Digital TV Spectrum Requirements

WP4: Status of Digital TV Spectrum in Latin America

Report for GSMA

2205/DTVS/TN/4.2/5

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1 STATUS OF DIGITAL TV IN THE LATIN AMERICAN REGION

1.1 Introduction

This report provides a review of the current status of planning for digital TV switchover in Latin America, with a specific focus on five countries, namely Brazil, Mexico, Colombia, Chile and Argentina. This introductory chapter provides a brief overview of the current status of digital TV spectrum in Latin America and compares the available technologies. The second chapter provides more in-depth analysis of the situation in each of the five countries.

1.2 Technology

The Latin American region is unusual in that there is no common, harmonised standard for digital TV in the region. Those countries that have so far decided on a technology have opted for one of three standards, namely SBTVD (Sistema Brasileiro de Televisão Digital, a variant of the Japanese ISDB-T standard), the European DVB-T standard or the North American ATSC standard. Brazil's decision in 2006 to adopt its own version of the Japanese ISDB-T standard and subsequent lobbying by Brazil and Japan has led to a number of other countries (including Argentina and Chile) following suit and SBTVD is set to become the dominant standard in South America. Colombia, Panama, Uruguay and French Guyana have meanwhile opted for the European DVB-T standard. ATSC has so far been adopted only in Mexico and Honduras, whilst other countries in the region have yet to decide on a standard.

Figure 1: Proposed standards for digital TV:

1.3 How the standards compare

The three standards deployed in Latin America have a great deal in common; particularly the use of the algorithms and structures provided in the MPEG-2 /MPEG-4 compression specifications. However, **ATSC** is somewhat inflexible, having been optimised specifically for the US market (with single TV stations serving large rural areas). In particular, the lack of support for single frequency networks (SFNs) and the use of MPEG-2 coding for HDTV results in relatively poor spectrum efficiency.

The **DVB-T** system is both more flexible and more robust, allowing transmissions to be tailored to particular circumstances. If used (as in Australia) to provide HDTV services with MPEG-2 coding, spectrum efficiency is rather poor; local variations of the standard (as in e.g. France and likely to be the case in Colombia) are adopting the MPEG-4 codec, however, which approximately doubles the capacity of each frequency. The DVB-T2 standard combines this codec with a more efficient coding and modulation scheme, allowing optimal efficiency with approximately 50% improvement over conventional DVB-T with MPEG-4.

The **ISDB-T** system has the versatility of DVB-T, coupled with an integrated means of delivering mobile TV services to small terminals. The international version which will be deployed in Latin America also integrates the more efficient MPEG-4 video coding into the standard, which as with DVB-T doubles the capacity of each frequency. The Argentinean Government's digital TV project has identified four options for multiplex configuration using the ISDB-T standard, namely:

i) 1 HD (1080 line interlaced) + 1 SD channel
ii) 1 HD (720 line progressive) + 2 SD channels
iii) 2 HD (720 line progressive) channels
iv) 5 SD channels

In each case there is also capacity for one mobile TV channel and one interactive data channel, which use approximately the same capacity as a single SD channel (hence there is in principle scope for up to 6 SD channels per multiplex).

1.4 Channel Plan

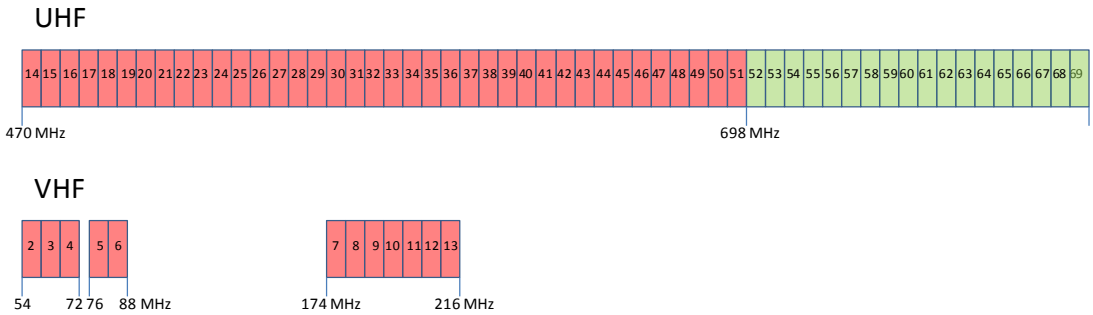
Latin America is in ITU Region 2; hence frequencies above 698 MHz are allocated on a co-primary basis to the Mobile service and have been identified for use by administrations wishing to implement IMT services. Frequencies above 806 MHz are already allocated to mobile throughout the region.

The TV channel plan for the VHF and UHF bands is based on 6 MHz frequency channels, as illustrated below. There are currently a total of 68 frequency channels allocated to TV broadcasting, which will reduce to 50 if the spectrum above 698 MHz is made available for mobile use. In bandwidth terms this equates to 300 MHz, which

is slightly more than the 256 MHz that has been reserved for digital terrestrial TV in the UK and the same as is currently available in the USA.

So far only two of the countries under consideration (Mexico and Chile) have stated their intention to release channels 52-69 for non-broadcast use, others appear to be undecided. In some countries (e.g. Columbia and Chile) channels 14-20 (470 – 512 MHz) are not currently used for broadcasting, although Colombia has announced its intention to release these frequencies for digital TV. Note that in some countries not all the internationally allocated spectrum is available for broadcasting. For example, in Argentina and Chile UHF channels 14-20 inclusive are not currently available.

Figure 2 TV channel frequency plan for Latin America



1.5 Switchover schedule

Completion of the switchover process in the Latin American region is likely to be many years behind other major markets such as the USA and Europe. Most countries are planning lengthy periods of dual illumination, though in some cases (such as Brazil) a phased geographic approach means that some of the more populous areas may switch off analogue services relatively early. Unfortunately the more rural areas that are likely to gain particular benefit from the release of lower frequencies for mobile are likely to be the last where these will become available. The continuing presence of analogue services is likely to be the biggest obstacle to releasing spectrum for non-broadcast uses in the medium term

Table 1: Planned digital switchover schedules

Country	Start Date	Completion	Comments
Brazil	2002	2016	Extensive use of UHF band by analogue transmitters
Mexico	2004	2022	Six phase geographic approach planned.
Colombia	2010	2019	Plans to make additional spectrum available in 470-512 MHz band to facilitate digital rollout; should help with release of 700 MHz frequencies.

Chile	2010	2019	Very few existing analogue transmissions in UHF band so likely to be better placed to release spectrum early
Argentina	2010	2019	Rollout commencing May 2010, 95% coverage target by end of 2012, remainder to be served by satellite. Some existing digital pay TV services operate in UHF band.

1.6 Existing Analogue services

The demand for spectrum to support digital TV is likely to reflect the existing analogue TV market, in that each major network will probably require its own digital service, probably including HD capability in the longer term. The table below summarises the current status of analogue broadcasting in each of the countries under consideration:

Table 2 Status of analogue broadcasting in the countries under consideration

Country	Networks	Comments
Brazil	7	Also a number of local networks serving main population centres
Mexico	2	A large number of local and regional stations also exist. One of the two national networks currently broadcasts two analogue stations
Colombia	6	Plus 7 regional and 48 local TV stations
Chile	5	Additional 30 local stations
Argentina	7	2 national public stations plus 5 main private stations (not all have national coverage). There are also a number of local free to air stations and a large number of subscription TV channels which broadcast in the UHF band, some in digital format.

1.7 Status of 698 – 806 MHz (channels 52-69)

The table below shows the current status of the frequencies above 698 MHz in each of the countries under consideration. Two of the countries (Columbia and Chile) have already announced their intention to release the band for mobile use and a third (Mexico) plans to consult on this during 2010. In Brazil, frequencies above 746 MHz are only used for low power relay stations, which could facilitate early release of at least part of the spectrum (corresponding to the US upper 700 MHz band blocks C

and D) in some geographic areas. There is currently no information on the status of the band in Argentina; however we do not consider that these frequencies will be required for TV once analogue services cease.

In general, these frequencies are currently used for analogue TV; however in most cases they are relatively lightly used compared to the VHF and lower UHF frequencies. For example, in Chile, access to the UHF band has been frozen since 2000 and the band is effectively reserved for digital services, so the spectrum could be released relatively quickly.

Table 3: Status of 700 MHz band in countries under consideration

Country	Status
Brazil	Spectrum above 746 MHz (channel 61) is currently reserved for low power relay stations in the NFAT. No decision yet made on future allocation of this spectrum but digital channels assigned so far appear to be below 690 MHz.
Mexico	Release of spectrum for mobile use will be considered by the regulator (Cofetel) during 2010.
Colombia	Government Resolution has been issued committing to releasing the 700 MHz band for mobile services, to be progressed during 2010.
Chile	Regulator has announced intention to release the band for mobile services including LTE.
Argentina	Currently used extensively by pay-TV services (analogue and digital), also some limited free to air analogue use. No information currently available on future plans.

1.8 Conclusion

Our analysis of the current TV landscape in each country, anticipated future requirements for terrestrial digital TV and announcements that have been made regarding the future of the 700 MHz band suggest that once the digital switchover is complete there should be no need to retain frequencies above 698 MHz for broadcasting. Indeed, some countries (Colombia and Chile) have already decided in principle to release this spectrum and others (Mexico) are planning to consult shortly. If these countries go ahead with spectrum release this will provide a strong incentive towards a harmonised regional allocation, similar to the situation that is taking place in Europe in the 790 – 862 MHz band.

In the shorter term, the lengthy switchover process (10 – 20 years, compared with 5 years or less in many European countries) could cause delays in spectrum release in those countries (e.g. Mexico and Brazil) where the UHF frequencies are heavily used

for analogue services, and in Argentina where there are a large number of pay-TV services using the upper UHF band.

Expediting the switchover process and ensuring a harmonised release of spectrum throughout the regions would be likely to yield substantial economic benefits. For example a recent European study estimated the benefit of releasing a harmonised block of UHF TV spectrum for mobile use in Europe would be €44 Bn[1]. There is a particularly strong case for this in Argentina, where the government is aiming to achieve universal availability of free to air digital TV by terrestrial and satellite means by the end of 2012.

[1] "Exploiting the digital dividend – A European approach", report for European Commission by Analysys-Mason, DotEcon and Hogan and Hartson, 2009.

2 INDIVIDUAL COUNTRY REPORTS

2.1 Brazil

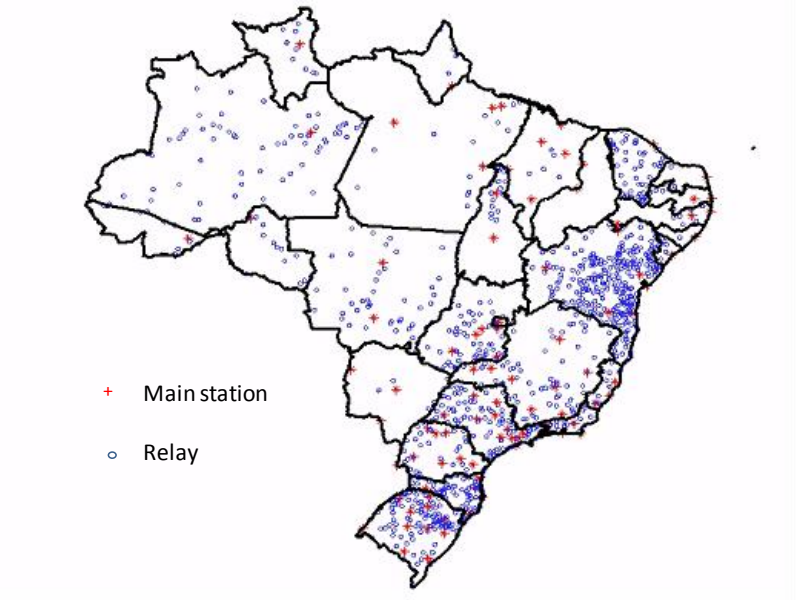
2.1.1 Current TV Landscape

Brazil covers a huge geographic area, much of which has a low population density. Terrestrial broadcasting is very important both commercially and politically although the take-up of pay TV via satellite[2] and cable is increasing. Acording to the regulator Anatel in 2009 there were approximately 7 million households with pay TV and more than 5 million with free-to-air satellite TV. Most TV stations in Brazil are commercial operations, There are seven main terrestrial networks, namely Network Record, Network Globo, Network Bandierantes, Network TV!, Network Gazeta, SBT (Systema Brasiliero de Telvisio) and MTV Brazil. The coverage of these networks varies but they are generally available in most or all of the main population centres. There are also a number of local and regional stations, particularly in the larger cities.

The majority of analogue transmissions by the main networks are in the VHF band. An extensive transmission network is in place: according to the regulator Anatel, in 2000 there were 333 main transmitter stations plus a further 748 large relay stations (5 kW typical) and over 7,000 low power relays. For example the figure below shows the network configuration for one of the national networks.

According to the Brazilian National Frequency Allocation Table (NFAT), frequencies above 746 MHz are used for TV repeater stations only and in common with the rest of the region frequencies above 806 MHz are allocated to mobile services.

Figure 3: Network configuration for Brazilian national TV network



[2] In September 2008, Anatel authorised TNL PCS (Oi) to provide subscription TV service (DTH satellite technology) in the whole country. They had twelve months in which to begin operations.

2.1.2 Digital Switchover Plan

In 2006 Brazil decided to adopt a variant of the Japanese ISDB-T standard, Sistema Brasileiro de Televisão Digital (SBTVD) for its terrestrial digital TV network. SBTVD was chosen because if was considered to be the most robust system for reception by small indoor antennas. Unlike the original ISDB-T standard, SBTVD includes MPEG-4 compression to provide greater capacity per multiplex and specific middleware to meet the needs of Brazil[3]. The International Telecommunications Union (ITU) has recently confirmed its recognition of the Brazilian digital TV standard (BDTVS) as a sub-system of the Japanese ISDB transmission standard, and recommended it as an international standard[4]. The standard also includes provision for a return path within the TV broadcast bands which has been proposed as a new WiMAX profile[5]

The Brazilian digital TV frequency plan is based on the following assumptions:

- Digital TV will use both VHF and UHF bands; however during the dual illumination period all digital channels are in the UHF band (due to heavy use of VHF by analogue transmissions).
- The service areas of the television stations will be similar to existing analogue services
- During the transition period analogue and digital would be broadcast simultaneously
- The current free to air TV model will remain a strict requirement
- Planning will be done in two phases – Phase 1 for areas where there are active full power stations and Phase 2 for areas where there are only relay stations or that are currently not served.

An SBTVD Forum has been set up to co-ordinate the switchover process in Brazil. According to the forum, digital TV has so far launched in 27 cities across the country. Most of these currently have only two or three digital stations but the most established market, Sao Paulo has ten in total. It is unclear whether all of these operate on their own dedicated frequency, although this does seem to be the case for the seven main networks (see table below). At least some of these broadcasters intend to provide programmes in high definition (HD) format. Note that with the exception of MTV, all the analogue frequencies are in the VHF band and all of the digital frequencies are in the lower part of the UHF band.

[3] See “Building the digital TV standard: the Brazilian experience” , T. L. de Souza, R.S.L. de Souza, GLOBELICS Conference, March, 2009
(htttp://globelics2009dakar.merit.unu.edu/papers/1238983482_TS.pdf)

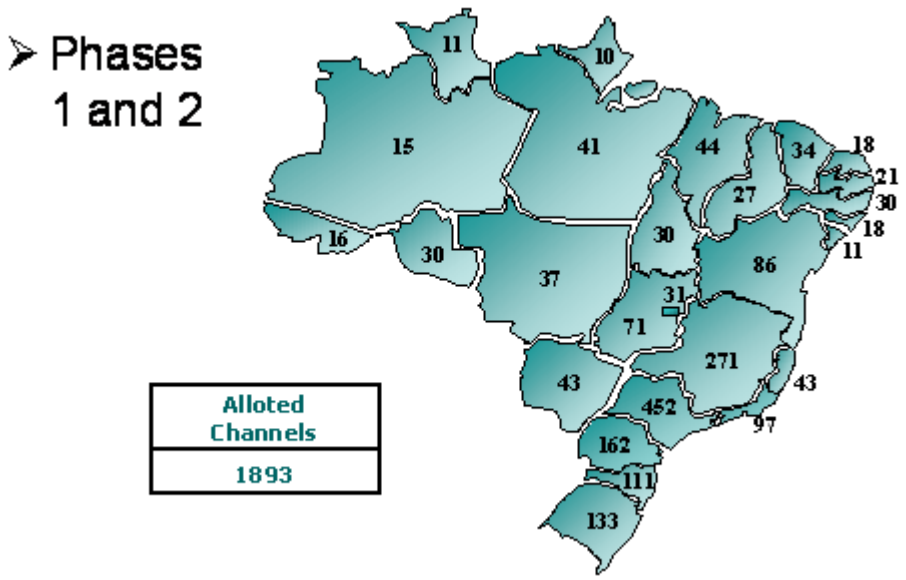
[4] Source: Rapid TV News 2009

[5] “Return Channel for the Brazilian Digital Television System-Terrestrial. Luís Geraldo P. Meloni, Dept of Communications, State University of Campinas

Table 4: TV Frequencies for national networks in Sao Paulo

Station	Analogue	Digital
Rede Record	7	19
Rede Globo	5	18
Rede Bandierantes	13	23
RedeTV!	9	29
SBT	4	28
MTV Brazil	32	31
Rede Gazeta	11	17

Under the current digital TV frequency plan, a very large number of frequency assignments will be required to provide national coverage of these stations and to support local and regional services. The original frequency plan, developed in 2002, made available the same number of digital frequencies as there are current analogue frequencies in each area. This would result in an eventual total of 1,900 individual digital frequency assignments across 900 municipalities, however it is unclear what frequency re-use assumptions had been made. The adoption of the ISDB-T standard means that many of these assignments could eventually take the form of regional single frequency networks, replacing the current situation where networks of lower power analogue repeaters serving adjacent areas all require different frequencies.



2.1.3 Estimating the demand for digital frequencies

Taking account of the current TV landscape in Brazil and the typical capacity of a 6 MHz SBTVD frequency channel of 5-6 SD or 1 HD stations plus mobile content, we estimate the long term (post-switchover) requirement for digital frequencies as follows:

If the seven main national networks each wish to broadcast a single HD channel, this would imply seven multiplexes. Additional multiplexes will also be required to support local and regional content in the main cities. As already noted, there appear to be up to ten digital multiplexes already operating in Sao Paulo and we assume a similar situation could arise in other major cities. This would imply a very high demand for frequencies if a conventional multi-frequency network (MFN) planning approach and national coverage were to be assumed, however in practice we would expect that deployment of regional SFNs would significantly reduce the demand for additional frequencies to support low power fill-in stations, removing the need for frequencies above 746 MHz that are currently reserved for this purpose. The release of spectrum in the VHF band that is currently heavily used by analogue services on completion of switchover would release a further twelve channels for digital TV and provide a more cost-effective solution to extending coverage to the more remote areas.

2.1.4 Conclusions

Even if the current ten digital multiplex scenario in Sao Paulo were to be replicated across Brazil with a conventional MFN planning approach the total spectrum requirement would not exceed 50 frequencies (based on an estimated five frequencies per multiplex), which could be accommodated in the available spectrum below 698 MHz once analogue services have been switched off. In practice, deployment of regional SFNs and a more rational approach to assigning multiplex capacity to in individual broadcasters should lead to a further significant reduction in the spectrum requirement. However, during the transition period the continuing presence of analogue services may limit the scope for spectrum release, except on a limited geographic basis.

2.2 Mexico

2.2.1 Current TV Landscape

There are two major national TV networks in Mexico and a number of regional services. Televisa is the largest national network TV Azteca is the second. TV Azteca operates two stations: XHDF ("Azteca 13") and XHIMT ("Azteca 7"), both with near national coverage. Regional television stations typically serve individual states. In each state, depending on the coverage that can be achieved, there may be a number of frequencies allocated to each television provider, to cater for multiple transmitter sites. For example in Baja California the television provider Televimex has four transmitters each operating on a different frequency. In each state there is a mix of high power transmitters as well as low power infill or local transmitters. For example in the state of Guanajuato the TV provider Gobierno del Estado de Guanajuato appears to use low power transmitters (many less than 1 kW) to provide service in a large number of areas and therefore has been assigned a total of 27 frequencies across the state.

2.2.2 Digital Switchover Plan

Mexico developed a 20 year plan for digital switchover[6], which started in 2004 after the decision was made to adopt the ATSC standard. The target date for analogue switch off is 1 January 2022. The transition period is split into six phases with the analogue signals turned off in a region once the regulator Cofetel determines that a specified level of *digital presence* and *replication* of the existing analogue signals is achieved. Digital presence in an area means digital coverage must be at least 20% of the current analogue coverage, whereas replication requires 90% of the current analogue coverage to be achieved

The six phases are detailed below:

Phase 1: 5 July 2004 – 31 December 2006

Digital presence in 9 major cities (Mexico, D.F., Monterrey, N.L., Guadalajara, Jal., Tijuana, B.C., Mexicali, B.C., Cd. Juarez, Chih., Nuevo Laredo, Tamps., Matamoros, Tamps., and Reynosa, Tamps

Phase 2: 1 January 2007 – 31 December 2009

- Digital replication in the Phase 1 cities
- Digital presence of at least 2 commercial signals in cities with 1.5 million or more inhabitants

Phase 3: 1 January 2010 – 31 December 2012

- Digital replication in Phase 2 cities

[6] Source: Wikipedia / COFETEL

- Digital presence of non- commercial signals in cities with 1.5 million or more inhabitants
- Digital presence of at least 2 commercial signals in cities with 1 million or more inhabitants
- All digital channels must broadcast at least 20% HDTV for at least 1 hour during primetime and the morning.

Phase 4: 1 January 2013 – 31 December 2015

- Digital replication in Phase 3 cities
- Digital presence of non- commercial signals in cities with 1 million or more inhabitants
- Digital presence of at least 2 commercial signals in cities with ½ million or more inhabitants

Phase 5: 1 January 2016 – 31 December 2018

- Digital replication in Phase 4 cities
- Digital presence of non- commercial signals in cities with ½ million or more inhabitants
- Digital presence of at least 2 commercial signals in cities with 150 thousand or more inhabitants

Phase 6: 1 January 2019 – 31 December 2021

- Digital replication of all analogue channels

So far only a limited number of digital stations have been activated, in accordance with Phase 1 and Phase 2. Additional stations will continue to be launched to achieve the expanded presence and signal replication required by the various phases. Note that many of these are likely to be low power relay stations. Unlike the ISDB-T and DVB-T standards that have been adopted elsewhere in the region, the ATSC standard does not provide the option for single frequency networks, so these relays would require different frequencies to be used from the local main transmitter.

2.2.3 Analysis of Frequency Use

The chart below shows the currently assigned frequencies for analogue and digital services in each Mexican state, based on information sourced from Cofetel and believed to reflect the situation in October 2009. Note that in many cases multiple frequencies are used to deliver the same channel from different locations within the state. It is interesting to note that the highest digital channel allocated is 51 (693.25 MHz) which is also the highest channel used for TV in the US.

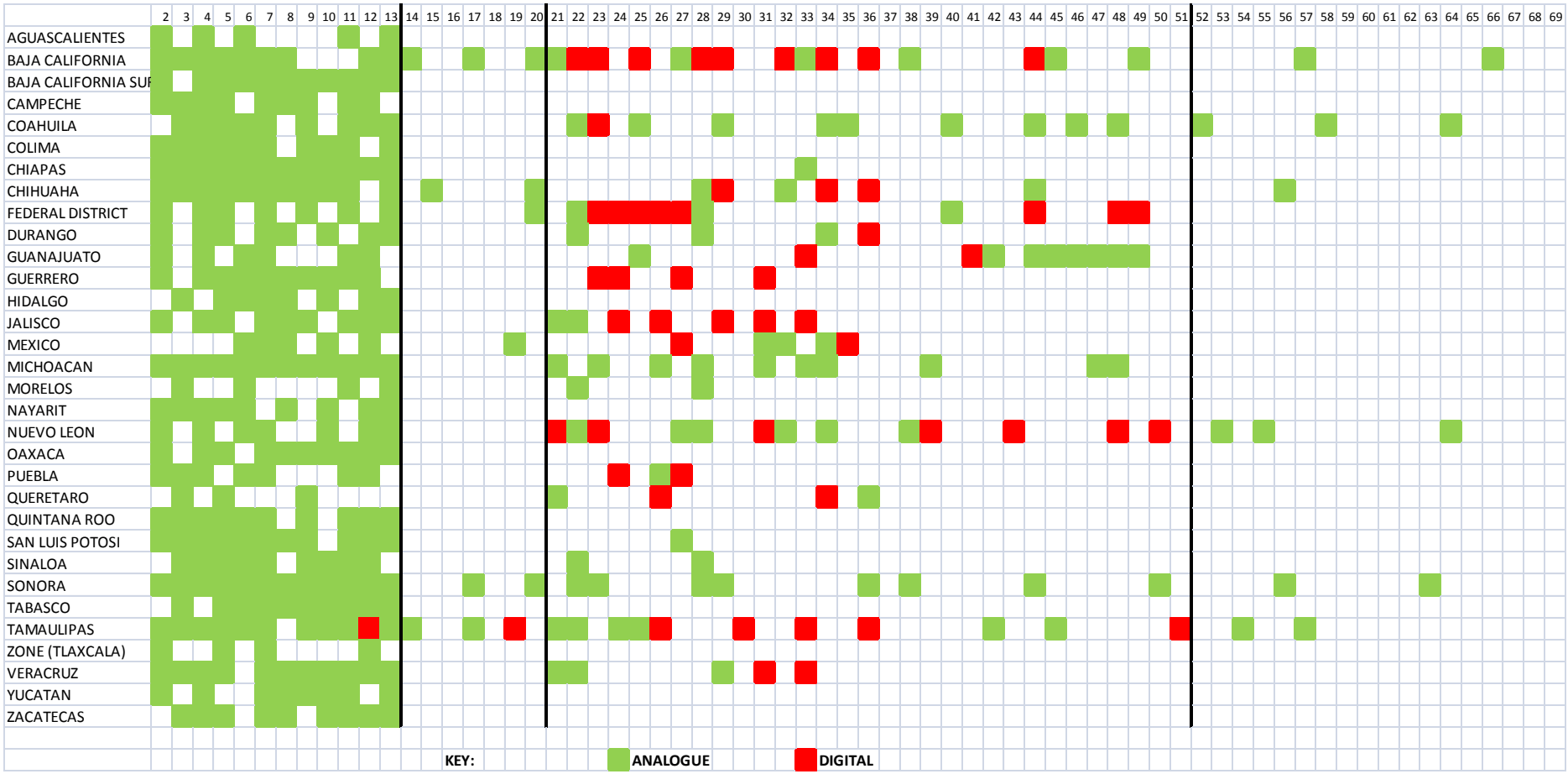
2.2.4 Status of the 700 MHz band

In January 2010 Cofetel announced plans to study the possibility of auctioning spectrum in the 700MHz band for mobile services. The band is already subject to co-ordination with the USA within 120 km of the border, which would constrain its use for high power TV transmissions within that area.

2.2.5 Conclusion

Mexico has signalled its intention to release the frequencies above 698 MHz for mobile use and its long term digital TV frequency plan is consistent with this. However, the protracted timescale for switching off analogue services, especially in rural areas, will seriously limit the utility of the band for mobile services, since it will be unavailable in the more remote areas that are most likely to benefit from the lower frequency band. The large exclusion zones that are required to protect analogue TV will also prevent use of the spectrum in many more populated areas.

Figure 4: Analogue and Digital TV frequency assignments in Mexico, by State (Oct 09)



2.3 Colombia

2.3.1 Current TV Landscape

Currently, there are three private (Caracol TV, RCN TV and CITY TV) and three state-owned (Canal Uno, Senal Institucional and Senal Colombia) national analogue TV networks in Colombia. In addition, there are 8 regional channels, more than 500 cable licensees, 48 local TV channels and three direct-to-home satellite TV networks[7]

The Colombian national regulator for television broadcasting is the national television commission (CNTV, www.cntv.org.co) which was created in 1991 as an autonomous entity in charge of policies for television broadcasting, radio spectrum administration and regulation of TV programme contents. In June 2009, CNTV published a frequency use plan outlining the technical conditions that need to be satisfied by TV broadcasting stations[8]. In the plan, lists of assigned frequencies for each town are also provided for national, regional and local TV networks.

2.3.2 Developments in Digital Terrestrial TV

After more than two years of analysis and studies, the Colombian government adopted the DVB-T standard in August 2008. The government signed an agreement with a Spanish association (Impulsa TDT) to receive help in the implementation of DTT. The CNTV web-site provides a document outlining the implementation steps and associated timescales[9] where the projected date for the transition from the analogue to digital is 2019[10]. The first commercial broadcasts began in Bogotá on January 29th, 2010. Viewers in the Bogotá area receive three services, Canal Uno, Señal Colombia, and Canal Institucional, from the public service broadcaster RTVC. During 2010 four additional transmission sites will open extending DTT service to viewers in and around Cali, Medellin, Antioquia, Barranquilla and Santa Marta.

2.3.3 Analysis of current frequency usage

CNTV has provided extensive data on the number of transmission frequencies used in each administrative area, enabling the number of available frequencies to be expressed as a percentage of population coverage. Under the current frequency plan, which utilises all of the VHF and UHF bands except for channels 14-20 (470-512 MHz)[11], all locations have at least seven frequencies available for analogue TV across both bands. The impact of removing channels 52-69 on the number of

[7] CNTV DTT Report, http://www.cntv.org.co/cntv_bop/tdt/documentos/tdt_colombia.pdf

[8] Available at www.cntv.org.co/cntv_bop/servicio_cober/espectro/index.html

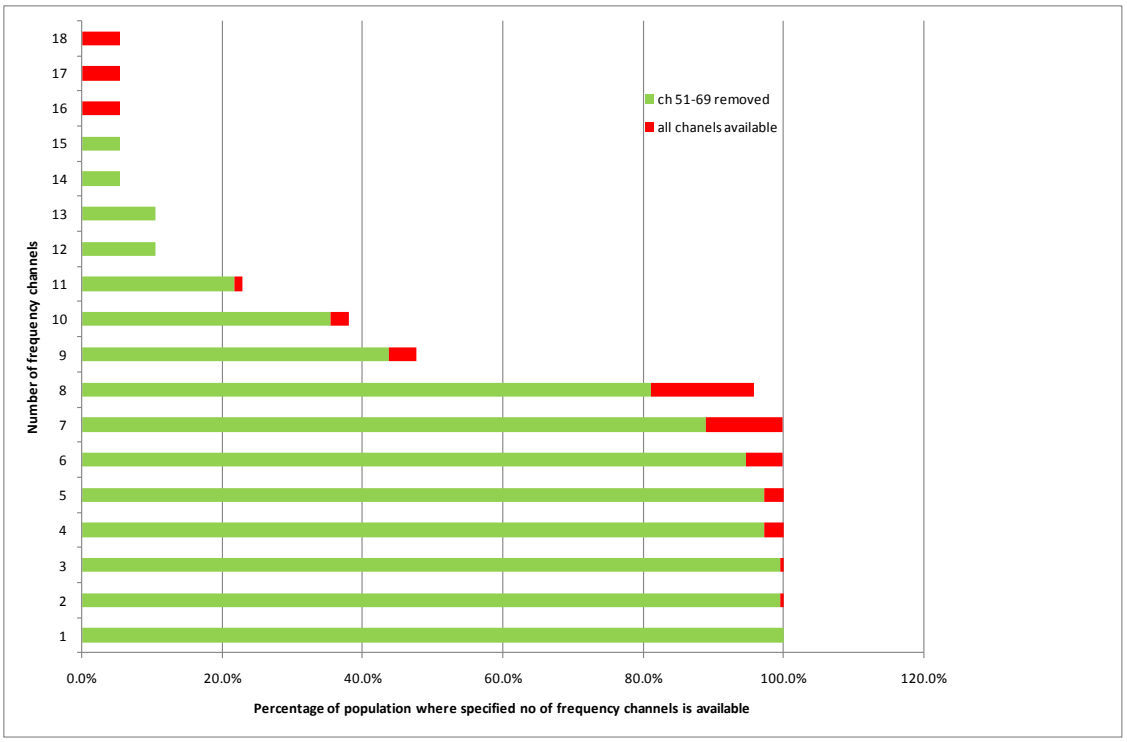
[9] See http://www.cntv.org.co/cntv_bop/tdt/contenido4.html)

[10] www.cntv.org.co/cntv_bop/tdt/contenido4.html

[11] A recent government Resolution committed to make these channels available for future digital TV services

channels available across the country is shown below. At least three frequencies are still available to virtually all of the population and approximately 90% of the population would still have access to at least seven multiplexes. However, digital switchover would allow frequency re-planning to take advantage of the improved frequency re-use compared to analogue transmission and it is likely that the current availability of at least seven frequencies would be retained country-wide.

Figure 5 Impact of removing channels 52-69 on TV channel availability in Colombia (based on current analogue plan)



2.3.4 Estimating demand for digital TV frequencies

If the six national networks each wish to operate a single HD station and assuming MPEG-4 is deployed that would imply 6 multiplexes would be required. Each of these could also accommodate a small number of SD stations. If the latest DVB-T2 technology were also to be deployed the number of HD multiplexes could be reduced to three, since it would be possible to accommodate 2 HD stations per multiplex. We anticipate that regional and local stations may require one multiplex each and that there may be a demand for a dedicated mobile TV multiplex, although experience in other markets suggests this demand may be limited and may be adequately met by the DVB-T multiplexes, given the relatively dense transmission network in Colombia.

Hence a total of 5 – 9 multiplexes may be required, depending on whether DVB-T2 technology is deployed and whether there is a requirement for a dedicated mobile TV multiplex. If a conventional MFN approach is adopted, requiring up to 5 frequencies per multiplex, the number of frequencies required would be up to 45 in the worst case. However, we would expect at least some of these multiplexes to be suitable

for single frequency network operation which would reduce this frequency requirement. As there would still be 50 frequencies available even if channels 52-69 are re-allocated there does not appear to be any need to retain these upper channels for broadcasting once analogue services cease.

2.3.5 Status of the 700 MHz band

In November 2009, the Colombian Minister of Information Technologies and Communications issued a Resolution confirming that the 698 – 806 MHz band would be allocated to "fixed and mobile radio services for the operation of disaster mitigation services and to provide telecommunication networks and services using the IMT standard". The process of re-allocation is planned to begin during 2010. The same resolution also made available the 470 -512 MHz spectrum (channels 14-20) for TV broadcasting, to facilitate the introduction of digital TV.

2.3.6 Conclusion

Columbia's choice of the DVB-T standard means it is better placed to deploy single frequency networks than Mexico and should have no problem accommodating all its digital services in frequencies below 698 MHz once analogue services are switched off. However, as with Mexico the release of the higher frequency spectrum cannot proceed until analogue services have ceased and under the current plan this is still many years away.

2.4 Chile

2.4.1 Current Situation

There are five main national TV networks in Chile, namely TVN, Canal 13, Mega, Chilevision and Red TV. All of these currently have over 80% population coverage and collectively they account for over 75% of viewing in Chile[12]. In addition there are approximately thirty regional and local terrestrial broadcasters and a further 120 such services available via cable.

The Chilean national television council (CNTV) regulates TV broadcasting in Chile. The technical aspects are regulated by the Ministry of Transport and Telecommunications through the Office of Communications (Subtel)[13]. Under the current channel plan, channels 52 – 69 (698 – 806 MHz) are earmarked for mobile TV and WiMAX services; however Chile's decision to adopt the SBTVD (ISDB-T) standard means that mobile reception can be provided without the need for a separate dedicated network so there would seem to be scope to make this entire spectrum available for non-broadcast applications.

There are 63 main broadcast transmitters and 121 repeater stations for analogue TV transmissions, operating primarily in the VHF band. The UHF band has been frozen since 2000 and almost all of the UHF bandwidth is considered available for new digital assignments (channels 21 to 52). A number of regional channels broadcast on cable only and may wish to extend their offerings to a digital terrestrial platform in the future. Analogue TV services are currently regionalised into 8 regions and this is likely to remain the case for digital services, necessitating an MFN approach. Chile does not currently use channels 14 – 21 (470-512 MHz) for TV broadcasting; instead these appear to be used for fixed services.

In the capital Santiago, the analogue TV transmissions are broadcast on VHF channels 2, 4, 5, 7, 9, 11 and 13, with a further station on UHF channel 22. The country's main TV channel TVN (with 99.9% coverage) has 199 analogue frequency licenses of which 120 are perpetual and 79 are for 25 years. Only one frequency per area per broadcaster is allowed.

2.4.2 Developments in Digital Terrestrial TV

In 2000, the Ministry of Transport and Telecommunications froze analogue TV licences in the UHF band and the bands 512 – 608 MHz (channels 21 – 36) and 614– 698 MHz (channels 38 – 52) were designated for digital TV. After extensive tests, studies and consultations, the government decided to adopt the Brazilian

[12] "Supporting Subtel in developing a regulatory framework for the launch of DTT services in Chile", presentation to Subtel by Spectrum Value Partners, 2007

[13] Source: CNTV web site www.cntv.cl

variant of Japanese standard ISDB-T with MPEG-4 in September 2009. This decision was primarily based on the suitability of the ISDB-T to the mobile TV reception as well as the fixed reception with indoor antennas (almost 50% of population uses indoor antenna for TV reception). It was also suggested that the Brazilian variant of the standard includes more advanced compression techniques enabling efficient high definition broadcasting[14].

Digital broadcasting using the ISDB-T standard will begin in 2010 and the analogue switch-off is scheduled for 2019.

2.4.3 Estimating demand for digital TV spectrum

A recent study for Subtel by Spectrum Value Partners put forward a number of options for the assignment of frequencies to multiplexes. One option is to allocate one multiplex to each of five main analogue broadcasters by direct allocation and make further multiplexes available by on a comparative selection basis. The second option is to allocate all available multiplexes to incumbent operators and setting obligations to sell a portion of the multiplex capacity to third party broadcasters. The third option is to allocate one multiplex to each current operator and offer incremental spectrum on auction basis[15].

Five national multiplexes planned on an MFN basis would imply up to 25 frequencies in total. A further 2 – 3 multiplexes may be required for local and regional services, implying up to a further 15 frequencies, or a grand total of 40 frequencies across the country. Currently a total of 43 frequencies are available in the VHF and UHF bands so there appears to be sufficient spectrum to accommodate anticipated long term demand for digital TV spectrum without using frequencies above 698 MHz.

2.4.4 Status of 700 MHz spectrum

In 2007 Subtel announced its intention to make spectrum in the 700 MHz band (channels 52-69) available for mobile broadband services[16]. More recently, it has been reported that Chile is temporarily holding off release of the spectrum until it is clearer how the band will be used worldwide, with specific reference to deployment of LTE in the band in Asia[17]. It was also reported that one of the Chilean mobile operators (Entel) was trialling LET technology, the first operator in the Latin American region to do so.

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[14] Resumen Ejecutivo: Decision Norma de Television Digital Terrestre, Ministerio de Transportes y Telecomunicaciones

[15] Supporting Subtel in Developing a Regulatory Framework for the Launch of DTT in Chile, Presentation by Value Partners, 2007

[16] Source: ITU newslog item (http://www.itu.int/ituweblogs/treg/Subtel+Plans+WiMax+Auction+In+700MHz+Band++Chile.aspx)

[17] See www.pressreleasepoint.com/chile-first-latin-america-and-fifth-world-test-lte

2.4.5 Conclusion

Chile appears to be the most advanced of the five countries considered in terms of planning the release of spectrum above 698 MHz for mobile services and there appears to be little in the way of releasing the spectrum once the preferred band plan has been agreed.

2.5 Argentina

2.5.1 Current Situation

There is a mix of public and private TV stations in Argentina. The main public station is Channel 7, which broadcasts from 293 transmitters across the country. Canal Encuentro (Encounter channel) is a national educational station run by the Ministry of Education, Science and Technology. Private channels include America TV, TeleArte (channel 9), Telefe (channel 11) and Artear (channel 13)

There are also a large number of low power TV stations and encrypted "wireless cable" services around the country and the Federal Authority for Audiovisual Community Services is currently undertaking a survey of these stations to clarify their legal status and develop a national frequency plan for broadcast TV services, which would include provision for digital TV[18]. Wireless cable services that were formerly operating on channels 22-25 inclusive were required to vacate these frequencies to make way for digital television[19]. Some of these services are now assigned frequencies above 700 MHz. Pay TV adoption in Argentina is very high by international standards at 60% of households, the third highest penetration in the World. Most of this is via cable or terrestrial subscription services, though digital versions of some Argentinean networks are available via the regional Nahuel in the north of the country.

Some of the subscription services are already digital, for example in 2006 the pay TV operator Antina launched a digital TV service in Buenos Aires using DVB-T technology which provides 65 TV channels over 10 UHF frequency channels[20]. The Argentinean DVB-T supplier Network Broadcast claims there are at least five UHF DVB-T networks operational in the country[21].

In October 2009, a new law regulating the broadcasting sector was adopted. The new law establishes a new regulatory authority, called the Federal Authority of Audiovisual Communications Services (AFSCA), to replace the existing Federal Broadcasting Committee (COMFER). According to the new law, the broadcasting spectrum will be divided into three equal parts. The divided spectrum will be assigned to governmental, non-governmental and commercial services. This implies a significant reduction in the amount of spectrum available for the current broadcasters. Furthermore, the number of licenses that can be assigned to a single

[18] See Resolution 3 /2009 of the Authority

[19] See Resolution 813/2009 of the Federal Broadcasting Committee

[20] Sources: dvb.org, digitaltvnews.net

[21] Source: nextvlatam.com

entity is limited implying that some of the existing media groups will need to sell their licenses.

The number of private and public channels by region is shown below (note that many of the stations are local and do not necessarily serve the entire region).

Table 5 Private and Public TV stations by region

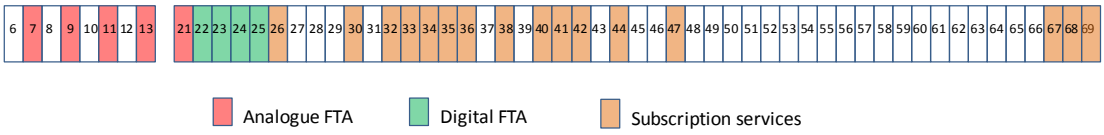
Region	Public stations	Private stations
AMBA (Buenos Aires)	1	4
Cuyo	2	4
North East	2	2
Pampas	3	12
Patagonia	4	3

2.5.2 Current Use of TV Bands

Current free to air analogue transmissions mainly use the VHF bands (channels 2 – 13) with limited use of UHF for repeater stations and local transmissions. There is however widespread use of the UHF band for encrypted subscription TV services, some of which have recently been migrated from the bottom of the UHF band to the upper part of the band to release frequencies for digital TV.

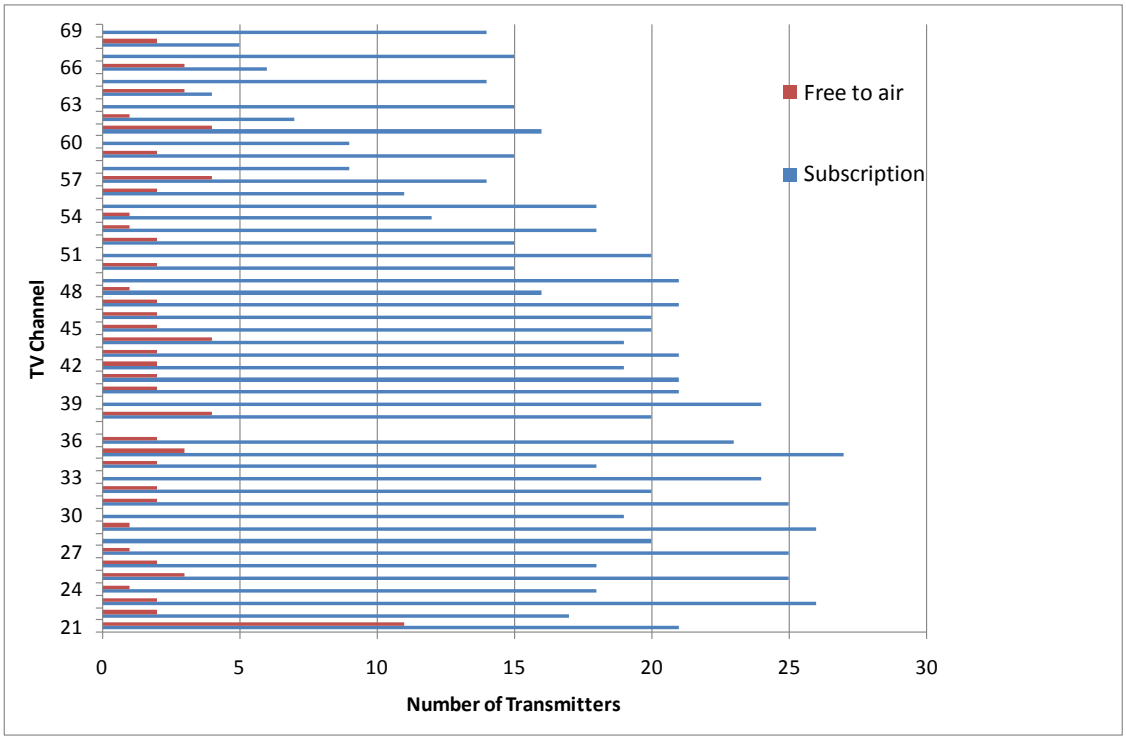
For example the current utilisation of channels in Buenos Aires is as follows:

Figure 6: TV frequency channel utilisation in Buenos Aires



Note that only channel 21 is used by analogue free to air (FTA) services but a further 16 frequencies are used by subscription TV services (at least 10 of which are digital). This situation is reflected nationally, as the following channel utilisation graphs show:

Figure 7: Utilisation of UHF TV frequencies across Argentina by free to air and subscription services



2.5.3 Developments in Free to Air Digital (FTA) Terrestrial TV

In 2009, the Argentinean president signed a decree[22] outlining the plan for the implementation of digital terrestrial TV in the country. The decree states that Argentina will use the Brazilian / Japanese SBTVD-T standard and aims to promote cooperation between Argentina and Brazil. As a part of the decree, an advisory board including representatives from a number of ministries was set-up to provide guidance in achieving the transition from analogue to digital TV for which a 10 year time scale has been proposed (i.e. the analogue and digital TV services will co-exist until September 2019).

Argentina is due to launch its FTA digital terrestrial television service on 1st May 2010. The government plans to give away one million set-top boxes to low income families in an effort to give digital access to those homes that cannot afford cable or satellite TV before the World Cup finals in June. Initially, 65 transmitters will be installed across the country in the nine largest cities (including five transmitters in Buenos Aires), covering 75% of the population. The digital package will include the two main public channels Canal 7 and Encuentro, children's channel Paka Paka, and movie channel INCAA, with other channels to be decided. The investment in this project is around $154 million[23]. According to an announcement by the Argentine

[22] No: 1148/2009 dated 31st August.2009

[23] Source: Screen Digest news report, 16th April 2010

Planning minister in March 2010, DTT coverage will extend to 95% of the population (40 main cities) by 2012, with the remaining population being served by satellite. Up to 40 digital terrestrial stations would eventually be available.

Currently four UHF frequency channels (22 – 25 inclusive) are reserved for public digital TV services, with the intention of providing four national multiplexes. Up to 3 multiplexes are planned for private national stations and at least one multiplex to cater for local and regional services. The current plans therefore envisage eight multiplexes in total, however as most of these appear to be intended for national programmes we would expect there to be widespread deployment of single frequency networks, reducing the number of frequency channels required. This already appears to be the case for the national public stations, which are being rolled out nationally on just four frequency channels.

2.5.4 Estimating the requirement for digital TV frequencies

The Argentinean government's digital TV plans currently envisage up to 8 national multiplexes, the majority of which will carry national channels and could therefore be configured as single frequency networks (SFNs). Assuming that one of the four public multiplexes and one of the three national private multiplexes are planned as multi-frequency networks (MFNs) to provide scope for regional content, this would imply five national SFNs and three MFNs. Assuming up to five frequencies are required per MFN, a total of 20 frequencies would be required nationally (i.e. 5 x 1 for the SFNs and 3 x 5 for the SFNs). Additional frequencies will be required to support subscription TV services, some of which currently transmit on up to 10 frequency channels and already use digital technology. Some additional frequencies (perhaps 1 – 2 per multiplex) may be required to support national services in border areas. Hence the total requirement post-switchover is likely to be of the order of 35 – 40 frequencies.

Accommodating all of these services in the currently available UHF frequencies will be difficult if frequencies above 698 MHz are re-allocated, since only 29 frequencies would be available. However additional frequencies could be made available in the lower UHF band (channels 14-20) and the VHF band, which is currently used for analogue transmission. We assume that there would be scope to migrate existing users of channels 14-20 (fixed and mobile services) to alternative frequency bands – in the case of fixed services these could be in bands above 1 GHz. If full use is made of all the internationally allocated TV spectrum it should be feasible to accommodate all FTA and subscription TV services below channel 50 post-switchover.

The current switchover period appears excessive given that Argentina has set an objective for universal coverage (using satellite to cover the final 5% of population) by 2012. Given the extensive promotion of digital TV both by the commercial sector (in the form of established pay-TV services) and government (in the form of set top box subsidies) it would seem reasonable to switch off analogue services soon after this date.

The presence of two digital TV standards in Argentina (DVB-T for pay-TV services and ISDB-T for FTA) may lead to some inefficiency, since pay-TV subscribers will expect to receive FTA content over their existing digital set top boxes and this will require some duplication of content. However we would expect this to be resolved in over time either by migration of the pay TV services to the ISDB-T standard or by deployment of dual-mode receivers.

2.5.5 Current Status of 700 MHz in Argentina

We have not been able to ascertain how intensively the UHF frequencies are currently used in Argentina; however it is apparent that no formal decision has yet been made on the future allocation of the frequencies above 698 MHz. The presence of a large number of subscription TV services in the upper part of the UHF band, some of which use digital (DVB-T) transmission technology could potentially hinder the release of this spectrum, at least until analogue transmissions cease.

2.5.6 Conclusion

Argentina is unusual in having a large number of local UHF pay-TV services, which complement the extensive cable TV networks in the country. The recently introduced Audiovisual Communications Services Law includes provisions to limit the duration of audiovisual licences to 10 years and also places an obligation on subscription TV service providers to include free to air national and regional broadcasts in their service packages. There may be a case for reviewing this requirement where it leads to duplication of content on different frequencies. A better solution would be to designate a number of digital multiplexes for free to air services and others for provision of subscription services so that there is no duplication of the content, however this may be problematic in the short term as different digital technologies are used for the free-to-air and subscription services (ISDB-T for the former and DVB-T for the latter). In the longer term there would be merit in encouraging subscription service providers to migrate to the ISDB-T standard that has been chosen for the free-to-air services, or alternatively to consider the provision of dual-standard receivers that can accommodate either standard.

In any case, an early decision on the closure of analogue TV services and the release of frequencies above 698 MHz should be made so that a frequency re-planning exercise can be undertaken to accommodate all existing subscription services on frequencies below 698 MHz, once analogue services have ceased.

3 CONCLUSIONS

It is clear from our analysis that once analogue TV services have ceased there should be no problem accommodating the required terrestrial digital TV services in each of the countries considered using frequencies below 698 MHz. However, while the analogue services continue to broadcast the need to accommodate these alongside the new digital services will constrain the release of spectrum above 698 MHz for other services in several of the countries analysed. It is therefore important to highlight to regulators and governments the benefits that will be realised by expediting the switching off of analogue TV transmissions and releasing spectrum above 698 MHz for mobile broadband use.

3.1 Benefits of early analogue switchover

We have already noted that a recent European study estimated the benefit of releasing a harmonised block of UHF TV spectrum for mobile use in Europe would be €44 Bn, equivalent to approximately €100 per person. This benefit is net of the projected costs associated with re-planning of digital TV networks that are already operational in many EU countries. In Latin America, digital TV rollout is much less advanced than in Europe which would enable the digital dividend release to be factored into the first stage of network rollout, obviating the need for subsequent re-planning that faces European broadcasters. The benefits of releasing the digital dividend spectrum in Latin America are substantially the same as in Europe, or may even be greater in view of the more limited availability of existing fixed broadband services. Therefore in relative terms the net benefit of releasing digital dividend spectrum is likely to be even greater than will be the case in Europe.

3.2 Importance of Mobile Broadband and the Digital Dividend

The benefits of deploying mobile broadband in lower (sub-1 GHz frequency bands) are likely to be highest in countries where fixed broadband penetration is low and large rural populations exist, making rollout of wireless broadband in higher frequency bands uneconomic. Broadband penetration in most EU countries is over 20%[24]. Chile and Argentina currently have about 10% penetration and other countries in the region somewhat less. Countries such as Argentina and Brazil also have large, dispersed rural populations with limited availability to telecommunications infrastructure.

Mobile broadband can provide an effective way to overcome the digital divide between urban and rural communities, but this depends on access to suitable radio spectrum to enable cost-effective coverage. For example, in Argentina, over 90% of

[24] Source: OECD

the population live in urban areas but the remainder (over three million in total) are spread thinly across the country, which has the world's eighth largest land area. This presents a particular challenge for mobile operators, especially in the more remote regions of Northern and Southern Argentina. For example, in 2007, Telecom Personal reported population coverage for its GSM network of 98% in the most populous AMBA region, but only 85% and 62% in the Northern and Southern regions[25]. Extending coverage to the remaining population whilst providing sufficient capacity to provide broadband data services can only be done by ensuring sufficient spectrum is available in the lower frequency bands below 1 GHz, which provide up to four times the coverage per base station compared to the higher cellular bands.

Mobile broadband is already playing a key role in developing the broadband market in the Latin American region. According to Informal, the year on year growth in mobile broadband subscribers in the region in 2009 was 385%, with over 10 million subscribers in total throughout the region[26]. In Argentina, there were a reported 300,000 mobile broadband subscribers, accounting for 10% of all broadband connections, despite the limited coverage of the current networks. Existing spectrum allocations below 1 GHz, on which networks depend to extend coverage into more rural and remote areas, are limited and already heavily committed to delivering voice service. This limits the scope to support continued growth without further spectrum being made available.

3.3 Expediting Analogue switch off is crucial to realising these benefits

The benefits highlighted above can only be realised by making the digital dividend available at the earliest opportunity, which in turn depends on the prompt cessation of analogue TV transmissions once digital services are fully available. However, the timescales currently planned for analogue switch off in Latin America compare unfavourable with other parts of the world, as the table below illustrates.

Failure to achieve switch off at an earlier date consistent with other countries in Europe, North America and the Far East risks losing many of the benefits that mobile broadband expansion could bring, particularly to rural areas.

Table 6: Planned analogue switch off completion dates

Year	Countries
2008	Netherlands, Sweden
2009	Germany, Finland, USA
2010	Austria, Denmark, Spain

[25] Source: Telecom Argentina Annual Report 2008

[26] "Mobile broadband users near quarter billion mark", telecoms.com editorial, 22nd July 2009

2011	Japan
2012	Korea, South Africa, UK
2013	Australia
2015	China, India, Russia
2016	**Brazil**
2019	**Argentina, Chile, Columbia**
2022	**Mexico**

3.4 Approaches to expediting analogue switch off

There are a number of ways in which the switchover process could be expedited. In some countries, including the US, a direct subsidy has been provided to households to cover part or all of the cost of acquiring a set top box or digital TV. In other cases (e.g. the UK, Spain), additional channels and services (such as interactive or high definition TV) have been provided as part of the digital package to provide an incentive for viewers to switch.

In some Latin American countries, such as Argentina, such measures are already in place. Set top box subsidies are available and the government has stated its intention to achieve national digital coverage by 2012, using a combination of terrestrial and free to air satellite signals. However no corresponding target for analogue switch off has been set, other than the previously mooted 2019 date.

Extending digital TV coverage to rural areas is important to maintain the universal availability of free to air TV. This can also be helped by expediting the analogue switch off process, since this will release the VHF frequencies that are currently most heavily used for analogue TV in the Latin American region and provide the most favourable coverage in rural areas. In Mexico, where a phased approach to switchover means some rural areas will not switch until 2020 or later, migrating the remaining analogue services to VHF frequencies (which will have been released in neighbouring urban areas once they have switched to digital) would enable UHF frequencies to be released much earlier for mobile use.

Early closure of analogue transmission is also likely to benefit the broadcasters themselves. Maintaining analogue transmissions after completion of the digital network rollout is likely to prove costly in terms of maintaining ageing analogue transmitters alongside the digital network, as well as hindering the rollout of broadband mobile services. Bringing forward the closure of the analogue network is therefore likely to benefit the broadcasters, in terms of reduced maintenance costs.

3.5 Meeting the cost of analogue switch off

Bringing forward the date of analogue switch off may incur additional costs for consumers and broadcasters, in terms of equipment being replaced at an earlier stage than would otherwise be the case. However, these costs will be partially offset by the savings in maintenance costs, as noted above. There will also be benefits to broadcasters in terms of new services and content that can be broadcast over the digital network, potentially increasing subscription and advertising revenue. By facilitating the rollout of mobile broadband services, broadcasters will also have more scope to deliver their content to mobile devices, creating new revenue opportunities.

The cost of migration could also be subsidised to a significant extent from the value of the released spectrum if this is sold at auction. The value of the released spectrum is likely to be significant: in the US digital dividend spectrum was sold for an average of approximately $3 per 2 x 1 MHz per capita and in Germany (where more spectrum was available) the corresponding price was $1.75. Prices in Latin America are likely to be somewhat lower – for example in the recent 2 GHz auctions prices realised in Brazil were about 20% of those realised in the US on a per MHz per capita basis, at 26 . Assuming that 20% of the recent German auction proceeds were to be realised and that 2 x 45 MHz could be released as a digital dividend, the total amount realised per capita would be $15.75, or $63 per household, which would be more than sufficient to cover the consumer costs of the transition.