopted for digital terrestrial transmission of television broadcasting, hereinafter Digital Terrestrial Television (DTT), which television station licensees and permit holders shall use to launch the transition to DTT on such terms and conditions as the Secretariat may establish for that purpose.

TWO. The Policy for Transition to Digital Terrestrial Television, hereinafter the "Policy," is hereby established, as follows:

a. So that the process affords legal certainty to all parties involved, short, medium, and long-term lines of action shall be established, together with objective conditions for monitoring the process, in order to evaluate its implementation and, if appropriate, reformulate the said lines of action.

b. The Policy contains the goals, requirements, conditions, and obligations for television licensees and permit holders in connection with the DTT technological transition process.

c. The Policy may be reviewed and, if appropriate, adjusted to take account of the evolution of the DTT technological transition process, and the Committee shall have responsibility for evaluating on an ongoing basis the progress of the process and preparing an annual report thereon, containing such recommendation or recommendations as may apply.

d. This Policy contains the following elements:

1. Objectives

a. Digital inclusion: To generate conditions for digital television receivers and decoders to become increasingly affordable to Mexican consumers so that society may benefit from the advantages of this technology.

b. Quality: To offer society a better television alternative with images and sound of greater fidelity and/or resolution than those now provided by analog television.

c. Strengthening of activity: To promote the healthy development of television station licensees and permit holders and related activities by incorporating terms and conditions that promote technical and legal certainty for the transition to DTT.

d. New services: To encourage the incorporation and development of new digital services, both associated with and additional to DTT, without this affecting the quality of the principal service.

e. Optimization of spectrum use: To make rational and planned use of the radio spectrum for the coexistence of analog and digital signals during the transition to DTT.

2. DTT model

DTT is a new technology that includes encoding of signals, multiplexing of signals and other data, final encoding, modulation, and transmission via the radio spectrum allocated to the television broadcasting service.

This technology has the potential to transform the existing industry so that society can reap the benefit. It is therefore felt that the model to be utilized to accomplish the proposed objectives must be flexible in order to optimize the benefit of the advantages now offered by the ATSC Standard A/53 and of those emanating from its future development and growth.

The DTT shall operate in accordance with the needs of society, for which must be promoted interaction between government and the players involved, the public, television station licensees and permit holders, public telecommunication network licensees, Standard promoters, equipment manufacturers, content producers, and educational institutions.

To ensure the continuity of analog television and implementation of the DTT transition process, an additional channel shall be used per analog channel to be used for simultaneous digital transmission of the same programming as is broadcast on the analog channel.

Provision is also made for the general public to be able to capture DTT signals using fixed receivers. Nonetheless, based on the recommendations issued by the Committee, the Secretariat shall examine the feasibility of incorporating in DTT portable and mobile television services.

DTT transmissions should be of high definition (HDTV) or enhanced definition (EDTV) quality. In addition, to launch digital transmissions on each additional channel, DTT must minimally have standard definition (SDTV) quality.

At the end of the third period, for all stations that have digital replication, it shall be mandatory to have HDTV or EDTV quality transmissions for at least 20% of the station's total operating time, in accordance with the provisions of their licenses or permits. With a view to greater social benefit, this should take place preferably during the peak viewing hours, with the understanding that at least one hour of such transmissions each day shall be made during peak viewing hours.

The following are defined in accordance with the recommendations issued by the ITU:

HDTV: Format 16 x 9, cinema like image quality, 1920 x 1080i resolution
EDTV: Format 16 x 9, HDTV comparable quality, with 1280 x 720p resolution
Format 16 x 9 or 4 x 3 with 704 x 480p or 640 x 480p resolution, similar to DVD
SDTV: Format 16 x 9 or 4 x 3 with 704 x 480i or 640 x 480e resolution, similar to NTSC

i = interlacing
p = progressive scan

Lastly, the model shall promote the provision of telecommunication services by television station licensees and permit holders in accordance with telecommunication legislation and regulatory provisions, without this permanently impeding the transmission of high definition programs. Accordingly, applications to provide telecommunication services which, in the event, are feasible for licensees or permit holders to provide via channels allocated to DTT without this in any way implying total or partial interruption of DTT, shall be subject to and resolved in accordance with the Federal Telecommunications Act and such other legal and regulatory provisions as may apply. The Federal Government may establish the financial consideration and, in such case, licensees or permit holders shall be obliged to pay it to the Federal Government in accordance with the legal, regulatory, and administrative provisions in force in the event its license is granted and at the time thereof.

3. Additional channels for the transition to DTT

To implement the transition to DTT, the licensees and/or permit holder must have been temporarily assigned an additional channel to be used for simultaneous digital transmissions of the programming

transmitted by each analog channel on the frequency bands corresponding to television, in accordance with the National Frequency Allocation Table and to promote technological convergence.

To ensure the availability of the radio spectrum set aside for DTT transmission, the Secretariat shall publish via the Internet the Table of Additional Channels for the Transition to DTT, which shall identify the channels available for the DTT transition process.

The aforementioned Table may be modified as the process evolves, taking account of fulfillment of obligations assumed by licensees and permit holders, as well as progress made in planning of the DTT radio spectrum.

For adequate planning of the radio spectrum and to promote its future optimization, an attempt will be made for most of the channels to be concentrated in the portion of the bands located from channels 2 to 52, seeking to avoid future assignment of analog channels above channel 52.

Assignment of new analog channels or modification of existing ones shall not affect the feasibility of use of the channels in the Table of Additional Channels for the Transition to DTT.

4. Three-year periods of the transition process

To implement the DTT transition process, a schedule shall be established for the installation and operation of digital channel equipment that establishes minimum goals for each of the periods without establishing a date on which analog transmissions are to end.

Based on the recommendations issued by the Committee, the Secretariat shall determine whether it is necessary to continue the analog transmissions of a particular station because a high level of penetration of DTT broadcasting has been achieved among the population and, if applicable, shall indicate to the licensee or permit holder the channel that shall be returned at the end of the simultaneous transmissions and shall establish the deadline for that purpose.

To that end, the Secretariat shall take into account both optimization of the radio spectrum and such proposal as the licensee or permit holder presents regarding the channel to be returned, should this apply.

The DTT transition process includes six three-year periods, which may be reviewed, each of which progressively combines presence and digital replication of the transmissions of current analog coverage.

The following are defined for purposes of this agreement:

Presence: when DTT signal transmission levels exceed the 41dBu threshold in at least 20% of the service area of the analog channel registered with the Secretariat.

Digital replication of coverage: when the aforementioned threshold is exceeded in at least 90% of the service area.

The concepts of service area and coverage area are defined based on Mexican Official Standard NOM-03-SCT1-93. In each case, the coverage area is that specified in the particular terms and conditions of each license or permit.

Accordingly, the following periods are established for the transition which, apart from the first, may be reviewed by the Secretary of Communications and Transportation based on the recommendations made by the Committee in that regard.

First period (from the date of entry into force of this Agreement until December 31, 2006)

Mexico City; Monterrey, Nuevo León; Guadalajara, Jalisco; Tijuana, Baja California; Mexicali, Baja California; Ciudad Juárez, Chihuahua; Nuevo Laredo, Tamaulipas; Matamoros, Tamaulipas; and Reynosa, Tamaulipas, with the presence of at least two commercial digital signals.

Second period (January 1, 2007 to December 31, 2009)
Digital replication of the commercial signals of the first period.
Presence of commercial digital signals in coverage areas of at least 1.5 million inhabitants.

Third period (January 1, 2010 to December 31, 2012)
Digital replication of the signals of the second period.
Presence of non-commercial digital signals in coverage areas of at least 1.5 million inhabitants.
Presence of commercial digital signals in coverage areas of at least 1 million inhabitants.

Fourth period (January 1, 2013 to December 31, 2015)
Digital replication of the digital signals of the third period.
Presence of non-commercial digital signals in coverage areas of at least 1 million inhabitants.
Presence of commercial digital signals in coverage areas of at least 500,000 inhabitants.

Fifth period (January 1, 2016 to December 31, 2018)
Digital replication of the signals of the fourth period.
Presence of non-commercial digital signals in coverage areas of at least 500,000 inhabitants.
Presence of commercial digital signals in coverage areas of at least 150,000 inhabitants.

Sixth period (January 1, 2019 to December 31, 2021)
Digital replication of all analog channels in all coverages areas served by analog television.

The Secretariat shall publish via the Internet the list of licensee and permit holder television stations in accordance with the period in which they are to have digital signals, taking account of the information in the 2000 INEGI census.

Stations for which permits and licenses have been issued whose operation is financed mainly from federal or state funds shall be considered non-commercial stations only for the purposes of this Policy.

5. Monitoring, review, and adjustments of the process

The DTT transition process shall include objective terms and conditions for monitoring the process in order to evaluate its implementation and, if appropriate, to adjust the lines of action established in this Policy.

To that end, the Committee shall conduct evaluations of implementation of the DTT transition process, for which it shall take account of, inter alia, the following factors:

i. Investments made;
ii. Receiver market, penetration, availability, and price of receivers and DTT-related equipment;
iii. Transmitter equipment in operation and available on the market, and its cost and characteristics;
iv. Advertising market;
v. Information from surveys;
vi. Censuses and their projections;
vii. Size of audience for programs transmitted via DTT broadcasting;
viii. Economic capacity of the population, including GDP, published by the Bank of Mexico;
ix. Number of television stations for which licenses or permits have been issued; and
x. International experiences.

So that the Committee has the information necessary to evaluate implementation of the process, licensees and permit holders who have been authorized to use at least one additional channel for the transition to DTT shall present to the Secretariat in January each year, starting on January 1, 2007, the required information contained in Annex I to this Policy.

After the end of the first period, the Committee shall issue to the Secretary of Communications and Transportation, by April each year, a report on the immediately preceding year containing such recommendation or recommendations as may apply. The Secretariat shall publish via the Internet, by May of the corresponding year, a version of the said report containing the information considered public in the terms of the Federal Transparency and Access to Public Governmental Information Act and, if necessary, shall make adjustments to this Policy.

6. Necessary adjustments to licenses and permits

As the transition to DTT is a long-term process requiring temporary use of a digital channel in addition to the analog channel currently used to provide the service, licensees and permit holders must have the conditions of legal and technical certainty necessary to implement that transition.

It is therefore necessary to:

a. Establish that the life of the licenses and permits coincides with the periods set out in Section 4 of this Policy;
b. Adjust the terms and conditions of license and permits to include provisions related to the transition process based on equity and transparency; and
c. Incorporate the procedure to be used to authorize the temporary use of an additional channel.

These actions shall be implemented based on the applicable legal and administrative provisions and the Terms and Conditions regarding New Technologies included in the licenses and permits, which establish that licensees and permit holders are obliged to implement the technology or technologies decided by the Secretariat. To that end, they shall observe and carry out all actions within such periods and in accordance with such terms and conditions as the Secretariat itself may indicate to them in order to ensure the technical efficiency of the transmissions.

New licenses or permits shall contain the Terms and Conditions regarding New Technologies and, in addition, all terms and conditions thereof shall be consistent with this Policy and the applicable legal provisions, in accordance with their nature and purposes. Licenses or permits which, if applicable, are granted by the Secretariat after the entry into force of this Agreement shall be subject to the obligations of presence or digital replication, as applies, taking account of the coverage area and the corresponding periods, in accordance with the provisions of Section 4 hereof.

6.1 Procedures and periods to request renewal of license or permit based on this Policy

6.1.1 Procedures

Licensees and permit holders seeking renewal shall present their applications, including the information indicated in Annex II of this Policy.

The Secretariat shall dispose of the request for renewal in accordance with the provisions of the Federal Radio and Television Act, its regulations, and the applicable legal provisions.

The terms and conditions of the certificate of renewal of licenses or permits that apply to licensees and permit holders who undertake to transition to DTT shall be established in accordance with Annexes III

and IV of this Policy, as applies. The life of such licenses or permits shall coincide with the end of the sixth three-year period indicated in Section 4 hereof.

6.1.2 Deadlines for applications for renewal

Apart from the first period, licensees and permit holders shall request the corresponding renewal and indicate their commitment to transition to DTT prior to the start of the period in which they are to have digital signals, in accordance with the provisions of Section 4 hereof.

To that end, the alternatives for applying for renewal of a license or permit are:

a. As of the publication of this Policy, provided commitments are given to transition to DTT; or

b. By no later than one year prior to the expiration of its current life, provided that the period has not yet begun in which the licensee or permit holder is to have digital signals.

Licensees or permit holders who select option (b) and at the time are not in a position to give their undertakings to transition to DTT may request their renewal to continue soldly with analog transmissions. In this case, the life of the renewal may not exceed the first year of the period in which the licenses or permit holder is to have digital signals, this without prejudice to the licensee or permit holder's ability to give its commitments to transition to DTT at any time prior to the expiration of the license, in which case, the provisions of Section 6.1.1 shall apply.
Licensees corresponding to the first period shall request renewal by no later than January 1, 2005.

6.2 Procedure for use of additional channels for DTT

To implement the DTT transition process, a procedure must be established for temporary assignment of an additional channel to make simultaneous digital transmissions of the programming transmitted by each channel making analog transmissions, taking into account the provisions of Section 3 of this Policy. Annexes III and IV of this Policy contain this procedure.

The Secretariat shall publish via the Internet the list of authorized digital channels, identifying whether they are in the process of installation or in operation, their technical characteristics, and the corresponding licensee or permit holder. In order to facilitate the relationship between analog stations and their corresponding additional digital channel equipment, the same call sign shall be used, but ending in "DTT".

7. Failure to comply with this Policy

7.1 Failure to give commitments to transition to DTT

Apart from the first period case, licensees and/or permit holders that do not give commitments to transition to DTT through application for renewal prior to the start of the period in which they are to have digital signals in accordance with the provisions of Section 4 of this Policy shall be deemed to have failed to comply with their obligations established in the Terms and Conditions regarding New Technologies in their license or permit.

First period licensees shall apply for renewal by no later than January 1, 2005. Failure to do so shall be deemed failure to have complied with their obligations established in the Terms and Conditions regarding New Technologies in their license.

The foregoing shall be grounds for non-renewal of their respective licenses or permits and, consequently, upon their respective expirations, the licensee or permit holder so deemed shall suspend its operations and dismantle its installations belonging to the corresponding station.

The Secretariat may dispose of the respective channels and shall take the actions necessary to ensure that the population included in that coverage area has analog and digital television signals, in accordance with the status of the evolution of the transition to DTT.

7.2 Failure to comply with commitments made for the transition to DTT broadcasting

Although the commitments to transition to DTT may be reviewed in accordance with the provisions of Section 5 of this Policy, should the licensee or permit holder not comply therewith on three occasions during the life of its corresponding license, the Secretariat shall, without just cause, institute the procedure for revocation and imposition of such financial sanctions as may correspond in accordance with the provisions of the Federal Radio and Television Act and its license or permit certificate, as applies.

Once the revocation procedure has been concluded, the Secretariat may dispose of the corresponding channels and shall take the actions necessary to ensure that the population in this coverage area has analog and digital television signals, in accordance with the status of the evolution of the transition to DTT.

7.3 Provision of telecommunication services without the corresponding license or permit in accordance with the Federal Telecommunications Act

Television licensees or permit holders who provide telecommunication services without the license or permit in accordance with the provisions of the Federal Telecommunications Act and applicable legal provisions shall forfeit to the Nation the assets, installations, and equipment used in committing the said infractions.

8. Digital television receivers

In order to promote the acquisition of digital television receivers on the best terms of quality, diversity, timeliness, availability, and price, the corresponding actions shall be decided and initiated with equipment manufacturers, sellers, and distributors.

In addition, participation by other players in the process shall be promoted, such as restricted television service licensees, licensees in the area of distribution of HDTV and DTV content and of the promotion of convergence; technology developers in order continually to update the Standard and maintain a high level of involvement in the Standard's evolution; manufacturers of DTT related-equipment in order to promote access to technologies by licensees and permit holders; content producers to develop programming that takes advantage of the possibilities afforded by the technology; and educational institutions with a view to levels of training and development consistent with the evolution of the technology so that the country may reap the benefit.

5.6 United States

As detailed in Section 2, in 1987 the U.S. government began the process of developing an advanced television standard in order to ensure that free over-the-air broadcasters had a means to improve the technical quality of their service, and to provide new, innovative services, in order to compete effectively with programming delivered by competing cable and satellite services. The U.S. experience is a remarkable example of an 18-year-long cooperative endeavor by government and industry to develop and deploy innovative new technology that provides quantum improvements in the quality and quantity of

television services and revolutionary new capabilities for information services, including interactive services, that can address important social goals.

As detailed in Section 3, the government made important guiding policy decisions at key points in this 18-year process, but relied on the private sector for billions of dollars of investment in research and development that led to technical recommendations for a DTT standard based on an open process involving more than one thousand industry volunteers. HDTV was the initial focus of this effort, and it remains the centerpiece application of DTT in the U.S. But in the course of this endeavor, an all-digital system was developed, which provides revolutionary capabilities that go far beyond HDTV.

Once the key policy decisions were made by the FCC, and once the DTT standard was developed under the auspices of the FCC's Advisory Committee (ACATS), documented by the ATSC and then formally adopted by the FCC, commercial DTT broadcasts began in November 1998. Under the FCC's transition plan, DTT broadcasting was launched first by the major networks in the largest cities, and later in the smaller cities, with all stations required to be on the air by May 2003. Since 1998 the costs of broadcast transmission equipment have fallen considerably, making the transition more affordable for smaller stations. At the same time, the amount of HDTV and other value-added DTT programming has increased dramatically, while the prices of digital television sets and set-top boxes have dropped precipitously, making HDTV and other DTT applications much more affordable for consumers.

Implementation Progress

Now, seven years since the service was launched in ten U.S. cities, DTT broadcasting is moving ahead at a feverish pace. More than 1,500 DTV stations are on the air in 211 metropolitan areas, reaching 99.99% of U.S. television households with at least one digital signal. More than 90% of households have access to at least five digital signals, and more than 80% have access to at least eight. In the largest U.S. cities, as many as 23 digital stations are on the air.

HDTV programming is widely available, not only via DTT broadcasts, but over cable and satellite systems as well. The widespread availability of HDTV programming by cable and satellite is important, because more than 80% of TV households subscribe to such services, at least for their main television. DTT broadcasting is also very important, because many of the multiple sets in cable and satellite households are not connected to these services. Indeed, approximately 35% of TV sets in the U.S. still rely on free over-the-air reception. But the wide and growing availability of HDTV programming via cable and satellite services has helped to create a critical mass of programming that has made HDTV receivers attractive to consumers.

Manufacturers throughout the world have responded to this demand by developing and marketing more than 750 different models of HDTV and other ATSC DTT consumer products, using a wide variety of new display technologies. Competition is frenzied, with prices continuing to fall rapidly and sales skyrocketing. Between late 1998 and June 30, 2005 approximately 20 million units of DTT consumer products had been sold in the U.S. alone, representing a consumer investment of approximately US$31 billion. Moreover, sales are continuing to grow exponentially, with projected unit sales for 2005 roughly equivalent to the cumulative unit sales of all prior years.

Standard-definition (SDTV) integrated 27" ATSC receivers are now available for as little as US$299, and integrated 27" HDTV receivers for as little as US$450. Indeed, prices for HDTVs are converging rapidly with those for analog color TVs. It is no longer possible to purchase a large-screen analog color TV in the U.S. They have all been replaced by digital HDTVs. This trend will accelerate and spread to smaller screen sizes over the next few years as the phase-in of the FCC's tuner mandate is completed. Under this regulation, virtually all television receivers sold in the U.S. must have ATSC tuning and decoding capability by July 2007. As a result, by 2007 *34 million* ATSC receivers per year will be sold in the U.S. alone, with cumulative sales reaching *152 million* by 2009. Such massive sales volumes will further drive down the price of ATSC receivers, such that many experts believe that within three or four years, virtually all TV sets sold in the U.S. will be HDTVs, because they will cost no more than analog color TVs by that time, even at the smaller screen sizes.

New Services

In addition to HDTV, broadcasters in the U.S. are using DTT to provide innovative packages of new services. Some broadcasters are providing multiple simultaneous programs of SDTV. This is especially important for public broadcasters in achieving their goals to support public education, providing multiple education programs instead of just one program at one time. Many commercial broadcasters are now offering a main program in HDTV, plus another SDTV program showing 24-hour news or weather, and sometimes offering an SDTV 24-hour weather radar map. Some broadcasters are also pooling their excess capacity to offer basic pay-TV platforms in competition with cable and satellite systems.

Broadcasters are also beginning to offer various data services using the ATSC family of standards, including interactive information services. (The worldwide leaders in the provision of such services are broadcasters in South Korea, who will launch commercial interactive services on December 1, 2005 using the newly finalized ATSC Advanced Common Application Platform (ACAP) Standard. Televisa in Mexico has also recently demonstrated interactive information services using the ATSC ACAP Standard.)

Projected End of the DTT Transition

As explained in Sections 2 and 3, the U.S. government wants to complete the transition to DTT broadcasting as rapidly as possible, in order to free up extremely valuable nationwide spectrum that can be used to promote public safety and national security, and to support new wireless services that will be engines of economic growth for decades to come. To hasten the end of analog transmissions, the U.S. Congress has urged the development of an inexpensive digital-to-analog set-top converter box that will permit consumers to view DTT signals on their existing analog TV sets. Several manufacturers have responded, indicating that they can provide such a converter at a cost of US$50 by 2008, if sold in large quantities.

Economies of Scale and Social Inclusion

As policy makers in the U.S. and throughout the Americas have stated, the availability of inexpensive DTV receivers and set-top boxes that can be used to deliver innovative digital services to existing analog TVs is a crucial requirement for ending the transition in the U.S. and for ensuring that all socio-economic classes throughout the Americas enjoy the benefits of digital broadcasting services. The most important factors in driving down the costs and prices of such consumer products are not how much processing or how much memory is included, but rather how many million units can be sold. By adopting the ATSC Standard, countries throughout the Americas can take advantage of the tremendous economies of scale already seen in the U.S., ensuring the lowest possible prices for consumer products in their countries and thereby ensuring a rapid and successful transition to digital television, while bringing innovative information services to all their citizens, including millions who may never own a personal computer.

Continued Receiver Improvements

Early experience in some U.S. cities, as well as tests conducted in Brazil in 1999-2000 demonstrated certain inadequacies in the ability of the first ATSC receivers to handle multiple reflected signals ("multipath impairments"). The early receivers were first- and second-generation receivers, and now fifth-generation receivers are being deployed in commercial products. These latest receivers have completely overcome the inadequacies in those early receivers. Indeed, recent tests in Canada and Brazil have demonstrated the remarkable improvements in ATSC receivers since 1999.

Portability and Mobility

DTT reception by portable receivers, e.g., with small indoor antennas, has been an important consideration in the U.S. throughout its planning and implementation of DTT broadcasting. The ATSC Standard has always had a significant advantage in this regard, because of its ability to keep working with much weaker signals than the competing systems used in Europe and Japan. Portable or indoor reception is now even better due to dramatically improved ability of ATSC receivers to handle multipath impairments.

Mobile reception, i.e., successful operation with fast-moving receivers, has not been of great interest to U.S. broadcasters, and as such, the ATSC Standard was not originally designed to provide this type of reception. Rather, the goal was to deliver the largest possible payload data rate to the largest service area, to ensure that broadcasters could reach the largest possible audience with the highest quality and the greatest quantity of HDTV, SDTV and information services, along with associated mulit-channel audio. For any system, providing reliable mobile reception requires a significant reduction in the payload bit rate, and U.S. broadcasters did not want to sacrifice these services provided to millions of viewers so that a relative handful could get a single SDTV service in cars, buses or trains. Nevertheless, high-quality mobile reception is expected to be possible with the ATSC Standard within the next few years, because of continued rapid advances in ATSC/VSB receivers; the use of enhanced VSB to allow operation at even weaker signal levels; the use of multi-transmitter, single-frequency networks that have now been deployed using the ATSC Standard for synchronized transmission systems; and the use of advanced audio and video coding techniques.

Conclusion

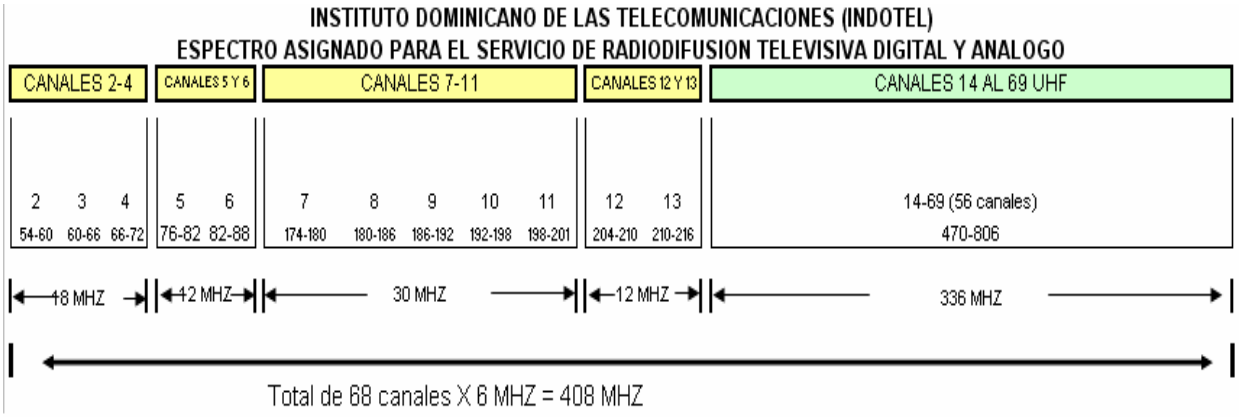
The implementation of digital television service based on the ATSC family of standards is moving ahead dramatically in the U.S. (and in Canada and South Korea as well, with commercial services to be launched in Mexico before the end of this year). HDTV is firmly entrenched, and is beginning to replace analog color television at a rapid pace. SDTV multicasting and information services are also being developed, as broadcasters learn to take full advantage of the rich possibilities of DTT broadcasting using the ATSC family of standards. A cornucopia of dazzling new consumer products is available, at rapidly falling prices that make DTT receivers affordable for all socio-economic classes. Continuing improvements in ATSC receivers and further extensions and new additions to the ATSC family of standards are laying the groundwork for additional new services and applications in the future.

The U.S. is now entering the final stages of its transition to digital television broadcasting, and the U.S. government is planning for the end of analog transmissions and the recovery of extremely valuable spectrum that will support new wireless services that will be engines of economic growth for decades to come.

5.7 Dominican Republic

Background

On the first of August, 1952, HITV station, the radio television palace of the Dominican voice was inaugurated, making the Dominican Republic the fourth country in the American Continent to install a television channel. It included an RCA Victor transmitter with five kilos of image and two and a half kilos of audio. This installation was carried out with a group of renowned experts, such as the American engineer, George K. Graham, from the Radio Corporation of America, and engineer Williard T. Hanson, from RCA. Logically, the standard used was the NTSC system, first implemented by the United States, Mexico, Cuba, and then by the Dominican Republic. Currently a total of 408 MHz of broadband access, comprised of frequencies from 54-806 MHz, have been assigned for the television broadcasting service.



Today the Dominican Republic has 43 television channels, in both VHF and UHF, in an area of approximately 48,000 square km. This has made the Dominican Republic one of the countries with the greatest number of channels assigned by territory, for a population of less than 10,000 million inhabitants.

Future and present plans

Following up on the guide approved by the CITEL at the III Meeting of the Permanent Consultative Committee (PCCII), celebrated on December 9, 2004, in the city of Buenos Aires, Argentina, in August of this year the government of the Dominican Republic held a national forum on the implementation of digital terrestrial television (DTT), with the goal of advancing actions of support for the Dominican Republic to initiate the transition process from analog to digital broadcasting. Experts from such countries as the United States, Brazil, Argentina and Cuba shared their experiences at the forum.

This event provided an opportunity for public and private sectors and representatives of the television industry to come together. The result was a successful exchange of comments, opinions and concerns, while standards such as ATSC and DVB were studied. In addition to the Administration's efforts, the private sector has initiated its own investigations, evaluations and technical training in order to prepare for the adoption of a new standard.

It is important to emphasize the advantages that can be obtained through the digital system. In addition to the commercial aspect, we can make a more efficient use of the spectrum and offer populations that currently lack effective information and basic education access to various services. For example, techniques currently exist that make it possible for free data information services to reach the poorest sectors. Such a public television service in a digital system would greatly contribute to distance learning.

A very important point that we should take into account is to weigh whether or not to make a radical change in an entire system that has now been operating for several decades, since this could signify large economic penalties for our countries. For example, with respect to television receivers, one way to make the adoption of the system faster and more feasible is through the mass production of receivers and transmitters in order to lower costs, which, for the Dominican Republic, represents an investment of approximately one million receivers in addition to totally equipping all of the television stations.

Finally we understand that it is preferable to adopt a common standard for the entire American Hemisphere in favor of the large investments existing in the facilities of the television channels and receivers each country currently possesses.

5.8 Bolivarian Republic of Venezuela

To select the standard to be adopted for DTT implementation in Venezuela, the National Telecommunication Commission (CONATEL) developed a digital television project based on studies for implementation of this service, with a view to DTT implementation in Venezuela in the medium term.

The DTT project was divided into three phases, principally to ensure methodical adoption of the DTT standard for Venezuela.

Phase 1:
This phase included preparation of a general technical report on the main DTT standards to determine which standard met the country's needs and requirements. The report covered the following topics:

- A technical study of existing DTT standards
- Evaluation of other countries' experiences
- Financial study
- Verification of the spectrum for which concessions have been awarded that is attributed to the open television service.

The technical study of DTT implementation standards was based on a study of the main elements of each, ranging from the digitization itself utilized in television studies to compression standards. It also compared the advantages and disadvantages of digital and analog television transmission.

A simulation of each DTT standard was made to visualize the transmission, operation, and behavior of the types of modulation it uses, in order to duly recommend the most robust and flexible standard in accordance with conditions present in Venezuela.

A general financial review was also made of each standard, covering the equipment each technology utilizes in for its implementation, underscoring the receivers each offers.

Phase 2:
This phase included a public consultation for the sector concerned (television stations, DTT equipment manufacturers, firms interested in the sector, universities, etc.). The consultation took account of the different arguments:

- A round table on existing standards
- Active participation in international organizations
- Equipment manufacturers and distributors
- Telecommunication regulatory entities in other countries

This phase is now very advanced. A working group meeting was held, chaired by CONATEL, in which television media representatives in Venezuela participated to observe the advantages and benefits of implementation of this new technology.

In addition, in October 2001, a roundtable was held, which discussed with providers of this technology worldwide the strengths and weaknesses of the different standards.

Recently, specifically in August and October 2005, further meetings were held with representatives of the DVB system (European), ATSC (United States), universities, open television operators, the Users Committee, and the regulatory body, to plan pilot tests for these standards.

In the case of ISDB (Japanese), steps are being taken to conduct tests using this DTT system.

Phase 3:

The objective of this phase will be to establish adequate procedures for appropriate implementation of the technological transition to digital television in Venezuela. Both experimental and regulatory experiences will be generated:

- Conduct of pilot tests
- Examination and definition of the transition to the digital television system
- Adjustment of the regulatory framework

6. Examples of DTT Services, Applications and Implementation Approaches
6.1 CBS (Attachment 6-1)
6.2 WRAL (Attachment 6-2)
6.3 APTS (Attachment 6-3)
6.4 TV Globo (Attachment 6-4)
6.5 Televisa (Attachment 6-5)
6.6 Implementation Approaches and Cost Implications
6.7 Others

Appendix 1

ATSC Standards, Recommended Practices, and Implementation Guidelines

1.1. Overview of ATSC Standards and Standards Activities (Appendix 1-1)
1.2. Guide to DTV Standards (Appendix 1-2) (CCPII-RADIO-0407/04)
1.3. ATSC Standard A/52B: Digital Audio Compression (AC-3) Standard, Rev. B (Appendix 1-3) (CCPII-RADIO-0533/04)
1.4. ATSC Standard A/53C with Amendment No. 1: ATSC Digital Television Standard, Rev. C (Appendix 1-4) (CCPII-RADIO-0526/04)
1.5. ATSC Recommended Practice A/54A: Guide to the Use of the ATSC Digital Television Standard (Appendix 1-5) (P2-0331/01)
1.6. Approved Proposed Standard A/57A: Content Identification and Labeling for ATSC Transport (Appendix 1-6) (CCPII-RADIO-0238/03)
1.7. ATSC Standard A/64A: Transmission Measurement and Compliance for Digital Television, Rev. A (Appendix 1-7)
1.8. ATSC Standard A/65B: Program and System Information Protocol for Terrestrial Broadcast and Cable, Rev. B (Appendix 1-8) (CCPII-RADIO-0239/03)
1.9. ATSC Recommended Practice A/69: Program and System Information Protocol Implementation Guidelines for Broadcasters (Appendix 1-9) (CCPII-RADIO-0240/03)
1.10. ATSC Standard A/70A: Conditional Access System for Terrestrial Broadcast, Rev. A (Appendix 1-10) (CCPII-RADIO-0527/04)
1.11. ATSC Standard A/76: Programming Metadata Communication Protocol Standard (Appendix 1-11) (CCPII-RADIO-0528/04)
1.12. ATSC Standard A/80: Modulation and Coding Requirements for Digital TV (DTV) Applications Over Satellite (Appendix 1-12) (P2-0339/02)
1.13. ATSC Standard A/81: Direct-to-Home Satellite Broadcast Standard (Appendix 1-13) (CCPII-RADIO-0241/03)
1.14. ATSC Standard A/90 with Amendment 1 and Corrigendums 1 and 2: Data Broadcast Standard (Appendix 1-14) (CCPII-RADIO-0242/03)
1.15. ATSC Recommended Practice A/91: Implementation Guidelines for the Data Broadcast Standard (Appendix 1-15) (P2-0460/02)
1.16. ATSC Standard A/92: Delivery of IP Multicast Sessions over Data Broadcast Standard (Appendix 1-16) (P2-0462/02)
1.17. ATSC Standard A/93: Synchronized/Asynchronous Trigger Standard (Appendix 1-17) (P2-0463/02)
1.18. ATSC Standard A/94: ATSC Data Application Reference Model (Appendix 1-18) (CCPII-RADIO-0243/03)
1.19. ATSC Standard A/95: Transport Stream File System Standard (Appendix 1-19) (CCPII-RADIO-0244/03)
1.20. ATSC Standard A/96: ATSC Interaction Channel Protocols (Appendix 1-20) (CCPII-RADIO-0407/04)
1.21. ATSC Standard A/100: DTV Application Software Environment - Level 1 (DASE-1)
    1.21.1. A/100-1, DASE-1 Part 1: Introduction, Architecture, and Common Facilities (Appendix 1-21.1) (CCPII-RADIO-0248/03)
    1.21.2. A/100-2, DASE-1 Part 2: Declarative Applications Environment (Appendix 1-21.2) (CCPII-RADIO-0248/03)
    1.21.3. A/100-3, DASE-1 Part 3: Procedural Applications and Environment (Appendix 1-21.3) (CCPII-RADIO-0248/03)
    1.21.4. A/100-4, DASE-1 Part 4: Applications Programming Interface (Appendix 1-21.4) (CCPII-RADIO-0248/03)

1.21.5. A/100-5, DASE-1 Part 5: ZIP Archive Resource Format (Appendix 1-21.5) (CCPII-RADIO-0248/03)
1.21.6. A/100-6, DASE-1 Part 6: Security (Appendix 1-21.6) (CCPII-RADIO-0248/03)
1.21.7. A/100-7, DASE-1 Part 7: Application Delivery System - ARM Binding (Appendix 1-21.7) (CCPII-RADIO-0248/03)
1.21.8. A/100-8, DASE-1 Part 8: Conformance (Appendix 1-21.8) (CCPII-RADIO-0248/03)
1.22. ATSC Candidate Standard CS/T3-606 Revision A: Amendment No. 1 to ATSC Standard: Program and System Information Protocol for Terrestrial Broadcast and Cable (Doc. A/65B) (Appendix 1-22) (CCPII-RADIO-0530/04)
1.23. ATSC Candidate Standard CS/T3-608 Revision A: Amendment to ATSC Digital Television Standard, Doc. A/53C (AVC/H.264 Version) (Appendix 1-23) (CCPII-RADIO-0531/04)
1.24. ATSC Candidate Standard CS/T3-609 Revision A: Amendment to ATSC Digital Television Standard, Doc. A/53C (VC-9 Version) (Appendix 1-24) (CCPII-RADIO-0407/04)
1.25. ATSC Candidate Standard CS/T3-614 Revision A: Amendment to ATSC Digital Television Standard, Doc. A/53C, Annex G: High Efficiency Audio System Characteristics (Appendix 1-25) (CCPII-RADIO-0532/04)
1.26. ATSC Candidate Standard CS/101: Advanced Common Application Platform (ACAP) (Appendix 1-26) (CCPII-RADIO-0407/04)
1.27. ATSC Standard A/110: Synchronization Standard for Distributed Transmission (Appendix 1-27) (CCPII-RADIO-0529/04)
1.28. ATSC Recommended Practice A/111: Design Of Synchronized Multiple Transmitter Networks (Appendix 1-28) (CCPII-RADIO-0534/04)
1.29. ATSC Recommended Practice A/58: Harmonization with DVB SI in the Use of the ATSC Digital Television Standard (Appendix 1-29)
1.30. ATSC Recommended Practice A/75: Developing DTV Field Test Plans (Appendix 1-30) (P2-059/02)
1.31. Implementation Finding: Multichannel Audio Program Delivery and Metadata Considerations (Pre-emission) (Appendix 1-31) (CCPII-RADIO-0535/04)
1.32. Implementation Finding: Optimization of Image Formatting for Transmission and Display (Appendix 1-32) (CCPII-RADIO-0536/04)
1.33. Implementation Finding: Relative Timing of Sound and Vision for Broadcast Operations (Appendix 1-33) (CCPII-RADIO-0407/04)
1.34. Assessment of Data Content and Delivery for Control of the Digital Broadcast Transport Stream and PSIP Generation (Appendix 1-34)
1.35. Implementation Finding: Report on Latency and Timing Issues (Appendix 1-35)
1.36. Implementation Finding: DTV Frequently Asked Questions (Appendix 1-36)
1.37. Implementation Finding: DTV Transport and Data Interfaces (Appendix 1-37) (CCPII-RADIO-0538/04)
1.38. Implementation Finding: Essential Information to be Carried in DTV Program Streams (Appendix 1-38)
1.39. Implementation Finding: Program Interchange Identification Requirements and Solutions (Appendix 1-39)
1.40. Implementation Finding: PTS Time Stamping AC-3 Bit Streams (Appendix 1-40)
1.41. Implementation Finding: Implementation of Data Broadcasting in a DTV Station (Appendix 1-41) (P2-0348/01)
1.42. Implementation Finding: Top Down Summary Report (Appendix 1-42) (P2-0341/01)
1.43. ATSC: Frequently asked questions (CCPII-RADIO-0407/04)
1.44. ATSC DTV tutorial (CCPII-RADIO-0620/05)
1.45. ATSC standard A/97: software download data service (CCPII-RADIO-0618/05)
1.46. Proposed standard: Advanced Common Applications Platform (ACAP) (CCPII-RADIO-0619/05)
1.47. ATSC Candidate standard CS/T3-608 revision B: Amendment to ATSC digital television standard, doc. a/53c (AVC/H.264 version) (CCPII-RADIO-0621/05)

1.48. ATSC standard Digital television standard (a/53), revising d, Including amendment no. 1(Document A/53D, 27 July 2005)