Report for the European Commission

‘Exploiting the digital dividend’ – a European approach

Annexes to the final report

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Contents

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Introduction to Annexes A–C

Annexes A–C are an inventory of national situations regarding the digital dividend in the Member States, neighbouring countries and other non-European countries. The information provided is based on two sources:

- completed questionnaires received from Member States (excluding Belgium, Greece, Italy and Poland, which did not respond)
- extensive desk research.

All sources of desk research are listed after Annex C.

Please note that these Annexes were completed by May 2009 and do not reflect changes that occurred subsequently. However, we have tried to take these changes into account in our main report where required.

Annex A: An inventory of national situations affecting the digital dividend in EU Member States

A.1 Austria

DTT is not the primary delivery platform for digital TV in Austria; the importance and success of DTT in Austria is overshadowed by the dominance of cable and satellite television. However, Austria's inclination is to use the digital dividend spectrum for broadcasting uses as per GE-06; this will precede any considerations for non-broadcasting uses. There has been no decision made on the use of the digital dividend for non-broadcasting uses. Based on Austria's history of co-ordinating with neighbouring countries (the Czech Republic, Slovakia, Germany, Switzerland, Italy and Hungary) on interference issues, any decision on non-broadcasting uses of the digital dividend will also require potential interference issues to be resolved.

A.1.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 21–69 were used for analogue TV broadcasting. However, use in Channels 61–69 was restricted due to the co-ordination requirements of neighbouring countries relating to military use.
VHF channels used for analogue TV	Channels 5–11.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	None.
UHF channels not used, or unusable because of co-ordination requirements	Channels 61–69, as described above.

Historical television broadcasting

Figure A.1 below illustrates the primary type of television signal historically received in Austria.

Primary type of television signal received	*% of households*
Analogue terrestrial	13.7
Digital terrestrial	0
Analogue cable	36.3
Digital cable	1.71
Digital satellite	48.3
IPTV	0

Figure A.1: Households primary TV signal typology in 2004 before the introduction of DTT [Source: Screen Digest]

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
2 channels (95%)	1 channel (73%)	See below	See below

Figure A.2: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses) [Source: BMVIT, December 2008]

Prior to the switchover, the two national public TV programming channels had 95% penetration, while the private national TV programming channel reached 73% of the population. The Federal Ministry of Transport, Innovation and Technology (BMVIT) differentiates between local and regional TV programming channels – there were three regional and four local TV programming channels.

Interleaved spectrum in Austria is used by radio microphones in frequencies 174–216MHz and services ancillary to broadcasting and programme making (SAB/SAP) in the 470–862MHz frequency band.

A.1.2 The transitory situation (as of December 2008)

Austrian television has traditionally been dominated by satellite and cable, which have a combined penetration of 93% of television households, as shown in Figure A.3 below. IPTV in Austria has been available since 2003 but the current take-up is still slow (it has reached 1.5% of the population in 5 years since it launched). Prior to the launch of DTT in 2006, analogue television reached about 14% of the population.

In 2001, the Austrian Communications Authority was instigated, following broadcasting legislation to oversee the digital switchover process. The soft launch of DTT in Austria took place

in 2004 in Graz, with four TV programming channels on one multiplex transmitting via a single-frequency network (SFN). The full launch of DTT followed in October 2006 with the first public service multiplex (multiplex A) carrying three TV programming channels reaching 70% of the population. However take-up was slow and the government offered EUR40 subsidies for set-top boxes to encourage take-up. At the end of 2008, this multiplex had 90% coverage.

Analogue switch-off started in March 2007 in Bregenz and progressed regionally; it is due to be completed in 2010 as per CoCom07. Meanwhile, a second multiplex (multiplex B) was established a year after the first, following a tender process that saw 32 companies bid for the contract to operate the multiplex. This commercially operated multiplex carries three TV programming channels and reached 78% penetration in 2007. A third multiplex (multiplex C) for regional and local TV programming channels was open to tender a year after the launch of the second multiplex (October 2008).

Austria has also established a fourth multiplex (multiplex D) that has been allocated for mobile TV service (DVB-H). Four major cities are covered by this multiplex and the penetration of this multiplex at the end of 2008 is expected to be 50%.

Figure A.3 illustrates the primary type of television signal currently received in Austria.

Primary type of television signal received	*% of households*
Digital terrestrial	5
Cable	43
Satellite	50
IPTV	1.5

Figure A.3: Penetration of different TV platforms [Source: BMVIT, December 2008]

A.1.3 The situation after analogue signals are switched off throughout the European Union

Three DTT multiplexes will carry six nationwide TV programming channels (two are privately owned). The two public and one private TV programming channels are planned for 95% coverage, the other three programmes have currently about 78% but could be increased in the future to 85%.

Expected DTT broadcasting

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
A (91%)	3	-	-	-
B (71%)	1	2	-	-
C*	-	-	-	-
D (50%)	-	-	-	-
Total	**4**	**2**	**-**	**-**

Figure A.4: Overview of DTT programming channels in the UHF band after ASO (population coverage in parentheses) [Source: BMVIT, December 2008]

*Penetration for multiplex C is unknown as authorisations were recently launched, however it is estimated to

be about 20% in 2008. While the split of TV programming channels between public and private is unknown, 16 regional and local authorisations for the use of the multiplex were awarded.

Technological evolution affecting the use of the spectrum for broadcasting

The multiplexes in Austria are mainly running on an SFN except in mountainous areas where multi-frequency networks (MFNs) are used. In the current landscape of DTT, Austria is transmitting in standard definition using MPEG-2 compression technology. However, the DTT broadcasting authorisations are technology neutral, leaving scope for future technology migration both in terms of transmitting in high definition and/or using MPEG-4 compression.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum.

What is the timetable for awarding this spectrum?	BMVIT has already made available spectrum for new national/regional and local DDT services and for mobile TV services (DVB-H). No additional awarding of remaining spectrum in the UHF bands is planned at the moment.
What type of award process is expected to be used (e.g. beauty contest, auction)?	The awarding process for DDT services and mobile TV was a beauty contest.
Will there be any restrictions on the type of organisations that can bid for the available spectrum?	There were no restrictions.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	More DDT multiplexes and DVB-H are strong candidates in Austria while HDTV and audio broadcasting are also possibilities if there is sufficient market demand.

Following the RRC-06 conferences, Austria was allocated 6/7 multiplexes. Austria has currently launched four multiplexes and has awarded the licences via a beauty contest for the additional multiplexes that will be use for local DDT services and mobile TV (DVB-H). While no decisions have been made to date regarding the use of digital dividend spectrum, including the frequencies in the 790–862MHz range, BMVIT has expressed a willingness to let market forces decide on the viability of HDTV, additional DDT or mobile TV's use of the digital dividend spectrum.. On the other hand, BMVIT is still undecided on non-broadcasting uses using the digital dividend spectrum.

The switchover from analogue to digital in Austria will mean that users of services ancillary to broadcasting and programme making (SAB/SAP) that were previously using interleaved spectrum in the 470–862MHz band, will face a decrease in the amount of spectrum available following the switchover. In particular, SAB/SAP users at the borders are likely to not be able to use the 470–862MHz band.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

To date national studies have not yet been completed or commissioned in Austria. The national public discussions on the subject of the digital dividend will start on 27 January 2009 within Digital Platform Austria, which was established in 2002 and is the body to support the government by the introduction of digital broadcasting in Austria.

A.1.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The current switchover process and the awarding of authorisations for digital terrestrial broadcasting are regulated in the Private Television Act[1] and other acts, in particular the national frequency-plan.[2] For a possible future use of "broadcasting-spectrum" for non-broadcasting services amendments of these provisions would be necessary.

Regulatory instruments used to switch analogue broadcasting into digital

New authorisations for the use of 470–862MHz have been awarded to multiplex operators, which are normally not programme providers. Programme providers have been awarded new authorisations for the distribution of their programmes over a multiplex platform. Existing analogue authorisations, which were granted to programme providers in the past will expire.

DTT and mobile TV authorisations have a duration of ten years. The first was granted in 2006. The latest, so far, at the end of 2008. Therefore the end of the authorisations already awarded will be between 2016 and 2018.

1 http://www.rtr.at/de/rf/PrTV-G

2 http://www.bmvit.gv.at/telekommunikation/funk/frequenzverw/natplan/index.html

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	Pluralism, increase of DDT population coverage etc. is regulated in the Private Television Act. These issues are not linked to UHF spectrum only.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	See above.
Co-ordination issues with countries outside the EU	Austria has to co-ordinate our frequencies with Switzerland and Croatia, which are outside EU. Co-ordination in the UHF bands is based on GE-06 Agreement.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	A digitisation report to the parliament is provided by the Regulatory Authority every year.[3] The report for the year 2008 is being prepared. BMVIT is of the view that digital satellite TV subscription will probably increase as analogue satellite TV penetration decreases rapidly. DTT penetration should increase with higher take-up from second and third TV sets in the households. Cable TV will remain slow in its switchover to digital. The IPTV will potentially take off in the future though this remains uncertain.

[3] As an example appropriate information can be found in the report http://www.rtr.at/de/komp/Digi_Bericht2006.

A.2 Bulgaria

A.2.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, in Bulgaria, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	26 channels were used within UHF IV/V for analogue TV (1003 frequency assignments).
VHF channels used for analogue TV	6 channels were used within VHF III for analogue TV (616 frequency assignments).
UHF channels reserved for other uses (e.g. radio astronomy, the 0military)	23 channels were reserved for other uses (aeronautical radio navigation).
UHF channels not used, or unusable because of co-ordination requirements	There were no UHF IV/V spectrum channels not used or unusable.

Historical television broadcasting

Figure A.5 below summarises the distribution of analogue TV programming channels in the UHF band before the introduction of DTT services in Bulgaria.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
BNT (98.5%)	BTV (97.7%)	n/a	n/a
n/a	NovaTV (76%)	n/a	n/a
1	**2**	**n/a**	**n/a**

Figure A.5: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Communications Regulation Commission, 2007]

Other uses accommodated within the UHF band

Figure A.6 summarises other uses within the spectrum band in Bulgaria.

Uses	*Spectrum channels*
SNG TES (Space to Earth)	10.70–11.70GHz
	12.50–12.75GHz
SNG TES (Earth to Space)	12.75–13.25GHz
	14.00–14.50GHz
Cordless camera	2300–2400MHz
	10.00–10.15GHz
	21.20–21.40GHz
	47.20–48.50GHz
Portable links	2300–2400MHz
	10.00–10.15GHz
Temporary radio-relay lines	10.00–10.15GHz
	21.2–21.40GHz
Radio microphones and hearing aids	29.70–47.0MHz
	174–216MHz
	470–862MHz
	863–865MHz
	1785–1795MHz
	1795–1800MHz
Mobile links (vehicular or aircraft)	2300–2400MHz

Figure A.6: Overview of other uses within the UHF band and VHF III band in Bulgaria [Source: Communications Regulation Commission, January 2009]

A.2.2 The transitory situation (as of December 2008)

Current television broadcasting

So far, one multiplex has been awarded for the area of Sofia city. Figure A.7 illustrates the primary type of television signal received in Bulgaria.

Primary type of television signal received	*% of households*
Analogue terrestrial	≈30
Digital terrestrial	≈0
Analogue cable	55.44
Digital cable	7.56
DTH/SMATV	7
IPTV	0

Figure A.7: Current households primary TV signal typology [Source: Communications Regulation Commission and Analysys Mason, January 2009]

Timetable for switchover

In accordance with the plan for introduction of DVB-T in the Republic of Bulgaria, adopted by the Council of Ministers on 31 January 2008, analogue TV stations will be switched off by the end of 2012.

Other uses accommodated within the UHF band

There are no multiplexes already awarded in Bulgaria for other uses than DTT. No decision about the digital dividend has been made yet.

A.2.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

After analogue switch-off (ASO) the Communications Regulation Commission expects to use 33 multiplexes for DTT (6 national and 27 regional). The Communications Regulation Commission intends to launch DTT services in 2009 on a national basis and expects that by the end of 2012 approximately 95–98% of the population will be covered by each of the national multiplexes.

The Communications Regulation Commission also expects to use six national multiplexes for DTT (one of them will be used for public services, the others will be used for private programmes). Each multiplex will distribute a minimum of four TV programming channels.

For mobile TV no decision has been taken yet.

Technological evolution affecting the use of the spectrum for broadcasting

In Bulgaria, MFNs will be used for national networks and SFNs for regional networks. The Communications Regulation Commission expects to use DVB-T technology with MPEG-2/MPEG-4 compression until 2012. DVB-T2 technology might be used in the future. HDTV launch has still to be decided.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum.

What is the timetable for awarding this spectrum	Yet to be decided.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Yet to be decided.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	Yet to be decided.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Yet to be decided.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

No studies concerning future uses of the UHF band have been completed or commissioned at this stage (February 2009).

A.2.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

A plan for introduction of DVB-T in the Republic of Bulgaria was adopted by the Council of Ministers on 31 January 2008.[4]

Regulatory instruments used to switch analogue broadcasting into digital

Analogue TV broadcasting will be switched off by the end of 2012. Instruments such as authorisation modifications, authorisation replacement, or new authorisations have yet to be decided.

[4] http://www.daits.government.bg/upl/docbg20080530160620.pdf

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	• Plan for introduction of DVB-T in the Republic of Bulgaria, adopted by the Council of Ministers on 31 January 2008. • Law on electronic communications[5] • Regulating policy for civil .radiofrequency spectrum management.[6]
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	Not applicable.
Co-ordination issues with countries inside the EU	Not applicable.
Co-ordination issues with countries outside the EU	Not applicable.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	Not applicable.

5 http://www.crc.bg/files/_en/ZES_ENG.pdf

6 http://www.crc.bg/files/_bg/REGULATORNA_POLITIKA_29.04.08.pdf

A.3 Cyprus

A.3.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

In Cyprus, DTT has not been launched yet; UHF bands IV and V were allocated as described below.

UHF channels used for analogue TV	Cyprus is using almost all UHF band IV and V channels (except two) for analogue TV.
VHF channels used for analogue TV	Cyprus is using two VHF band III channels for analogue TV.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	UHF Channel 46 and UHF Channel 52 have been reserved for DTT during the switchover period.
UHF channels not used, or unusable because of co-ordination requirements	There are no unused or unusable UHF bands IV and V channels in Cyprus.

Historical television broadcasting

Figure A.8 summarises the distribution of analogue TV programming channels in the UHF bands IV and V before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
3 (99%)	7 (90%)	0	8

Figure A.8: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses) [Source: Ministry of Communications and Works, January 2009]

Other uses accommodated within the UHF band

In Cyprus, the interleaved spectrum is used mostly by radio microphones on authorisation-exempt basis.

A.3.2 The transitory situation (as of December 2008)

Current television broadcasting

In Cyprus, the authorisations for the operation of DTT networks have not been granted yet. There is an ongoing procedure which includes two nationwide authorisations for DTT network/multiplex operators. One authorisation will be granted to the public broadcaster in order to use one multiplex and the second authorisation will be auctioned. The second authorisation will include two multiplexes during the switchover period and five multiplexes after the switch-off. It is expected that one of the five multiplexes after the switch-off will be for uses other than DTT. These processes are currently underway and it is expected that both authorisations will be granted by 2010.

Figure A.9 summarises the distribution of current DTT programming channels in the UHF band.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	n/a	n/a	n/a	n/a
2	n/a	n/a	n/a	n/a
3	n/a	n/a	n/a	n/a
Total	**n/a**	**n/a**	**n/a**	**n/a**

Figure A.9: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: The Ministry of Communications and Works, January 2009]

Currently the main national TV programming channels are received through analogue broadcasts only. Figure A.10 illustrates the primary type of television signal received in Cyprus.

Primary type of television signal received	*% of households*
Analogue terrestrial	68.3
Digital terrestrial	0
Analogue cable	11.6
Digital cable	0
DTH/SMATV	20.1
IPTV	n/a

Figure A.10: Current households primary TV signal typology [Source: European Audiovisual Observatory]

Timetable for switchover

The Council of Ministers decided that the analogue switch-off date will be 1 July 2011.

Other uses accommodated within the UHF band

It is expected that one of the five multiplexes after the switch-off will be for uses other than DTT. The remaining frequencies in the UHF spectrum that will not be authorised by the above-mentioned processes for DTT will be available for other uses (including broadcasting).

The Ministry of Communications and Works believes that the digital switchover will not affect any other current uses of UHF spectrum. The remaining frequencies in the UHF spectrum that will not be authorised by the abovementioned processes will be available for other uses (including broadcasting).

A.3.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

After the switch-off date (1 July 2011), the total number of DTT multiplexes will be six. One multiplex will be for the public broadcaster and the other five for the private operators. It is expected that the population coverage will be the same as in the analogue TV (i.e. 99%).

The public multiplex will be allowed to broadcast the three existing TV programming channels as well as future public service TV programming channels. The five private multiplexes will be allowed to broadcast the seven existing TV programming channels as well as any other new future TV programmes channels. Also, the private operators will have the right to use these frequencies to offer other electronic communications/information society services.

In addition to the six already awarded, another multiplex has also been reserved for mobile TV.

Technological evolution affecting the use of the spectrum for broadcasting

In the short term period, the Ministry expects to deploy SFNs, with DVB-T technology, and MPEG-2 compression technology. In the short term, SDTV will be implemented. In the long term the abovementioned technologies will be reviewed.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum.

What is the timetable for awarding this spectrum	Not decided yet.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Not decided yet.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	Not decided yet.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Regarding the spectrum released from the switch-off, no final decision has been taken at a national level.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

Cyprus has conducted a public consultation on 24 November 2006 regarding the possible future uses of the UHF band.[7] The results of the public consultation have shown that all the options for the use of the UHF band are open. The responders to the public consultation have shown interest in using the UHF band for broadcasting (DVB-H, HDTV), mobile networks and other services.

7 www.mcw.gov.cy/dec see "Public Consultations"

A.3.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The existing Radiocommunications and Electronic Communications laws will be used to authorise the use of frequencies and the establishment of DTT networks.

Regulatory instruments used to switch analogue broadcasting into digital

The Cyprus RadioTelevision Authority which is responsible for issuing the analogue TV authorisations is in the process of defining the framework for licensing TV programming channels delivery after the switch-off date.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	The Ministry did not answer this question.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	The Ministry did not answer this question.
Co-ordination issues with countries inside the EU	The Ministry did not answer this question.
Co-ordination issues with countries outside the EU	In the RRC-06, Cyprus got seven uncompleted DTT multiplexes because of technical coordination issues with Turkey. These seven uncompleted multiplexes represent only 40% of Cyprus requirements in the UHF band. As mentioned above, Cyprus is planning to authorise six multiplexes for DTT and one multiplex for mobile TV. In order to be able to operate fully the seven multiplexes, Cyprus needs to modify the GE-06 plan by adding a new number of requirements (i.e. five additional frequencies).
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	The Ministry did not answer this question.

A.4 Czech Republic

A.4.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 21–64 had been allocated for the TV broadcasting in the UHF band IV and V.
VHF channels used for analogue TV	Channels 6–12 had been allocated for the TV broadcasting in the VHF band III.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	National frequency allocation table (NFAT) of the VHF and UHF bands is compatible with Radio Regulations and the European Table of Frequency Allocations and Utilisations. The operation of applications of radiocommunication services other than broadcasting have gradually been terminated.
UHF channels not used, or unusable because of co-ordination requirements	There is a limitation of spectrum channel usage due to the international coordination based on the Geneva Agreement 2006 (GE-06) as well as the geographical position of the TV transmitter. However, in general terms, any of the VHF band III or UHF bands IV and V channels are usable for broadcasting in the region of the Czech Republic. Note the size of the Czech Republic, four neighbouring countries and the operation of primary and secondary broadcasting networks (1746 transmitters). Also taking into account switchover manoeuvres i.e. transition period when usage of a spectrum channel is multiple and changing continuously in various part of the country it is complicated to speak about used and not used spectrum channels.

Historical television broadcasting

Before DTT was introduced four nationwide analogue TV programming channels (two public and two private) were accessible in Czech Republic. Two of them (one public and one private) provided regional programming on the basis of time-sharing. These TV programming channels are still provided by analogue networks.

Figure A.11 summarises the distribution of analogue TV programming channels in the UHF band before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
CTI (99.6%)	NOVA (98%)	1	1
CT2 (91%)	PRIMA (73%)	n/a	n/a
2	**2**	**1**	**1**

Figure A.11: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Czech Telecommunication Office, January 2009]

Other uses accommodated within the UHF band

The Radio Spectrum Utilisation Plan enables the operation of radio microphones within the CEPT/ERC/REC 70-03 (SRD) within both the VHF band III (173–230MHz) and UHF bands IV and V. Moreover, VHF band III can be used for professional microphones.

A.4.2 The transitory situation (as of December 2008)

Current television broadcasting

Figure A.12 summarises the distribution of current DTT programming channels in the UHF.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	2	0	0	0
2	0	1	0	0
3	0	1	0	0
4	Testing phase	Testing phase	Testing phase	Testing phase
Total	**2**	**2**	**0**	**0**

Figure A.12: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: Czech Telecommunication Office, January 2009]

Figure A.13 below illustrates the primary type of television signal received in the Czech Republic.

Primary type of television signal received	*% of households*
Analogue terrestrial	40.81
Digital terrestrial	9.20
Analogue cable	23.07
Digital cable	3.85
DTH/SMATV	20.51
IPTV	2.56

Figure A.13: Current households primary TV signal typology [Source: European Audiovisual Observatory]

Timetable for switchover

In April 2008, the Government Decree No. 161/2008 Coll. on the Technical Transition Plan (TTP) has been issued. The TTP sets the legal framework for the switchover process within the Czech Republic (schedule and technical issues). Final switch-off date is planned for June 2012.

Other uses accommodated within the UHF band

Digital switchover affects the television transmissions itself. Due to lack of spectrum for simultaneous analogue and digital transmissions the switchover procedure is a complicated procedure which has to be scheduled stepwise region by region (11 regions). Use of the band 790–862MHz harmonised by WRC-07 is being envisaged for mobile communication networks in the future.

A.4.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

Basic decision of future use of the UHF bands IV and V has been made by the governmental approval of the TPP. Such plan[8] details methods and time schedule of switchover and its main target. The target of the plan is to create basic digital broadcasting networks distributing 1 public and 3 private multiplexes. Accordingly, networks for four multiplexes are operated or being prepared for deployment.

One network for mobile TV has been envisaged, nevertheless needed spectrum will not be accessible before the ASO.

Generally, the Czech Telecommunication Office (CTO) underlined that the deployment of DTT has to be in line with GE-06 and cross-border co-ordinations. However, use of the harmonised sub-band for mobile communication networks will decrease number of usable layers planned by GE-06.

8 http://www.portal.gov.cz see document number 161/2008

According to the CTO, in the UHF band, significant doubts regarding the future use of specific mobile TV technologies have been indicated by potential investors. It has been pointed out that the market does not allow to set up real business plan for mobile TV based on e.g. DVB-H due to limited number of customers and ability of users to receive terrestrial free-to-view DVB-T transmission by new mobile equipment that recently entered the Czech market.

Technological evolution affecting the use of the spectrum for broadcasting

Czech Republic has MFN plans. The Czech legislation (NFAT, TTP and Radio Spectrum Utilisation Plan - RSUP) does not preclude any concrete digital technology for DTT. Network operators built their business plans on MPEG-2 in the starting phase. Compression technologies other than DVB-T/MPEG-2 are in testing phase; HDTV via DTT is under market players consideration.

Existing plans to release the digital dividend spectrum

Public discussion on the further use of the digital dividend was launched in August 2008 in the Czech Republic. It has been identified in its first round, that the full capacity of the digital dividend can be known even after switch-off in the Czech Republic and the neighbouring countries, and that a decision is to be made on the future use of the band by the mobile communication networks.

The table below summarises the current plans to release the digital dividend spectrum in the Czech Republic.

What is the timetable for awarding this spectrum	It is premature to discuss details of further spectrum awarding in UHF band as the real time schedule of the switchover itself can deviate from the planned ones and timetable of spectrum awarding depends in particular on the market demand. Even more, another period for so called Digital-to Digital Transition has to follow. That it is to say that amount of work must be done to identify the accessible spectrum after switch-off and consequently measures have to be taken to clean up the harmonised band for mobile communication networks. Such work has to be made in cooperation with neighbouring countries.
What type of award process is expected to be used (e.g. beauty contest, auction)?	According to the CTO, auctions are expected to meet the conditions of the Electronic Communications Act.

Will there be any restrictions on the type of organisations that can bid for the available spectrum	Conditions of the award process will be specified in the call for bids.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	The measures taken within Digital-to-Digital Transition have to respect market and technology development. The CTO envisages that there will be also need to improve the existing broadcasting networks (higher compressions, new standards, HDTV etc.) as well as possible introducing of another services should be taken into account.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

In the Czech Republic, public discussion on the transition to digital broadcasting, its consequences and the digital dividend, was opened in August 2008, with the following results:

- different national and international views have been indicated
- the future use of the frequency bands shall reflect the market demand
- various views were expressed on the harmonised deployment of broadband access networks and further broadcasting (TV) networks development.

A second round of public consultations is scheduled for March 2009.

The Czech communications regulator (the CTU) has also started a public consultation on possible uses for spectrum freed up from the switch to digital broadcasting. The consultation focuses on the frequency range 470–862MHz, which could be used for HD.

A.4.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

Generally – NFAT, TTP, RSUP, GE-06, European Commission COM(2007)700, RSPG Opinions (for details, see the answers above).

Regulatory instruments used to switch analogue broadcasting into digital

Based on the TTP, new licensees for digital broadcasting have been awarded to private and public broadcasters. Some authorisations have been issued as 'compensation authorisations'.

Information on the broadcasting authorisations are available on the website of the Council for Radio and TV Broadcasting (www.rrtv.cz). Expiration dates of the two main private nationwide broadcasters are 2017 and 2018 respectively. Public broadcasters are not limited by any end dates.

Analogue broadcasting should respect the final switch-off date (Czech Republic, June 2012).

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	No special national constraints limit the future use of the UHF spectrum. The Radio Spectrum Utilisation Plan is close to the European Table of Frequency Allocations and Utilisations. DTT coverage is given by the TTP. For the public multiplex at least 95% of population (2011); other private multiplexes, transmitting the TV programming channels simultaneously via DTT and analogue TV (until switchover), will have comparable (or similar) coverage as the analogue TV network before the switch-over process. Note that the main purpose of the existing TPP is to cover general interest in pluralism, demand of the public by opening the real competition in the broadcasting market which has been strongly limited by lack of spectrum.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	General interest is a matter of content regulation (outside NRA responsibility). Usually after broad discussion within society, appropriate changes in legislative are approved and consequently implemented by responsible bodies. This method has been used for the national decision on switchover as well e.g. TPP has been consequently issued.
Co-ordination issues with countries inside the EU	
Co-ordination issues with countries outside the EU	Coordination issues outside the EU are based on GE-06. It happens in limited cases in dedicated bands for the Czech Republic.

The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	The terrestrial platform is very important in the Czech Republic. Moreover, this platform is also a base for mobile TV or multimedia reception and plays a significant role in the country. Note that the satellite platform is not comparable with the national terrestrial free-to-view offer.

A.5 Denmark

Denmark has a cable-dominated broadcast market, with terrestrial television playing a relatively minor role. Denmark has not yet made any decision on how the digital dividend will be allocated or whether there will be a digital dividend. There has been a nationwide DTT service since early 2006 and the analogue switch-off is planned for October 2009, at which point three more multiplexes will be activated and the offering on the DTT platform will improve significantly. The majority of the Danish DTT platform is controlled by Boxer, the Swedish incumbent operator, and will be run on a subscription pay-TV basis.

A.5.1 The situation before the introduction of digital terrestrial television (DTT)

In Demark, cable television is the most important delivery platform and terrestrial television is a distant second. There were two TV programming channels offered on the terrestrial analogue television platform: DR1, a TV programming channel provided by the public service broadcaster, Digi-TV, reached almost 100% of the population and TV 2/Danmark, a commercial one provided by TV 2. There were also a number of commercial regional TV programming channels.

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 22–60 in the UHF band were used to broadcast analogue television.
VHF channels used for analogue TV	Channels 5–11 in the VHF band were used.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	Channels 61–69 in the UHF band were reserved for other uses.
UHF channels not used, or unusable because of co-ordination requirements	Channel 21 was unusable.

Other uses accommodated within the UHF band

The 800–820MHz sub-band was used for authorisation-exempt radio microphones. Interleaved spectrum in the 470–862MHz band was used for licensed SAB/SAP, including temporary authorisations to operate SAB/SAP on dedicated spectrum channels. In Denmark there is no distinction between professional use and non-professional use, only between licensed and authorisation-exempt use.

A.5.2 The transitory situation (as of December 2008)

Currently only one DTT multiplex is operating in Denmark, this is the first of the public service broadcaster's two multiplexes. In total there are six multiplexes that have been completed and licensed; multiplexes 2–5 will come into operation by November 2009 and the final DTT multiplex in November 2010. Multiplexes 1 and 2 will broadcast free-to-view DTT and multiplexes 3–6 will broadcast subscription television.

In April 2008 the Swedish incumbent pay-TV operator, Boxer, won a 12-year authorisation to operate all of Denmark's commercial multiplexes. Digi-TV's multiplex currently covers close to 100% of the population and the second multiplex will be required to provide the same coverage, Boxer's multiplexes are required to cover at least 97% of the population. Boxer will also launch a seventh, DVB-H, multiplex for mobile television in 2010, this will cover at least 37% of the population. Digi-TV plans to provide seven SDTV programming channels and one HDTV programming channel once the first two multiplexes come online, Boxer will provide 29 SDTV channels and some, intermittent, HDTV programming channels once the remaining multiplexes are activated.

Cable is the most common option, serving more than 60% of households. The strongest cable operators are YouSee (controlled by TDC, the incumbent Danish telecommunications operator, now privatised) with 1.1 million subscribers in the first quarter of 2008, and Stofa (controlled by Swedish company TeliaSonera), as well as Dansk Kabel TV (200 000 subscribers in 2008). According to Cable Europe and Screendigest, a total of more than 1500 cable operators are operating in Denmark.

Current television broadcasting

Figure A.14 illustrates the primary type of television signal received in Denmark.

Primary type of television signal received	*% of households*
Analogue/digital terrestrial	24.7
Analogue/digital cable	63.4
Satellite	6
IPTV	1.5

Figure A.14: Current households primary TV signal typology [Source: National IT and Telecom Agency, January 2009]

Timetable for switchover

Analogue switch-off is planned for the end of October 2009.

Other uses accommodated within the UHF band

The use of the UHF band for SAB/SAP will remain mostly unchanged, however some UHF SAB/SAP users will have to be re-allocated to other parts of the UHF band.

A.5.3 The situation after analogue signals are switched off throughout the European Union

Denmark plans to launch eight DTT multiplexes in the long term, with seven operating in 470–862MHz and one in 174–230MHz. Five of these multiplexes should be operational from November 2009, with one further multiplex coming online in November 2010. Two of the multiplexes, one using 470–862MHz and the 174–230MHz multiplex, will be set aside for innovation and be allocated when appropriate new technologies become available. From November 2010 one of the innovation multiplexes will be given to Boxer for a DVB-H multiplex for mobile and handheld television, which will have a minimum coverage of 37%, and Boxer will be able to use up to 15% of the capacity on the four multiplexes it controls to provide further DVB-H services.

Expected television broadcasting

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	6		NA	
2	All			
3		Most		
4		Most		
5		Most		
6		Most		
Total	**NA**	**NA**	**NA**	**NA**

Figure A.15: Overview of DTT programming channels in the UHF band after the ASO [Source: National IT and Telecom Agency, January 2009]

Technological evolution affecting the use of the spectrum for broadcasting

A mixture of SFNs and MFNs will be used to provide DTT. All the multiplexes will use DVB-T technology, the public service broadcasters multiplexes (1 and 2) will use MPEG-2 compression until 2012, when they will upgrade to MPEG-4; the remaining multiplexes will be launched using MPEG-4 encryption.

One multiplex will be used until November 2010 to trial new technologies, including DVB-H and DVB-T2. This multiplex will then be given over to the commercial operator, Boxer, for use as a DVB-H multiplex.

One further multiplex is planned solely for HDTV transmission.

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	None.
What type of award process is expected to be used (e.g. beauty contest, auction)?	n/a.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	n/a.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	n/a.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

None.

A.5.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The Parliament's decision on the analogue switch-off dictates the means by which the spectrum will be allocated and how the ASO process will be carried out. The vast majority of the digital dividend has been allocated to the provision of further television services; mostly by a commercial gatekeeper, Boxer, on a pay-TV platform. Two multiplexes, however, are placed in an "innovation reserve", the allocation of these multiplexes will be decided later when appropriate new technologies are developed.

Regulatory instruments used to switch analogue broadcasting into digital

The authorisations for broadcasting are unchanged. DTT is introduced by authorisations for distribution, the expiry dates of which are:

- Digi-TV: 31 December 2013
- Boxer: 2020.

A.6 Estonia

Estonia launched a minimal DTT service in December 2006; this service has not developed since. Only three out of four available multiplexes have been in operation, offering seven national DTT TV programming channels. There have not yet been any decisions made on the future evolution of the DTT platform or the digital dividend; this will be decided in the Estonian digital dividend strategy. Any spectrum released in the 790–862MHz sub-band will be subject to severe usage restrictions due to co-ordination requirements with the Russian Federation who use Channels 61–69 for a combination of military and aeronautical radionavigation purposes.

A.6.1 The situation before the introduction of digital terrestrial television (DTT)

The analogue terrestrial market in Estonia was characterised by intense competition between the two providers of commercial TV programming channels, TV3 (owned by the Modern Times Group, Sweden) and Kanal2 (owned by Schibsted, Norway); there was also a third on offer from the public service broadcaster, Eesti Rahvusringhääling (ERR). The penetration of the ERR TV programming channel was 100% whereas the other two had around 80% penetration; there was also one regional service on offer that covered 10% of the population.

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Analogue TV used the following UHF Channels: 22–23, 25–32, 34–35, 39–44 and 49.
VHF channels used for analogue TV	Analogue TV used the following VHF 8MHz Channels: 6, 8, 11 and 12.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	None.
UHF channels not used, or unusable because of co-ordination requirements	Channels 24 and 54, as well as Channels 61–69 which were used by the Russian Federation for a combination of military and aeronautical radionavigation purposes.

Historical television broadcasting

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
1 (100%)	2 (80%)	1 (10%)	0

Figure A.16: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses) [Source: Ministry of Economic Affairs and Communications, January 2009]

Other uses accommodated within the UHF band

SAB/SAP used interleaved spectrum in the 470–862MHz band as long as effective radiated power was at or below 50mW.

A.6.2 The transitory situation (as of December 2008)

There are currently four DTT multiplexes operational in Estonia, three of which are in use. Multiplex 1 has 100% population coverage, multiplexes 2 and 3 have 95% coverage. There are no multiplexes for other uses, any such multiplexes will be agreed in the Estonia digital dividend strategy at a later date. There are seven national TV programming channels being broadcast, two of which are provided by the public service broadcaster.

There is a strong cable market in Estonia with two main operators, STV and Starman, with both companies providing a "triple-play" offering. The STV offering depends on the region – most regions can receive up to 70 TV programming channels and in some regions as many as 120 are available. Starman provide up to 70 TV programming channels in their premium cable package.

Current television broadcasting

Figure A.17 illustrates the primary type of television signal received in Estonia.

Primary type of television signal received	*% of households*
Analogue terrestrial	32
Digital terrestrial	4
Analogue/digital cable	46
IPTV	6

Figure A.17: Current households primary TV signal typology [Source: Ministry of Economic Affairs and Communications, January 2009]

Timetable for switchover

According to Broadcasting Act #451, subsection 15: the transmission of TV programming channels and services in the analogue network shall be terminated not later than by 1 July 2010.

Other uses accommodated within the UHF band

SAB/SAP uses interleaved spectrum in the 470–862MHz band, as long as effective radiated power is at or below 50mW.

A.6.3 The situation after analogue signals are switched off throughout the European Union

Use of the remaining spectrum will be agreed in the Estonian digital dividend strategy and it is currently unknown how many extra multiplexes will be built and what their use might be.

Technological evolution affecting the use of the spectrum for broadcasting

Currently Estonia has four DVB-T multiplexes; the three that are broadcasting use MPEG-4 compression and 64QAM modulation. The multiplexes are deployed in MFNs. There are currently HDTV and DVB-H tests being carried out in several regions; whether these technologies will be deployed will be decided in the Estonian digital dividend strategy.

In the long term, Estonia plans to upgrade to DVB-T2 multiplexes.

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	Not decided.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Not decided.

Will there be any restrictions on the type of organisations that can bid for the available spectrum	Not decided.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Not decided.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

None.

A.6.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

Broadcasting Act 45 fully outlines the ASO strategy and specifies the ASO date.

Regulatory instruments used to switch analogue broadcasting into digital

Any analogue TV broadcasting authorisation holder will receive a digital TV broadcasting authorisation upon application.

According to the legislation radio licences are valid for one year with right to extend them for one year. TV programming channel authorisations are valid for two years; new authorisations will be issued by beauty contest for a duration of five years.

Specific issues affecting the future use of the UHF bands

On the coordination of countries outside the EU, there are some difficulties in bilateral co-ordination with the Russian Federation as their ASO date is in 2015. They also have other primary services, both military and civil, in the upper part of the 470–862MHz range.

A.7 Finland

Finland was a relatively early adopter of DTT, officially launching the platform in August 2001. This was over a year later than neighbouring Sweden. However, Finland completed its analogue switch-off a month earlier, making it the fourth country in Europe to switch to a fully digitalised terrestrial platform. Finland currently has four national DTT multiplexes with two more in development; both VHF and UHF spectrum will be used to transmit DTT. Following a government decision in June 2008, the 790–862MHz sub-band was allocated to broadband mobile communications; the sub-band is however subject to co-ordination issues due to aeronautical radio navigation use by the Russian Federation. This is highly unlikely to change before the Russian ASO which, optimistic estimates suggest, will be in 2015. The award process for authorisations in the sub-band has not yet been decided.

A.7.1 The situation before the introduction of digital terrestrial television (DTT)

There were four TV programming channels on the Finnish terrestrial analogue network, two were public and two private. All four effectively had national coverage. The two public TV programming channels were YLE TV1 and YLE TV2 both run by the public service broadcaster, Yleisradio. There was no regional offering.

These four were broadcast using all available spectrum channels in both the VHF and UHF bands, there were however usage restrictions on Channels 60–69 as these were (and are) used for aeronautical radionavigation in the neighbouring Russian Federation, as well as military communications in Finland.

Except for Channel 21, which was reserved for SAB/SAP services, there were no other uses permitted in the UHF spectrum reserved for television broadcasting. The majority of SAB/SAP services were located in Channels 60–69. There were around 3000 licensed devices operating in the band, but the national regulator estimates that the total figure (including unlicensed usage) could be ten times this amount.

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	All available (except Channels 60–69)
VHF channels used for analogue TV	All available

UHF channels reserved for other uses (e.g. radio astronomy, the military)	Channels 60–69 – used for radio microphone and military.
UHF channels not used, or unusable because of co-ordination requirements	Channels 60–69 – used for aeronautical radionavigation in the Russian Federation.

A.7.2 The transitory situation (as of December 2008)

Current television broadcasting

Finland completed its ASO in September 2007 after a six-year period of simulcast. DTT penetration is currently at 50% of households, the only rival technology is cable, which is also has a 50% penetration.

There are currently four national digital television multiplexes and one regional multiplex in the UHF band in full operation. There is one more multiplex available in the UHF band and also a multiplex in the VHF band awaiting deployment.

There are 21 national TV programming channels available on the digital television network, as well as three regional TV programming channels in the Vaasa area and one regional TV programming channel in the Turku area. Multiplex A carries the national broadcasters four main TV programming channels only, all four are free-to-view. Multiplex B carries six TV programming channels of which two are not free-to-view. Multiplex C carries five pay TV programming channels and one regional, free-to-view, TV programming channel for the Turku region. Multiplex E carries six pay TV programming channels. The regional multiplex carries only three TV programming channels and operates only in the Vaasa region.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
A (99.9%)	4			
B (99.9%)	4	2		
C (78%)		5	1	
E (95%)		6		
Regional			3	
Total	**8**	**13**	**4**	**0**

Figure A.18: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Communications Regulatory Authority, January 2009]

Figure A.19 illustrates the primary type of television signal received in Finland.

Primary type of television signal received	*% of households*
Analogue terrestrial	0
Digital terrestrial	50
Analogue cable	0
Digital cable	50
IPTV	0

Figure A.19: Current households primary TV signal typology [Source: Communications Regulatory Authority, January 2009]

Other uses accommodated within the UHF band

Channels 60–69 are assigned to broadband mobile communication. They are also used for aeronautical radionavigation in the Russian Federation.

A.7.3 The situation after analogue signals are switched off throughout the European Union

By 2012 Finland will have all six national multiplexes at full capacity: there will be five multiplexes in the UHF band and one multiplex in the VHF band. The VHF band multiplex will primarily be used for HDTV. There will also be one regional multiplex. As Finland has already completed its ASO there is unlikely to be much change to the relative importance of the two competing television platforms, the national regulator theorises that the penetration of DTT will stay at approximately 50%.

Expected television broadcasting

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
A	4			
B	4	2		
C		5	1	
D		6		
E		6		
VHF		Up to 10		
Regional			3	
Total	**8**	**29**	**4**	**0**

Figure A.20: Overview of DTT programming channels in the UHF band after the ASO [Source: Communications Regulatory Authority, January 2009]

Technological evolution affecting the use of the spectrum for broadcasting

Currently, all functioning multiplexes use DVB-T and MPEG-2 compression. There is a multi-frequency network in operation. The multiplex in the VHF band is planned to be deployed for HDTV and will use MPEG-4 compression to increase capacity. The technologies used will stay the same until, at least, 2012 when DVB-T2 will be considered as an upgrade possibility.

There is already one multiplex in operation for DVB-H (mobile television), this covers 40% of the population. It is not anticipated that any more multiplexes will be deployed for DVB-H or population coverage extended in the foreseeable future.

HDTV has already been decided as that format for the multiplex in the VHF band, but there are no authorisations yet issued for this multiplex. There is unlikely to be any other HDTV available until after an upgrade to DVB-T2 some time after 2012.

Existing plans to release the digital dividend spectrum

In June 2008 Finland decided to assign the 790–862MHz sub-band to broadband mobile communications. The sub-band has not yet been licensed and there is no fixed date for this to happen; the award process has not yet been decided on.

Broadband mobile communication is likely to require paired spectrum for frequency division duplex, this would leave a centre gap available for SAB/SAP use.

What is the timetable for awarding this spectrum	The digital dividend of the 790–862MHz sub-band has already been assigned to broadband mobile communications, this process was completed in June 2008. The timetable, or method, for licensing of this spectrum has not yet been decided.

What type of award process is expected to be used (e.g. beauty contest, auction)?	This has not yet been decided.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	The 790–862MHz sub-band will be restricted to broadband mobile communications.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	The 790–862MHz sub-band has already been assigned to broadband mobile communications, this process was completed in June 2008.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

The Use of Analogue Television Spectrum after the Digital Switchover, Ministry of Transport and Communications 2007.[9]

A.7.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

Spectrum use for television, and radio, broadcasting, as well as for public mobile communication, is defined by a government decree. The decree defines the number of television, radio and mobile networks, and the radio spectrum to be used for these operations. Due to the rapid development in the sector the decree, and the related radio frequency allocation plan, are regularly updated, the last update was in June 2008. The most significant changes were related to the use of the digital dividend, this was assigned to wireless broadband services.

9 http://www.lvm.fi/fileserver/3107_ENG.pdf

Regulatory instruments used to switch analogue broadcasting into digital

All analogue broadcasters received a digital broadcasting licence, a new licensing system was introduced for digital network operators.

The operating licences for multiplexes B and E are valid until 31 December 2016. For multiplex C the expiry date of authorisations is 31 August 2010. The regional multiplex has an authorisation that runs out on 31 December 2016. The DVB-H multiplex has an operating authorisation that expires on 22 March 2026.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	There is a government decree that is updated regularly which, dictates exactly how spectrum can be used. The decree was last updated June 2008.
Co-ordination issues with countries in the EU	Finland's neighbours in the EU are Sweden, Norway and Estonia. Both Norway and Sweden are also releasing in the 790–862MHz sub-band as the digital dividend and Estonia is undecided. Finland has no co-ordination problems with countries inside the EU.
Co-ordination issues with countries outside the EU	Finland borders one non-EU country, the Russian Federation. the Russian Federation uses Channels 60–69 for aeronautical radionavigation and as such these cannot be used to their full capacity. the Russian Federation has no plans to move its aeronautical radionavigation to another frequency at any point.

A.8 France

A.8.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	The UHF bands IV and V were used for analogue broadcasting services between 470MHz and 830MHz. In addition, spectrum channels above 830MHz were also assigned in specific cases to TV transmitters.
VHF channels used for analogue TV	In VHF band III, six channels of 8MHz were used by analogue TV (for the commercial broadcaster Canal +). In VHF band I, some channels were also used for TV transmission.
UHF and VHF channels reserved for other uses (e.g. radio astronomy, the military)	Channels 66–69 (frequency band 830–862MHz) were allocated to Defence for mobile applications. Radio microphones were authorised with a secondary status in Channels 21 to 65 (frequency band 470–830MHz). Some VHF channels (from band III) were assigned in limited areas (Paris, Lyon, Marseille) for land radio mobile (Radiocom 2000). These mobile networks were closed in 1995. The VHF band III is also used on a secondary status by other services.
UHF channels not used, or unusable because of co-ordination requirements	All UHF band IV and V channels were used in France. However, France had to protect Radio Astronomy (Channel 38) and Radiolocation (Channel 36) services used in other countries, which significantly restricted the use of these spectrum channels throughout France.

Historical television broadcasting

Figure A.21 summarises the distribution of analogue TV programming channels in the UHF band before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
France 2	TF1	France 3	n/a
France 3	Canal+[10]		
ARTE/France 5[11]	M6		
3	**3**	**1**	**n/a**

Figure A.21: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Analysys Mason, CSA]

Other uses accommodated within the UHF band

Before DTT was introduced in France, 470–862MHz was used by radio microphones on a secondary status. Radio microphones are operated by professionals as ancillary broadcasting systems.

A.8.2 The transitory situation (as of December 2008)

Current television broadcasting

The French television market is characterised by innovation and consolidation. The market has changed significantly in recent years, with all sectors undergoing development. The rising popularity of IPTV and DTT has triggered mergers in the cable and satellite sectors, and historically terrestrial TV programming channels are relying on their new target content TV programming channels to drive growth in the increasingly multi-channel landscape. In addition, at the end of 2008 only about 40% of households have access to cable in France. As such, the French government and the broadcast regulator, Conseil Supérieur de l'Audiovisuel (CSA), have prioritised the development of the digital terrestrial platform.

Currently there are a total of six multiplexes in use in France. The first multiplex (R1) is reserved for public broadcasting, while the fifth (R5) is being used for HD DTT. Unlike a number of other European nations in which the majority or all multiplexes are operated by one player, each multiplex is operated by a different company. The multiplexes have been allocated to the different terrestrial broadcasters. At present, the six multiplexes offer a total of 29 national TV programming channels (5 of which are simulcast in SD and HD).

In France, DTT is an important mode of primary television reception, which has driven the CSA's development of the capacity of the platform and willingness to introduce HD services.

[10] Broadcast in the VHF band.

[11] Broadcast on a time-share basis.

France offers a mixture of free-to-view and pay-DTT services. 18 TV programming channels are available on the free-to-view service, comprising of the current analogue terrestrial TV programming channels and a number of digital-only ones. The remaining 11, including Canal+ and Eurosport are available via a pay-DTT service. HDTV programming channels are available both on a free-to-view and pay-DTT basis.

Figure A.22 summarises the distribution of current DTT programming channels in the UHF.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
R1	6 SD	0	1	18[12]
R2	1 SD	5 SD		
R3		6 SD 1HD		
R4	1 HD	4 SD		
R5	1 HD	2 HD		
R6		7 SD		
Total	**7 SD 2 HD**	**22 SD 3 HD**	**1**	**18**

Figure A.22: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: CSA, July 2008]]

Figure A.23 illustrates the primary type of television signal received in France.

Primary type of television signal received	*% of households*
Analogue terrestrial	28.5
Digital terrestrial	30.1
Analogue cable	8.5
Digital cable	5.5
DTH/SMATV	14.1
IPTV	10.5

Figure A.23: Current households primary TV signal typology [Source: CSA, ANFR]

Timetable for switchover

The completion date target for analogue switchover is 30 November 2011. Details were published on December 2008 as part of the National switchover scheme.[13] The switch-off will be spread out from 2009 to 2011 and will occur region by region.

12 As of 1 January 2008.

13 http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000019981964&dateTexte=

Other uses accommodated within the UHF band

One multiplex has been awarded for mobile TV, the roll out of which had not started as of February 2009.

Some interleaved spectrum is also used in areas where local digital TV programming channel could not fit on the first national multiplex called R1. In VHF band III, the process for digital radio services authorisation is on going.

The frequency band 790–862MHz will become available for electronic communication mobile services after the digital switchover, i.e. from 1 December 2011.

On 23 December 2008, the French national frequency allocation table has been modified in order to allocate the frequency band 790–862MHz to the mobile service, with ARCEP as the assigning authority in this frequency band, from 1 December 2011.

A.8.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

It is believed that after the analogue switch-off in France, DTT coverage should be nearly as high as the current analogue terrestrial TV coverage (95% of population). It is also expected that ADSL TV should keep on growing and that FTTH TV should appear.

The decision has been taken in France for the future planning of the UHF band[14]:

In a first phase, six multiplexes are to be deployed over the territory for 95% of population (fixed rooftop antenna reception) for all multiplexes. This first phase has started on 31 March 2005 with five multiplexes and more than 87% of the population is currently covered. An additional multiplex, with four HDTV programmes started on 31 October 2008.

As stated by law, all the free-to-view SD national DTT programming channels can be received from satellite (TNT SAT) everywhere in France.

After the complete switch-off, the objective adopted by the French government is to have 11 national multiplexes (HD) (mobile TV not included).

As of January 2009, each multiplex may contain six (free-to-view MPEG-2) to nine (scrambled pay-TV MPEG-4) SDTV programming channels, or three (MPEG-4) HDTV programming channels, or any intermediate mix. CSA is in charge of defining the multiplex structure and its

14 See Arrêté du 22 décembre 2008 approuvant le schéma national de réutilisation des fréquences libérées par l'arrêt de la diffusion analogique http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000019981950&dateTexte=

further evolutions. Most of these TV programming channels are produced as national ones, other are regional ones. In addition, there are regional and local TV programming channels broadcast within existing multiplexes (mainly multiplex R1).[15] The coverage target for the existing national programmes is 95% of the population (fixed rooftop antenna reception). To avoid serious regional discrepancies, an additional coverage target has been defined by CSA at the local metropolitan level (French "départements"). Overseas territories are currently under study.

Technological evolution affecting the use of the spectrum for broadcasting

A target of two mobile TV networks has been adopted by the French government. The services which will use the first multiplex have been selected by CSA but not yet authorised due to the on-going discussion between TV programming channels providers, mobile operators and broadcasters about the creation of the multiplex operator.[16] The target for this first multiplex coverage is 60 % of the population at launch, with a good indoor penetration. The coverage target objective in "Plan France Numérique 2012" for the two mobile-TV multiplexes suggests 70% of the population by 2012.

In France, for the DTT network, a mixed of SFNs and MFNs is envisaged. The reduction of the spectrum available for DTT and the objective of identifying additional national multiplexes for DTT will probably lead to a more intensive use of SFNs.

Currently, DVB-T is used with MPEG-2 for free-to-view SDTV and MPEG-4 for pay TV for HD. In accordance with law n°2008-776 ("loi de modernisation de l'économie"), as of December 2012, every new TV set will include a DVB-T MPEG-4 decoder, paving the way for a possible generalisation of MPEG-4 for the compression of DTT services. DVB-T2 is not a short-term option in France.

HDTV has been launched in France with five TV programming channels. Today, 87% of the population can receive two terrestrial HDTV programming channels (one free-to-view and one pay-TV), and three additional free-to-view HD services already cover 40% of the population (and 60% by end of May 2009)[17].

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

15 http://www.csa.fr/TV_numerique/tv_numerique_chaines_numeriques.php

16 http://www.csa.fr/actualite/communiques/communiques_detail.php?id=127564

17 http://www.csa.fr/TV_numerique/tv_numerique_chaines_HD.php

What is the timetable for awarding this spectrum	A public consultation for the spectrum made available by the switch-off is planned for beginning 2009 with the objective of an awarding process in the end of 2009. On 12 January 2009, the Prime Minister has set the objective of launching the award process of this frequency band before the end of 2009, together with the 2.6GHz band. To this end, ARCEP is mandated to launch a public consultation on the conditions and the methods of this award process before the end of February.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Auctioning may be envisaged for mobile services in Channels 61–69. However, the awarding mechanism has not been decided at this stage.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	This will be addressed in the public consultation. A priori, any actor could bid for the available spectrum
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	The 790–862MHz sub-band is allocated for mobile service and can be used by cellular mobile networks in order to provide high data rate wireless broadband services. The decision concerning paired/unpaired frequency plan depends on the studies at the CEPT, which have not been finalised yet. This issue is also to be discussed in the public consultation. Low-power services (e.g. Radio microphones) may be envisaged for the centre gap. Studies are still ongoing on this issue at the CEPT level.

Sub-band 470–790MHz

The analogue TV switch-off will release some spectrum that will allow new HD services (it is believed that all DTT services are to switch to HD, sooner or later) and a new mobile TV multiplex. The timetable for awarding this spectrum has not been decided yet.

VHF band (174–225MHz)

After the analogue switch-off of Canal +, this band will be fully dedicated to digital radio services. The awarding process is ongoing.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

The Parliament Committee for the digital dividend (Commission du dividende numérique), has published its report[18] which has been used as an input to the final decision from the government. (Other studies are available on the Comité stratégique pour le numérique server).

ARCEP has also ordered an external study on the value of the digital dividend – Etude sur la valorisation du dividende numérique, réalisée par les cabinets Analysys Consulting and Hogan & Hartson (May 2008).[19]

The "Commission consultative des radiocommunications" has published an external study about the need of frequencies for the telecommunication sector available on ARCEP's website.[20]

CSA has published in June 2008 a document[21] about the needs of the broadcasting sector.

In August 2007, ANFR has also completed a study for the Comité stratégique pour le numérique, on the feasibility of allocating the upper UHF band to the mobile service. This study has not been made public, but its results were used in establishing French positions and contributions in ECC/TG4 and WRC-07.

A.8.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The Law of the 5 March 2007 (Loi du 5 mars 2007 relative à la modernisation de la diffusion audiovisuelle et de la télévision du futur[22]) is in force and prepares the future use of the digital dividend in France.

The detailed planning of this use has been decided by the Primer Minister after advices of a Parliament Commission, CSA and ARCEP.

18 http://www.dividendenumerique.fr/remise_rapport.php

19 http://www.arcep.fr/index.php?id=8455&tx_gspublication_pi1[typo]=4&tx_gspublication_pi1[uidDocument]=609&cHash=261066d65d

20 http://www.arcep.fr/uploads/tx_gspublication/rapport-ccr-151007.pdf

21 http://www.csa.fr/actualite/dossiers/dossiers_detail.php?id=126508

22 http://www.csa.fr/infos/textes/textes_detail.php?id=116517

Regulatory instruments used to switch analogue broadcasting into digital

This process has been organised by the Law in 2000 (Loi n° 2000-719 du 1er août 2000), 2004 (Loi n° 2004-669 du 9 juillet 2004) and 2007.

The existing authorisation for analogue TV Canal + will end on 6 December 2010. Authorisations for other analogue TV broadcasting have to end before 30 November 2011.

Existing analogue TV programming channels have also been licensed as digital TV programming channels and are broadcast on the DTT multiplexes together with new digital TV programming channels. There is a legal framework for the transition from analogue to digital.

Authorisations for DTT (SD and HD) and mobile TV programmes have been granted for a duration of ten years with the possibility of a five-year extension.

There is no new framework for SAB/SAP which is implemented under general authorisation regime in the broadcasting bands.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	The law of 5 March 2007 says that the majority of the digital dividend will be used for the development of terrestrial TV. It has also defined target population coverage for DTT multiplexes. Launch of HDTV, mobile TV and development of local/regional programmes were also covered by this law.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	The main objectives in increasing the number of multiplexes is to develop new TV services. Free DTT TV programming channels should have the ability to go HD, and the objective of a second mobile TV multiplex has been adopted. The process to implement the extension of broadcasting is taking into account by public consultation managed by the CSA.[23]
Co-ordination issues with countries inside the EU	The current negotiations process to clear the 790–862MHz sub-band in France is proving to be long but not impossible, especially given the fact that many bordering countries are in line with the French decision of allocating the sub-band to telecoms.

[23] http://www.csa.fr/rapport2005/donnees/rapport/I_evenmt.htm

Co-ordination issues with countries outside the EU	There is no important coordination issues with countries outside the EU.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	The terrestrial platform is very important in France.

A.9 Germany

Germany has high cable and satellite TV penetration and successfully completed the analogue switchover in December 2008. It has a two-tier system in which the federal government holds authorisations for multiplexes, but frequencies are assigned by the Federal Network Agency in coordination with federal state media authorities; the German approach to the switch-over was heterogeneous. Any plans to coordinate efforts to re-plan the freed spectrum might be complicated by the above-mentioned separation of powers as well as the regional divide.[24] Germany has not yet decided on how and when to assign the 790–862MHz sub-band, but will use it for mobile services.

A.9.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT.

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 21–69.
VHF channels used for analogue TV	Channels 2–12. Channel 12 has been used to T-DAB following the Wiesbaden Agreement 1995.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	Channel 61–63 and 67–69 are used by military services (probably until 2012) and Channel 38 is used by radio astronomy.
UHF channels not used, or unusable because of co-ordination requirements	None.

Historical television broadcasting

Federal state governments in Germany each have their own federal state media authority that controls the broadcasters[25], hence there are varied broadcast licensing agreements across the 16

[24] See Spectrum Value Partners (2008) "Broadcast Migration Study – Final Report, 2008", p.77.

[25] Except Berlin/Brandenburg and Hamburg/Schleswig-Holstein that have joint media authorities.

federal states. In addition, a two-tier system is in place in which the federal government holds the authorisations, but frequencies are allocated by the Federal Network Agency in cooperation and coordination with the state media authorities.

Terrestrial television in Germany is a free-to-view service and traditionally, there has been very low terrestrial penetration in Germany of less than 10% with the majority of the population on cable or satellite.

There are two national terrestrial public broadcasters – ARD and ZDF and two commercial broadcasters – RTL and ProSiebenSat.l. There are three national public TV programming channels and about two to three national private TV programming channels that each reach 99% of the population. In addition there are over 20 regional terrestrial TV programming channels, therefore the number of TV programming channels available on terrestrial in each federal state varies from 10 to 30.

Figure A.24 illustrates the primary type of television signal received in Germany.

Primary type of television signal received	*% of households*
Analogue terrestrial	8
Analogue cable	59
Analogue satellite	25
Digital satellite	8

Figure A.24: Historical households primary TV signal typology before the introduction of DTT in 2002 [Source: Screen Digest]

Other uses accommodated within the UHF band

SAB/SAP at temporary events uses interleaved spectrum from frequencies 174–216MHz (in the VHF III band) and 470–862MHz band. In addition, 863–865MHz is also used for SAB/SAP.

There is also non-professional use of interleaved spectrum in the 790–814MHz and 838–862MHz range.

A.9.2 The transitory situation (as of December 2008)

The switchover process in Germany was to be overseen at a federal state level by respective federal state media authorities hence the switchover would take place regionally with a short simulcast period in each federal state. This process began in large urban areas with high population densities but few transmitters. Berlin/Brandenburg was the first federal state to undergo the switchover with digital terrestrial transmission in November 2002 and switched off its analogue signals less than a year later, in August 2003. The success of the switchover process in Berlin/Brandenburg encouraged other federal states to kick-start their switchover. By December 2008, the switchover was completed in Germany two years earlier than scheduled with DTT signals reaching 90% of the population.

The public broadcasters currently have three multiplexes and will roll these out to achieve national coverage by 2008. The private broadcasters with a single multiplex will roll out theirs regionally with no obligation for national coverage or a timeline for roll out.

Other uses accommodated within the UHF band

One multiplex has been set aside for DVB-H, though service on this multiplex has yet to be launched due to discrepancies across the regional states on issues such as the viable business plan.

790–862MHz has been designated for mobile services and the Federal Network Agency has the inclination for this upper band to be used for services to roll out high-speed Internet to rural areas. The media authority of Berlin/Brandenburg launched a project in Wittstock/Dosse in 2008 using frequencies from the digital dividend to provide broadband Internet access to rural areas. This is the first European pilot project of its kind and it employs a 3G CDMA system adopted to 750MHz. In particular, issues related to coverage, technological requirements and potential interference with DVB-T are investigated.[26]

Interleaved spectrum in 470–862MHz available to SAB/SAP services will be reduced with the switchover and the allocation of 790–862MHz for mobile services.

In addition, Channels 61–63 and 67–69 currently used by military services may be made available for civilian use in the near future.

A.9.3 The situation after analogue signals are switched off throughout the European Union

Expected DTT broadcasting

There are currently just three public service and three commercial free-to-view TV programming channels on the terrestrial network in Germany. However with the freed up digital dividend spectrum, this is expected to increase to 24 in total.

A unique feature of the German case is that the availability of multiplexes varies across regions as authorisations are assigned on the federal state level. In any one region as many as nine multiplexes can be received with one being reserved for national DVB-H. It is unlikely that more than nine multiplexes will be made available in any one federal state in the future.[27]

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26 Medienanstalt Berlin Brandenburg, 2008, press release 1 December 2008, available at http://www.mabb.de/presse-publikationen/archiv/2008/01122008.html

27 See Spectrum Value Partners (2008) "Broadcast Migration Study - Final Report, 2008", p.75.

There is currently one multiplex for DVB-H which was awarded by tender to T-Systems in 2007. Mobile3.0, a consortium of Mobiles Fernsehen Deutschland and Neva Media, won the authorisation in January 2008. However, they had to hand it back in October 2007 as they failed to meet some conditions relating to the authorisation. It is improbable that additional multiplexes will be made available for this technology in the near future.[28]

Technological evolution affecting the use of the spectrum for broadcasting

Currently, Channels 21–69 (except for Channels 38, 61–63, 67–69) are used to provide DTT. Larger multiplexes use SFNs whereas local multiplexes with a single transmitter operate as MFNs.

Currently, DVB-T is transmitted using MPEG-2 compression, but a migration scenario to MPEG-4 will be discussed in the near future. However, a change to MPEG-4 is at least two to three years away as it requires replacing set-top boxes with MPEG-4 compatible boxes and the Federal Network Agency has given multiplex operators the freedom to decide whether they want the to go ahead with the upgrade.

Regarding transmission technology, no decision has been made to switch from DVB-T to DVB-T2 though it has been considered that a simultaneous upgrade of compression and transmission technology after 2010 would significantly reduce costs for consumers who would then only have to change their equipment once.

Moreover, there are no plans to provide HDTV via DVB-T at the moment. However, if HD services via DVB-T were to be introduced, a re-organisation of multiplexes seems unlikely and HDTV programming channels would be integrated into the SD multiplexes already in place. As digital HD programming channels are already provided by many cable services, this service would face serious competition.

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	The 790–862MHz sub-band will be made available in the near future.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Not yet decided
Will there be any restrictions on the type of organisations that can bid for the available spectrum	Not yet decided

[28] Ibid. p.76.

Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	The 790–862MHz sub-band will be used for mobile services whereby preference is for services providing high-speed Internet to rural areas.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

Two studies are currently being carried out. The first study, undertaken by the Ministry of Economics and Technology, is concerned with compatibility of mobile applications and broadcasting in the UHF band. The second study, undertaken by the Federal Network Agency, investigates the digital dividend. The results of both studies are to be published in March or April 2009.

A.9.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The digital switchover and the awarding of authorisations is governed by the German Telecommunications Act. The German government decides on the use of frequency domains for different services. These are then incorporated in the frequency usage plan by the Federal Network Agency[29] that is also responsible for frequency allocation. The federal state media authorities, that are mainly responsible for broadcasting, and coordinate efforts with the Federal Network Agency when allocating specific frequencies to broadcasters at a federal state level. Therefore, regional autonomy leads to a heterogeneous number of multiplexes across federal states.

Recently, the German parliament announced a plan to remove the power of federal states to restrict usage of the UHF band to broadcasting services. This would simplify the legal process significantly as federal state media authorities would not be involved in the allocation of frequencies anymore and it would be the sole responsibility of the Federal Network Agency to award the spectrum.[30]

BITKOM, an influential media and telecoms association in Germany published a detailed proposal on how to use the digital dividend.[31] They suggest that all revenues from the allocation of spectrum to mobile services shall be kept in a "digitalisation fund" to finance fast allocations of spectrum to mobile services as well as optimisation of frequency usage.

29 Frequency usage plan, 2008, available at http://www.bundesnetzagentur.de/media/archive/13358.pdf

30 http://www.internationallawoffice.com/newsletters/detail.aspx?g=1c52ebca-992d-41fd-9bf3-b270f62cfba4

31 See BITKOM (2008) available at www.bitkom.org/files/documents/Bitkom_Eckpunkte_Digitale_Dividendel(1).pdf

Regulatory instruments used to switch analogue broadcasting into digital

The federal states are in charge of licensing broadcasters and the duration of authorisations are laid out in the media laws of the respective federal states (up to a maximum of ten years).

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	The 470–790MHz range will be reserved for broadcasting. According to media law, states have to ensure that people have access to a wide range of audio-visual content and both national as well as regional content has to be provided. The 790–862MHz sub-band will be used for mobile services, preferably to roll out broadband to rural areas.
Co-ordination issues with countries outside the EU	The federal government is responsible for telecommunications law and harmonises its plans with neighbouring countries.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	Relatively low due to the dominance of cable and satellite TV. The terrestrial platform is mainly used by public broadcasters to ensure basic coverage. It has also become increasingly important for mobile devices and second TV devices.

A.10 Hungary

A.10.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	In Hungary, UHF Channels 22–60 are used for analogue TV.
VHF channels used for analogue TV	Hungary also uses 8MHz blocks in VHF Band (VHF Channels 6–12). All VHF band III channels are used for analogue TV. Channel 11 has been used only for some low-power transmitters and SAB/SAP services, but recently most of these spectrum channels have been released in order to introduce T-

	DAB service.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	At present Channels 54–56, 62–63 and 66–67 were used for military services in Hungary (some spectrum channels used by military services have been released in the previous years). The Hungarian military services are protected only in the service area (not at national level). The digital TV stations planned on these spectrum channels can be used only after successful coordination with the governmental frequency management service (restrictions necessary depending on the position of the TV stations).
UHF channels not used, or unusable because of co-ordination requirements	There are some restrictions in the use of some UHF channels because of protection of military services in neighbouring countries (mainly Channels 61–69 in the eastern part of Hungary).

Historical television broadcasting

The public service TV programming channel (m1) has been broadcasted over a terrestrial network using mainly VHF channels and some UHF channels as well (two other public service TV programming channels are distributed by satellite).

There is no special network for regional public service TV in Hungary. Within the public service TV programming channels there is special TV programming for each region, on a time-shared basis, using the same infrastructure and spectrum channels of the national programmes.

Figure A.25 summarises the distribution of analogue TV programming channels in UHF band IV/V before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
M1 (97%)	RTL Klub (86%)	0	0
n/a	TV2 (86%)	n/a	n/a
1	**2**	**0**	**0**

Figure A.25: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: National Communications Authority]

Other uses accommodated within the UHF band

According to Hungarian regulation (National Table of Frequency Allocation and Table of Radio Applications) the professional and non-professional programme-making devices and other applications using interleaved spectrum can be used as follows.

- In the bands 470–798MHz (Channels 21–61), 814–830MHz (Channels 64–65) and 846–862MHz (Channels 68–69), frequencies may also be assigned to transportable low-power transmitting stations for the transmission of radio and television news in the fixed service, on a secondary basis and with geographical restrictions. (A coding technique shall be applied in case of transmission of programmes without editing, ERPmax = 10 W).
- In the bands 34.9–38.5MHz, 146–149.9MHz, 173.965–174.015MHz, 174–222MHz, 470–862MHz, 863–865MHz and 1785–1800MHz, frequencies may be assigned to radio microphone applications of short-range devices (SRDs) on a tertiary basis. (Exempted from the obligation of individual licensing).

A.10.2 The transitory situation (as of December 2008)

Current television broadcasting

In accordance with the Act on rules of broadcasting and digital switchover (Act LXXIV/2007) Hungary has successfully completed a tendering process for five national DTT multiplexes five multiplexes are awarded currently (four DVB-T and one DVB-H national network).

At present only frequencies for three multiplexes are available (two DVB-T networks and one DVB-H network), the other two multiplexes awarded during the tendering process can be put into operation after switching off the analogue TV networks.

The first three multiplexes use MPEG-4 and DVB-T technology over SFNs, with eight to ten TV programming channels per multiplex. The second multiplex is suitable for DVB-H, and it is confirmed that the winner has decided to use the multiplex for this use. The use of these three multiplexes is as follows:

- MUX A: two national public service TV programming channels (using HDTV technology) and negotiations are ongoing regarding others
- MUX B (DVB-H): four national public service TV programming channels and negotiations are ongoing regarding others
- MUX C: one national public service TV programming channel using HD, one national public service TV programming channel using SD and negotiations are ongoing regarding others.

Figure A.26 illustrates the primary type of television signal received in Hungary.

Primary type of television signal received	*% of households*
Analogue terrestrial	26
Digital terrestrial	≈2
Analogue cable	59
Digital cable	2
DTH/SMATV	11
IPTV	≈0

Figure A.26: Current households primary TV signal typology [Source: National Communications Authority]

Timetable for switchover

Hungary's deadline for analogue switch-off is 31 December 2011 (it has not changed). This is specified in the Act on rules of broadcasting and digital switchover (Act LXXIV/2007). The analogue digital switchover process will be a phased process with approximately 6–12 months simulcast period. The networks will be developed gradually as the analogue stations are switched off. According to the above mentioned Act, 94% population coverage and availability of digital TV receivers (set-top boxes) is also precondition of complete switchover.

Other uses accommodated within the UHF band

It is most probable that Channels 61–69 (790–862MHz) can be for new uses, but as these are mainly available at present for digital broadcasting, the National Communications Authority must use these in the introductory phase in order to start the digital services. The National Communications Authority expects the band 790–862MHz to be available only after 2015 as some of Hungary's neighbouring countries are not EU countries and intend to protect their analogue broadcasting services until the end of 2015.

As for January 2009 the National Communications Authority has no clear information about the spectrum need for digital broadcasting in the future and the real effect of digital switchover on UHF spectrum use. As most of the spectrum available for digital broadcasting in Hungary and in the neighbouring countries is used for analogue broadcasting at present, in the introductory phase the TV spectrum channels released could be used mainly by military services and some ST61 channels which are not in use for analogue purposes. The National Communications Authority thinks that the future use of UHF band can be better estimated when the services have been started and we have more information about the demands of the service providers and expectations of the customers.

A.10.3 The situation after analogue signals are switched off throughout the European Union

Antenna Hungária ZRt has control over decisions regarding the multiplex and so the likelihood and timescale of any future technical changes is uncertain. In addition, with the multiplex likely to be launched with MPEG-4 compression, 64QAM modulation and over SFN, the multiplexes are relatively 'future compatible' compared to other European nations such as the UK, and the Netherlands.

The next likely change in DTT technology is an upgrade of transmission technology on the multiplex to DVB-T2. It is considered in Hungary that the multiplex operator will be likely to deploy the strongest technology, and therefore it could be expected that DVB-T2 could be introduced at ASO in 2011 when more multiplexes are introduced.

Beyond the initial three multiplexes, one further multiplex (multiplex 4) could become available at the earlier switch-off. A fifth multiplex is also likely at the analogue switch-off of the commercial stations (RTL, TV2). These additional multiplexes would be suitable for HD programming, and while the decision on this lies with the operator, it is considered likely that they will be used for this.

Expected television broadcasting

According to the GE-06 Plan Hungary has frequencies for seven digital TV layers/national coverage in the UHF band, and for one digital TV layer/national coverage in the VHF band. Keeping in mind that Channels above 60 might be used for other services than broadcasting (almost two layers are based on Channels 61–69), it is most probably that the remaining spectrum channels released by the digital switchover will be needed for broadcasting (e.g. local television).

2 DVB-T multiplexes and one DVB-H multiplex started operation in December 2007. The other two DVB-T multiplexes awarded will start after the analogue switch-off.

At present one mobile TV multiplex is awarded. Need for further mobile TV multiplex will be considered.

Technological evolution affecting the use of the spectrum for broadcasting

Hungarian operator uses both MFNs and for some regions larger area SFN networks. DTT in Hungary is based on DVB-T using MPEG-4.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	The National Communications Authority thinks that the amount of spectrum made available by the digital switchover for new uses can be better estimated when more information about the demands of the service providers and expectations of the customers are available. It is most likely that the "digital dividend" will be available only after 2015 (as some of Hungary’s neighbouring countries are not EU countries and intend to protect their analogue broadcasting services until the end of 2015). Possibility of a tender on technology neutral bases only after the analogue switch-off (starting from 2012).
What type of award process is expected to be used (e.g. beauty contest, auction)?	No decision yet.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	No decision yet.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	The real demands will be identified only after gaining experience from the DTT services launched recently.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

The issue concerning future uses of UHF band is under consideration, but no studies have been completed on this subject yet.

A.10.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

Act LXXIV of 2007 on the rules of broadcasting and digital switchover (Digital Switchover Act, DSO Act) is the basic act for the digital switchover. There is no legislation available regarding use of the digital dividend in Hungary.

Regulatory instruments used to switch analogue broadcasting into digital

The DSO Act created new authorisations to the digital broadcasting, and practically excluded the nationwide incumbent broadcasters (RTL Klub and TV2) from the one-step beauty contest for the assignment of five digital television broadcasting networks and one VHF band digital radio broadcasting network. The aim of the exclusion set by the law was to avoid any potentially harmful consequences on competition in the broadcasters markets, and broadcast transmission markets. "No enterprise may participate in the television tender, including enterprises associated in terms of management, either independently or as a consortium member […]which provides programmes under Act of 1996 on radio and television broadcasting (Rttv.), targeted primarily at the territory of Hungary.".

In return for the above exclusion, the DSO Act offered the nationwide incumbent broadcasters the opportunity to participate in the digital switchover by obligating the applicants of the tender (and so the future winner) to enter into contract with the above broadcasters, if the broadcasters require it, to issue a binding statement and to enter into a contract within 60 days from the decision of the NCAH of the winner of the tender.

The radio authorisations for the existing analogue TV services have been granted until 31 December 2011. The authorisations for DTT (DVB-H) are granted for 12 years.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	Pursuant to the provisions of the DSO Act, the National Communications Authority (hereinafter NCAH) conducts a one-step beauty contest for the assignment of five digital television broadcasting networks and one VHF band digital radio broadcasting network. Although the NCAH conducted a beauty contest, all quality attributes and criteria were measurable or clearly assessable. For example: • lowest transmission fees for public service broadcasters • the better technology used (e.g. MPEG-2 or MPEG-4, and DVB-H service for television, DAB+ by radio) • pace of building of the transmission network and pace of penetration of service • highest price bid • commitment to broadcast certain programme-types (e.g. news and public life programmes by radio) • involvement of and co-operation with incumbent analogue broadcasters in the switch-off process • taking part in the information of the consumers and users • commitment to operate special set top box distribution system • commitments relating to interactive supplementary services, etc. In order to secure the supervision of the Parliament the DSO Act created a special Ad Hoc Committee of the Parliament (Committee) for the purposes of digital switch-over. This Committee has special rights in the process as below. The NCAH prepared the tender Documentations, and handed those over to the Committee. • The Committee decided in 10 days whether to accept the Documentation. • The NCAH published the Documentations on its website and in the papers. At the same time, the consultation about the Documentations was beginning (20 days). (Both oral and written consultation comments were accepted.) • The questions and remarks were discussed with experts of the Committee, and the NCAH made a summary of those in 10 days and made a proposal to the Committee, which is to adopt or reject. • The Committee decided in 15 days to approve the Documentation (in round 2).

- The NCAH published the invitations to the tender on its website and in the newspapers on 25 March 2008.
- Applicants submitted their bids within 30 days (24 April).
- The tender opening session was on the 30th Day from the publication of the invitations to the tender.
- The NCAH had 15 days to decide about the validity/invalidity of the bids (there was no invalid bid).
- There was a decision about the final result of the tender, and the decision was also included in the so called administrative contract to be entered into with the winner. The NCAH sent the draft administrative contract containing the result of the tender to the Committee in 60 days following the tender opening session.
- The Committee decided to send back the administrative contract to reconsider the result stating that the tender Documentation had not been followed and NCAH had made a calculation mistake. The NCAH gave further comments and explanation of the calculation and the methods of the decision, which was accepted by the Committee.
- The NCAH published the result of the tender on its website and in the papers, and on 5. September, 2008 the NCAH entered into the administrative contract with the 100% subsidiaries of the Antenna Hungária Zrt being the winner of both radio and television tender.

Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	No information provided.
Co-ordination issues with countries inside the EU	Hungary has to coordinate with a number of countries outside the EU and we have no information about the phasing of the digital switchover in these countries.

Co-ordination issues with countries outside the EU	No information provided.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	The digital transmission started in Hungary from December 2008. It is too early for Hungary to answer this question.

A.11 Ireland

Ireland has started its transition to DTT relatively late in day, probably motivated by lack of emphasis on free-to-view terrestrial television, which only 25% of the Irish population rely on. The take up of DTT is not expected to alter significantly from current analogue take up, thereby freeing up the digital dividend for other uses, such as mobile/fixed communications in the 790–862MHz sub-band which is currently under consideration. In order to maximise the benefit from its digital dividend due to interference issues, it is in Ireland's interest to align their digital dividend plans with those of the UK.

A.11.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	All except Channels 36, 38 and 69.
VHF channels used for analogue TV	RTÉ 1 and RTÉ 2 have a hybrid transmission network, that is to say it uses UHF and VHF Band III.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	Channel 36 (not used due to radar use in UK), Channel 38 (not used due to radio astronomy use in UK) and Channel 69 (used for SAB/SAP services).
UHF channels not used, or unusable because of co-ordination requirements	Nil.

A.11.2 The transitory situation (as of December 2008)

The current television broadcasting landscape

DTT is yet to be launch in Ireland and there are four TV programme channels in analogue - RTÉ 1, RTÉ 2, TV3 and TG4. There are also 23 "Deflector" licensees which retransmit 4 UK services in limited local areas, principally in the west and south of the country, where those services would not necessarily otherwise be available.

Primary type of television signal received	*% of households*
Analogue terrestrial	25.1
Digital terrestrial	0
Cable	30.0
Satellite	38.5
MMDS[32]	6.4

Figure A.27: Historical households primary TV signal typology before the introduction of DTT in 2008 [Source: DECRN, January 2009]

Three out of the four terrestrial broadcasters in Ireland (RTÉ 1, RTÉ 2 and TG4) are public service broadcasters, the fourth (TV3) is a privately owned and a commercial broadcaster. RTÉ One and RTÉ Two have 98% population coverage, TG4 has 95% population coverage and TV3 have approximately 90% population coverage based on the free-to-view terrestrial analogue TV transmitter networks deployed.[33]

RTÉ 1, RTÉ 2, TV3 and TG4 are also available on cable, MMDS and satellite. While DTT has yet to be launched yet, it is expected that DTT will eventually erode away the number of MMDS subscribers due to its efficiency to serve low household density areas as well as the larger number of TV programming channels it can hold (compared to analogue).

The main user of interleaved spectrum is SAB/SAP-type services and deflector schemes. On a much smaller scale, the band has also been used in an interleaved way to facilitate the 'Test and Trial' licence regime[34] for testing and trialling innovative new services, such as DVB-H, which is operated by the Commission for Communications Regulation (ComReg), the Irish Spectrum Management Agency and National Regulatory Authority for Telecommunications.

32 MMDS stands for Multichannel Multipoint Distribution System

33 For a full list of available channels see http://en.wikipedia.org/wiki/List_of_Irish_television_channels

34 http://www.comreg.ie/radio_spectrum/wireless_test_and_trail_licensing.541.545.html

Timetable for switchover

The first DTT trials in Ireland began in 1998 and the first contract to run six nationwide multiplexes was awarded to ITS Digital Limited in 2001. ITS Digital Limited had planned to launch a pay-TV and broadband service on its DTT platform, however they had no broadband authorisation and did not have a viable business plan without providing broadband service, hence it subsequently returned its multiplex authorisation.

In August 2006, seven out of nine applicants were allowed to broadcast content in a DTT trial, with the possibility of running the actual platform when it is eventually launched.[35] The trial was carried out on four multiplexes using DVB-T standard and MPEG-2 compression technology though it is expected that the actual DTT platform will use MPEG-4 compression technology which will facilitate HD television services.

In April 2007, legislation to provide for the development of public DTT services in Ireland was enacted under The Broadcasting (Amendment) Act, 2007.[36] One multiplex spectrum use authorisation has been issued by ComReg to RTE in accordance with national legislation for a duration of 12 years. RTE's multiplex will offer a free-to-view service and carry the other analogue terrestrial programming channels (TG4 and TV3) nationally.

In 2008 the Broadcasting Commission of Ireland (BCI), the broadcasting content regulator, selected a commercial operator for three multiplexes following a "beauty contest" process. There were three consortium bids (from a total of nine applicants) for all three multiplexes. Boxer DTT Ltd (made up of Communicorp, Boxer TV Access in Sweden and BT Ireland) won the beauty contest.

Contract negotiations between Boxer TV and the BCI are underway in relation to these three multiplexes. ComReg will issue a spectrum use authorisation to the BCI in accordance with national legislation in respect of these multiplexes when requested by the BCI following the completion of contract negotiations.

Ireland is expected to launch a DTT service on four multiplexes in autumn 2009, which will simulcast for a period with analogue TV. Interleaved spectrum use by SAB/SAP services and deflector use might be affected following the switchover. In addition, Ireland is currently considering the 790–862MHz sub-band for mobile/fixed communications services or other use.

35 http://sarcms03:800/NR/exeres/2DBE9F95-FB6B-4880-9287-C927D6952E20.htm?NRMODE=Unpublished&wbc_purpose=Basic&WBCMODE=PresentationUnpublished

36 http://www.dcenr.gov.ie/NR/rdonlyres/760714DA-76B7-450B-8BAB-E2ED2F774064/0/BroadcastingAmendmentAct2007.pdf

A.11.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting landscape

Under the GE-06 Plan, Ireland's Plan for the UHF band contains spectrum equivalent to eight national multiplexes. DTT is not launched in Ireland yet, it is expected to launch with four multiplexes in the autumn of 2009. National legislation requires that DTT be available to the whole community of the state in so far as is reasonably practicable. Legislation requires that the multiplex operated by RTE be available, when rollout is complete, to an extent similar to that such as is currently available by the analogue RTE services, that is to say 98%.

It is expected that following completion of contract negotiations with the BCI, the three commercially operated multiplexes will launch along with the RTE multiplex in autumn 2009. These will provide in excess of 80% population coverage at launch rising to a minimum of 92% population coverage.

It is anticipated that after analogue transmitters in the UHF band are switched off that a further multiplex could be operated by RTE which would have approximately 98% coverage and a further multiplex could be operated by a BCI contractor. This would make a total of six multiplexes operating in the UHF band after analogue transmitters have been switched off. Provision also exists in legislation for issuing authorisations for additional television multiplexes and a further provision that allows ComReg to issue other multiplex authorisations.

The TV programming channels that are carried on the RTE multiplex (which will include the four analogue TV programming channels) should eventually, as above, be available to 98% of the population. Legislation is also passing through Parliament to allow for the establishment of a "parliamentary channel" and an Irish Film Channel. These will be required to be available in so far as practicable to the whole community of Ireland. It is expected that RTÉ 1, RTÉ 2 and TG4 along with the "parliamentary channel" and Irish Film Channel will be carried on a multiplex operated by RTE. There is provision in legislation that TV3 could be carried on an RTE multiplex also. Approximately seven or eight programme services might be carried on the RTE multiplex. There has been speculation that RTE could carry four of the Northern Ireland's free-to-view TV programming channels (BBC1, BBC2, ITV and Channel 4) on its multiplex.[37] This has been faced with strong protest from cable and satellite providers who current carry these TV programming channels on their platform and will face increase competition from RTE DTT platform.

No decision has been made on the number of programme services which will be on each commercial multiplex, which are expected to operate as a pay-DTT service, however between eight and ten services had been proposed during the application stage.

37 http://www.independent.ie/business/media/the-death-of-analogue-tv-is-nigh-long-live-digital-1267905.html

National legislation in Ireland does not provide explicitly for the provision and/or allocation of spectrum for mobile TV. Currently, there is a consultation on-going in Ireland on the provision of UHF spectrum in five of the major urban areas in Ireland (namely Dublin, Cork, Limerick, Waterford and Galway). The proposal is to make available one UHF channel at each these locations and the spectrum will be suitable for mobile TV. For more information, see ComReg's consultation 08/44.[38]

Technological evolution affecting the use of the spectrum for broadcasting

In autumn 2009, DTT is expected to be launched in Ireland using DVB-T technology with a MFN and MPEG-4 compression technology. However, the likely evolution of technologies is not know at this stage.

It is possible that some HD content will be carried via the DTT network prior to 2012 as the DTT receiver specification in Ireland will allow for HD content. However details of the launch of HDTV in Ireland has yet to be discussed by Irish programme service providers or the commercial multiplex operator. The likelihood is that HDTV service provision will increase with the launch of additional multiplexes (above the currently planned four multiplexes).

Existing plans to release the digital dividend spectrum

As Ireland has yet to launch DTT, they are currently at the initial stages of planning to obtain the digital dividend. Some aspects are defined in national legislation allowing for extra TV programme services to be available on a free-to-view basis and the operation of a number of commercial multiplexes.

Questions relating to the timetable for the award of spectrum for services are not specifically identified in legislation, the associated award process, type of organisations that can bid and the suitable services are not known at this stage. ComReg will be addressing these questions in a series of related consultations on the subject of the digital dividend, which is expected to begin in the first quarter of 2009.

A report by Europe Economic on "How Ireland can best benefit from its Digital Dividend" was commissioned by ComReg[39] to look at the way forward regarding the digital dividend. Given that DTT is not the predominant TV platform in Ireland, as the Irish do not rely on free-to-view broadcasting (DTT penetration less than 24%), the report's finds that:

38 http://www.comreg.ie/_fileupload/publications/ComReg0844.pdf

39 http://www.comreg.ie/_fileupload/publications/CP50e.pdf

Paragraph 1.9

1. Once the initial benefits associated with broadcasting are guaranteed there is little scope for increasing the value by assigning larger amounts of spectrum to it.

2. A mixed approach to the allocation of the digital dividend spectrum is central to Ireland's ability to achieve greatest benefit from its digital dividend.

3. The amount of spectrum assigned to alternative uses could be in the region of 80MHz to 120MHz.

4. Legislation and regulation will need to ensure that re-allocation can be implemented if needed.

Paragraph 1.10

Two subsidiary issues arise for Ireland. First, the question arises whether Ireland would benefit from the reservation of some spectrum (if it is available) for experimental purposes in order to encourage "inward innovation", with consequent potential gains to Irish intellectual capital and employment. Secondly, it may also prove beneficial to Ireland to make available three 8MHz channels not currently used for broadcasting (nos. 36, 38 and 69) as part of its digital dividend."[40]

A.11.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The Broadcasting (Amendment) Act 2007.[41]

Regulatory instruments used to switch analogue broadcasting into digital

Under the Broadcasting (Amendment) Act 2007, there will be at least six DTT multiplexes on a national basis. Provision also exists in the legislation for issuing authorisations for additional television multiplexes and a further provision that allows ComReg to issue other multiplex authorisations.

40 Europe Economic (2008) "How Ireland can best benefit from its Digital Dividend", Executive summary.

41 http://www.dcenr.gov.ie/NR/rdonlyres/760714DA-76B7-450B-8BAB-E2ED2F774064/0/BroadcastingAmendmentAct2007.pdf

A.12 Latvia

Currently, Latvia only has test DTT transmissions in the Riga area. There is no nationwide DTT platform; this is expected to be launched in 2009. The DTT platform will have eight multiplexes, seven in the 470–862MHz and one in 174–230MHz, Latvia also plans to dedicate one multiplex to DVB-H transmissions for handheld/mobile devices. Latvia suffers interference in UHF Channels 60–69 from non-EU countries such as the Russian Federation, this is not expected to change before 2015 when these non-EU countries switchover to DTT. Latvia's use of the sub-band may therefore be contingent upon European pressure on The Russia Federation.

A.12.1 The situation before the introduction of digital terrestrial television (DTT)

As Latvia not yet implemented nationwide DTT, therefore the analogue terrestrial platform is still very important in delivering television. Latvia has four analogue terrestrial TV programming channels on offer: TV1 and TV2 are public channels provided by the public services broadcaster Latvijas Televīzija, TV3 and TV4 are commercial channels operated by Modern Times Group. TV1 covers 98.6% of the population, TV2 cover 95.4%, TV3 covers 83.8% and TV4 covers 83.5%. There are also 25 regional public TV programming channels that vary in coverage from 1% to 50% of the population.

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	37 channels in the UHF band were used for the broadcast of terrestrial analogue television.
VHF channels used for analogue TV	7 channels were used to broadcast in the VHF band.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	There were no channels reserved for any other use.
UHF channels not used, or unusable because of coordination requirements	The use of 12 channels, mainly in the upper sub-band, had limitations placed upon them due to co-ordination problems with aeronautical services in two bordering non-EU countries: Belarus and the Russian Federation.

Historical television broadcasting

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
1 (98.6%)	1 (83.8%)	25 (1%–50.4%)	
1 (95.4%)	1 (83.5)		
2	**2**	**25**	**0**

Figure A.28: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Electronic Communications Office, January 2009]

Other uses accommodated within the UHF band

Interleaved spectrum in 174–230MHz and 470–862MHz was (and is) used for SAB/SAP services including:

- professional and non-professional radio microphones, mainly in the 790–820MHz sub-band
- other SAB/SAP devices
- studio-transmitter radio links, in the free spectrum channels throughout the 470–862MHz.

A.12.2 The transitory situation (as of December 2008)

Currently there are six multiplexes in one service area, Riga and its environs, awarded for DTT test transmissions. One multiplex in the same service area is awarded for test transmissions of DVB-H signals.

Regular transmissions are due to start in 2009.

Current television broadcasting

Figure A.29 illustrates the primary type of television signal received in Latvia.

Primary type of television signal received	*% of households*
Analogue/digital terrestrial	33
Analogue/digital cable	55
Satellite	0
IPTV	2

Figure A.29: Current households primary TV signal typology [Source: Electronic Communications Office, January 2009]

Timetable for switchover

1 December 2011 is defined by Regulations of the Cabinet of Ministers Nr.714, 2 September 2008 as the end date of the analogue switch-off.

A.12.3 The situation after analogue signals are switched off throughout the European Union

Latvia plans to launch seven nationwide multiplexes in the 470–862MHz band and one further multiplex in the 174–230MHz band. It has been decided that there will be at least three nationwide free-to-view TV programming channels and one dedicated to local coverage. There are also plans for one DVB-H (handheld) multiplex. All DTT multiplexes will have 99% area coverage, and therefore greater than 99% population coverage, the DVB-H multiplex will have 80% population coverage.

Technological evolution affecting the use of the spectrum for broadcasting

It is anticipated that all multiplexes will be operated on SFNs using DVB-T technology and MPEG-4 compression. The mobile handheld network will also use MPEG-4 compression but will transmit using DVB-H.

HDTV will be used to some extent, but as the multiplexes have not yet been licensed on a national level, no plan for the implementation of HDTV has yet been set.

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	Awarding of spectrum for new uses has not been decided due to missing information about realistic needs for new TV services, HDTV, mobile hand-held and other future audio-visual applications. The basis for such a decision probably could be established at the end of the ASO period. It is decided to use all available spectrum in accordance with the GE-06 for TV broadcasting during the transition period.

What type of award process is expected to be used (e.g. beauty contest, auction)?	Undecided.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	Undecided.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	The viable candidates for the use of the digital dividend are: distribution of extra TV programmes, transmission of HDTV programmes, transmission of programmes for hand-held mobile reception using DVB-H system, interactive TV applications, SAB/SAP applications. As for non-broadcasting services; broadband wireless access systems are considered as possible candidates for the use of part of the dividend.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

Specialists are participating in studies carried out by the ITU (Joint Task Group-5/6) and CEPT (Task Group 4).

A.12.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

Radio and Television Law (passed 10.10.1996, with later amendments), Regulations of the Cabinet of Ministers Nr.714, 2 September, 2008, National Concept for development of electronic mass media, for period 2009-2011 (issued by National Radio and TV Council).

Regulatory instruments used to switch analogue broadcasting into digital

Broadcasting authorisations for analogue TV will automatically be replaced by new ones for broadcasting digital TV. New broadcasting authorisations will be granted based on results of tenders by beauty contest.

The validity of a broadcasting authorisation is usually seven years.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	A new audio-visual law is under preparation that will contain a new approach to broadcasting, it will replace the previous Radio and TV law (1996, with amendments). As the legislation is currently in the draft stage it is subject to change.
Co-ordination issues with countries inside the EU	None.
Co-ordination issues with countries outside the EU	Latvia borders two non-EU countries: the Russian Federation and Belarus. Co-ordination difficulties have arisen because in these countries some parts of the spectrum are used for aeronautical services what imposes certain limitations for broadcasting uses. ASO date in these countries is expected to be 17 June 2015, as agreed at the Regional planning conference, RRC-06. This implies that in Latvia the broadcasting spectrum will be fully available for use only after this date if the situation remains unchanged.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	The importance of the terrestrial platform is expected to persist at least at the current level because of the distribution of the population over the territory. Furthermore, a terrestrial platform is the only way able to support portable, mobile reception and mobile TV to hand-held devices. Therefore, the role of the terrestrial platform, to a great extent depends upon Latvia's ability to provide these services.

A.13 Lithuania

Lithuania is heavily dependent upon terrestrial transmissions for broadcasting services due partly to its size and partly to its topography. Lithuania is a small country and roughly 40% of the population live in rural areas, this implies that cable and satellite are not viable technologies. Therefore, Lithuania's plans to allocate any digital dividend to HDTV and mobile TV. However the allocation of any frequencies above 830MHz in the 470–862MHz band is contingent upon resolution of co-ordination problems with the Russian Federation and Belarus, who both use the upper sub-band for aeronautical radionavigation systems and military use.

A.13.1 The situation before the introduction of digital terrestrial television (DTT)

In Lithuania, analogue terrestrial television was the only way of delivering broadcasting services to the majority of the population due to the country's size and topography. Prior to the introduction of DTT, virtually the entire population in Lithuania could receive analogue transmission. For the transmission of analogue terrestrial signals, UHF Channels 21–60 and VHF channels R2–R4 and R6–R12 were used. In Lithuania, VHF spectrum is divided into 8MHz (not 7MHz) channels and therefore there are only 12 channels in VHF bands I–III. Channels 61–69 were (and are) not used for broadcasting in Eastern Europe as they are reserved for military use.

The analogue terrestrial platform provided seven nationwide TV programming channels, including two public TV programming channels: all the national channels covered at least 60% of the population. There were also 23 regional TV programming channels available.

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	UHF Channels 21–60 were all used for analogue TV. UHF Channels 61–69 were not planned for Eastern Europe at Stockholm-61 conference because they were used there for military services.
VHF channels used for analogue TV	VHF channels R2–R4 (I and II band) and R6–R12 (III band) were used for analogue TV today. R1 and R5 were also used in the past. In Lithuania the VHF band is divided into 8MHz (not 7MHz) channels, therefore R1–R12 account for the entire VHF band.

UHF channels reserved for other uses (e.g. radio astronomy, the military)	There are no reserved channels for other uses in Lithuania, but use of some Channels (e.g. 46, 54, 55, etc) is heavily restricted due to military use by the Russian Federation and Belarus.
UHF channels not used, or unusable because of co-ordination requirements	UHF Channels 66–69 are unusable because these channels are used for aeronautical radionavigation by non-EU countries.

Historical television broadcasting

Primary type of television signal received	*% of households*
Analogue terrestrial	62.6
Digital terrestrial	1.83
Analogue cable	26.45
Digital cable	1.15
Satellite	4
Analogue MMDS	0.58
Digital MMDS	1.08
IPTV	2.33

Figure A.30: Historical households primary TV signal typology before the introduction of DTT [Source: Communications regulatory authority of the Republic of Lithuania, January 2009]

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
2	5	23	0

Figure A.31: Overview of analogue TV programming channels in the UHF band before the introduction of DTT [Source: Communications regulatory authority of the Republic of Lithuania, January 2009]*

**Nationally available TV programming channel means coverage of more than 60% of population. Otherwise the TV programming channel is local (one transmitter) or regional – a few transmitters. Information about particular population coverage is not available for analogue TV programming channels.*

Other uses accommodated within the UHF band

There are SAB/SAP uses also accommodated in the UHF/VHF band, including:

- 173.965–174.015MHz – radio microphones, one channel 50kHz
- 174–216MHz – 210 channels of 200kHz on a tuning range basis
- 470–862MHz – 1960 channels of 200kHz on a tuning range basis.

A.13.2 The transitory situation (as of December 2008)

There are currently five DTT multiplexes operating in Lithuania, four national multiplexes and one for regional coverage. At the moment there are eleven national TV programming channels on offer, two of which are public, and these are distributed using two of the national multiplexes. The coverage is about 95% of population. There is also a pay-DTT service in operation, the service is operated by TEO, the incumbent private operator, and is called GALA-TV and offers 50 TV programming channels. The national multiplexes cover 91.4%, 89.4%, 83.6%, and 65.4% of the territory of Lithuania respectively, which corresponds to roughly 80–95% of population.

Current television broadcasting

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1 (91.4%) 2 (89.4%) 3 (83.6%) 4 (65.4%) 5				
Total	**NA**	**NA**	**NA**	**NA**

Figure A.32: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: Communications regulatory authority of the Republic of Lithuania, January 2009]

Timetable for switchover

Some DTT broadcast underway with 95% penetration. ASO is planned for 29 October 2012.

Other uses accommodated within the UHF band

Low-power networks, e.g. wireless broadband access, high-speed mobile data access, SAB/SAP, are accommodated in the 830–862MHz sub-band as the sub-band is heavily restricted due to the aeronautical radio navigation systems of the Russian Federation and Belarus.

A.13.3 The situation after analogue signals are switched off throughout the European Union

In accordance to Geneva Plan 2006 (GE-06) Lithuania has allocations for nine national DTT multiplexes and a few single stations; currently four national multiplexes are active. The remaining five national multiplexes could be used for DTT, including HDTV and mobile TV, after the final switch-off of analogue terrestrial TV. In some areas the multiplexes cannot be used until the ASO in the Russian Federation and Belarus, which optimistic scenarios predict will be around 2015.

Due to the importance of the terrestrial platform in Lithuania, the RRT plans to award any digital dividend to HDTV or mobile TV use. RRT has evaluated the possibility of mobile services' use of the 830–862MHz frequencies given its neighbours' (the Russian Federation and Belarus) current aeronautical radio navigation use of the band and the results prove that use of mobile services will be questionable.

Technological evolution affecting the use of the spectrum for broadcasting

In June 2005, Lithuanian Radio and TV Centre and Lithuanian Telecom each won an authorisation to launch two national SFNs in Lithuania. According to GE-06, Lithuania will use national MFNs

that are composed of regional SFNs. All multiplexes are currently are, of will be, deployed will be DVB-T multiplexes with MPEG-4 compression. The long-term evolution of the technologies used to broadcast DTT is determined by the network operators.

There is currently a test HDTV transmission consisting of one TV programming channel.

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	There is no digital dividend in the upper band (Channels 62–69) because of interference from aeronautical navigation systems in Russian and Belarus.
What type of award process is expected to be used (e.g. beauty contest, auction)?	n/a.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	n/a.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	n/a.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

None.

A.13.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The Model of Introduction of the Digital TV in Lithuania, approved by the Decision No 1492 of the Government 25 Nov 2004 (Official Journal, 2004, No 171-6336).[42]

42 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=328350&p_query=&p_tr2=

The Program of Analogue Terrestrial TV Switch Off And Digital TV Fosterage in Lithuania, approved by the Decision No 969 of the Government 24 Sep 2008 (Official Journal, 2008, No 116-4416).[43]

Regulatory instruments used to switch analogue broadcasting into digital

There has not yet been any decision on the system for replacement of analogue transmission licences with digital one, currently the licensing periods are a follows:

- analogue TV – the rights of usage ending 31 December 2011 – 29 October 2012
- DTT – the authorisations are granted till 31 August 2015
- mobile TV – no authorisations granted
- SAB/SAP – the authorisations for temporary (from a week to a few months) usage
- Radio microphones – non-licensing regime.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	The specific issues concerning the future usage of the UHF band in Lithuania will be noted in the Strategy for the Assignment of Radio Frequencies to Broadcasting and Transmission of Radio and Television Programmes that is going to be approved by Government by the end of 2009. The Strategy will set the policy priorities, for example how the UHF frequencies will be used for DTT.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	None.
Co-ordination issues with countries inside the EU	None.

43 http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=328172&p_query=&p_tr2=

Co-ordination issues with countries outside the EU	The 830–862MHz sub-band is subject to co-ordination issues as it is used for aeronautical radio navigation systems in the Russian Federation and Belarus, this implies that use of the sub-band in Lithuania is heavily restricted. Moreover, any use of the VHF-UHF spectrum needs to be co-ordinated with the Russian Federation and Belarus and their DTT plans with heavily influence those of Lithuania.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	The terrestrial method for delivering broadcasting services to inhabitants of Lithuania is the most widely used as it is by far the most economically viable choice. More than 40% of the inhabitants of Lithuania live in rural areas where cable delivery is not economically possible. Satellite delivery is similarly not feasible as Lithuania is a small country with its own distinct language and cannot afford its own satellite network.

A.14 Luxembourg

A.14.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Prior to the launch of DTT 3 UHF Channels (21, 24, 27) were used for terrestrial analogue TV.
VHF channels used for analogue TV	1 VHF channel (7).
UHF channels reserved for other uses (e.g. radio astronomy, the military)	None.
UHF channels not used, or unusable because of co-ordination requirements	In line with the Stockholm agreement ST61.

Historical television broadcasting

Figure A.33 summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services in Luxembourg.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
0	4 (≈100%)	0	0

Figure A.33: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses) [Source: ILR, January 2009]

Other uses accommodated within the UHF band

SAB/SAP and unlicensed usage are authorised in the UHF band in Luxembourg.

A.14.2 The transitory situation (as of December 2008)

Current television broadcasting

There are four multiplexes currently in use in Luxembourg. three are digital and one is still analogue (which is used to broadcast French analogue TV). Two multiplexes are used for DTT, broadcasting eight TV programming channels, one used for the current mobile TV tests.

Figure A.34 below illustrates the primary type of television signal received in Luxembourg.

Primary type of television signal received	*% of households*
Analogue terrestrial	0
Digital terrestrial	1
Analogue cable	12.3
Digital cable	64.7
DTH/SMATH	21
IPTV	1

Figure A.34: Current households primary TV signal typology [Source: ILR, January 2009]

ILR notes that DTT, cable reception, DSL TV and satellite TV are not exclusive. The following figures show the overall situation (households): DTT: 1%, cable: 77%; DSL TV: 1%; satellite: 28%. Also according to ILR, and with regard to evolution, DTT is used more and more for reception on personal computer and on the move. This situation is not reflected in the above figures.

Timetable for switchover

The complete switch-off of Luxembourg's analogue TV happened on 31 August 2006 (although one analogue multiplex is still in use for French TV).

Other uses accommodated within the UHF bands IV/V

In Luxembourg, frequencies in the UHF bands IV/V are currently not used for any services other than DTT. Frequencies in the 790–862MHz sub-band are under consideration for broadband access services.

A.14.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

According to GE-06, Luxembourg may use seven multiplexes, out of which two are currently in use, all of them with 100% coverage. Additional assignments depend on market demand and development of technology, e.g. mobile in UHF band V.

Figure A.35 summarises the expected DTT programming channels in the UHF band after the ASO.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	0	4 (100%)	0	0
2	0	4 (100%)	0	0
Total	**0**	**8**	**0**	**0**

Figure A.35: Overview of DTT programming channels in the UHF band after the ASO (population coverage in parentheses) [Source: ILR, January 2009]

Regarding mobile TV, there is one multiplex used for tests. The number of multiplexes for mobile TV will be determined based on market demand.

Figure A.36 summarises the expected mobile TV programming channels in the UHF band after the ASO.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	n/a	n/a	n/a	n/a
Total	**n/a**	**n/a**	**n/a**	**n/a**

Figure A.36: Overview of mobile TV programming channels in the UHF band after the ASO (population coverage in parentheses) [Source: ILR, January 2009]

Technological evolution affecting the use of the spectrum for broadcasting

Among the technologies deployed the Luxembourg is considering deploying a SFN for its DTT platform. However, ILR will let the market decide. At present the DTT network is using DVB-T and MPEG-2 norms and might use DVB-T2 and MPEG-4 in a later stage. The HDTV will be deployed depending on the market demand.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum in Luxembourg.

What is the timetable for awarding this spectrum	Taking duly account of ITU/CEPT studies, the award of digital dividend spectrum will have to be fully compliant with decisions taken in the neighbouring countries. The timetable largely depends on those countries.
What type of award process is expected to be used (e.g. beauty contest, auction)?	To be defined according to market situation.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	To be defined in detail. In principal, there will be no distinction between network and/or service operators.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Wireless broadband (IP based service neutrality) is under consideration.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

ILR has not completed any study so far.

A.14.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The general legislation on radio spectrum (Loi du 30 mai 2005 portant organisation de la gestion des ondes radioélectriques)[44] is still the law in force in Luxembourg.

Regulatory instruments used to switch analogue broadcasting into digital

The authorisations that have been allocated are technology neutral. There is no authorisation for mobile TV or SAB/SAP. The DTT authorisations expire in 2020.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	None.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	None.
Co-ordination issues with countries inside the EU	No significant issues to be mentioned. ILR has recently bilaterally negotiated with France in order for France to be able to complete its "Plan Numérique 2012". Luxembourg is also in discussion with France as one multiplex is still used for the French analogue TV.

44 http://www.legilux.public.lu/leg/a/archives/2005/0073/a073.pdf#page=17

Co-ordination issues with countries outside the EU	Not applicable.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	Due to high cable penetration, DTT is of less importance in Luxembourg. The very diverse demand of the heterogeneous population in Luxembourg can best be satisfied by the large offer of international TV programming channels broadcast via satellite. Moreover, the high availability of DSL favours IPTV with additional features and potentially more personalised offers. In Luxembourg, the main advantage of DTT could reside in mobility.

A.15 Malta

A.15.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 29, 44 and 50 were allocated for analogue TV broadcasting and were assigned to local national broadcasters.
VHF channels used for analogue TV	Channel 10, allocated for analogue TV broadcasting; was assigned to local national broadcaster.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	No UHF channel was reserved for other uses in Malta.
UHF channels not used, or unusable because of co-ordination requirements	Before DTT was introduced, Malta had been allocated eight channels for analogue TV (four of which were used as indicated above, four of which are still unused).

Historical television broadcasting

Figure A.37 below summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
1 (100%)	3 (100%)	0	0

Figure A.37: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses) [Source: Malta Communications Authority, January 2009]

Other uses accommodated within the UHF band

Channel 69 used for SAB/SAP on a non-protected and non-interference basis.

A.15.2 The transitory situation (as of December 2008)

Current television broadcasting

Eight UHF multiplexes have been awarded to a local DTT operator, operating a pay-TV service. In addition, two Channels (one VHF and one UHF) are currently reserved for free-to-view DTT.

Figure A.38 below illustrates the primary type of television signal received in Malta.

Primary type of television signal received	*% of households*
Analogue terrestrial	14.7
Digital terrestrial	20.0
Analogue cable	39.2
Digital cable	26.1
DTH/SMATV	0
IPTV	0

Figure A.38: Current households primary TV signal typology [Source: MCA, EPRA, Analysys Mason]

Timetable for switchover

In Malta, ASO is planned to happen by the end of 2010.

Other uses accommodated within the UHF band

In Malta, VHF Channels 6A, 6C and 12A are assigned to a local operator for T-DAB.

MCA believes that the digital switchover will not affect any other current uses of UHF spectrum.

At the moment no frequencies have been identified as available for new uses in Malta.

A.15.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

Before the introduction of DTT Malta had coordinated an additional 15 new frequencies for DTT (in addition to the 4 frequencies allocated to analogue TV but un-used). RRC-06, which produced the GE-06 digital plan, required Malta to re-coordinate 11 of these 15 coordinated frequencies with neighbouring countries. According the MCA, this process is proving difficult, since some neighbouring countries have not yet reconfirmed the coordination proposal.

Malta's current policy is then based on 19 SFN multiplexes. It is noted that since the report issued by CoCom in April 2007, Multiplus was taken over by Maltacom, now GO plc. GO handed back 8 of its 16 frequencies to the MCA.

The GE-06 agreement allocated 8 spectrum channels to Malta for digital broadcasting and required the additional 11 previously coordinated UHF channels to be reconfirmed with neighbouring countries.

Channel allocations post analogue switch-off should be as follow:

- UHF Channels 26, 28, 31, 38, 45, 56, 58, 60: assigned to GO plc for DTT. Transmission on these frequencies commenced in 2007.
- UHF Channel 66 and VHF Channel 5: reserved for GIO broadcasting. Transmissions on one of these channels is expected to commence in the very near future. It is noted by the MCA that Channel 66 lies within the upper band of the UHF which the EU has identified for mobiles services.
- Remaining spectrum channels will be in use following successful co-ordination process which process is anticipated to have to follow analogue switch-off in neighbouring countries.

All multiplexes are required to provide nationwide coverage.

It is planned that one of the multiplex reserved for GIO broadcasting (either VHF Channel 5 or UHF Channel 66) will carry two publicly owned TV programming channels and up to four privately-owned national TV programming channels. The privately owned ones would need to satisfy General Interest objectives.

Privately owned national TV programming channels that do not meet the General Interest objectives are seek commercial agreements with the commercial DTT operator, GO plc.

No coordinated spectrum is currently available for mobile TV. It is however noted that GO Mobile (subsidiary of GO plc) offers mobile TV services via EDGE technology.

Technological evolution affecting the use of the spectrum for broadcasting

From information held by the MCA at the time of replying to this questionnaire, it is not envisaged that technologies will change by 2020.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum.

What is the timetable for awarding this spectrum	No spectrum will be available after the digital switchover date. Spectrum that will be released has been allotted to other countries. At present Malta is still short of frequencies to provide a DTT service in line with its published policy.
What type of award process is expected to be used (e.g. beauty contest, auction)?	n/a.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	n/a.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	n/a.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

The MCA is reviewing its digital broadcasting policy and the use of the UHF band taking into account international developments and EU policy and direction on the subject.

A.15.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

Preparation for digital switchover is based on the policy and implementation strategy adopted in 2005 as set out in the document Policy and Implementation Strategy regarding DTT, 3G and BWA[45] and in a policy and strategy for digital broadcasting that meets General Interest Objectives which is currently in consultation phase (see Making Digital Broadcasting Accessible to All[46]).

Regulatory instruments used to switch analogue broadcasting into digital

In the digital environment, content authorisations will no longer include spectrum authorisations, as was the case with analogue broadcasting. Specific treatments will be applied for commercial broadcast content authorisations and broadcast authorisations with a public service remit:

Commercial broadcast content authorisations	Private entities interested in obtaining a television broadcasting authorisation will be able to apply for either a Commercial Broadcast Content authorisation or a General Interest Broadcast Content authorisation. Authorisations will be strictly in respect of content and will not include licensing of the transmission infrastructure. Entities will enter into commercial negotiations with authorised network operators or service providers in order to obtain access to transmission capacity. Applicants will be required to notify, to the Broadcasting Authority, the relevant details in respect of the network operator and the specific frequency on which the TV programming channel will be transmitted.
Broadcast authorisations with a public service remit	The GIO TV programming channels can be both generalist and niche and will need to meet stringent requirements both in terms of programming quality as well as in terms of the specific general interest objectives that they fulfil. Only one General Interest Broadcast Content authorisation will be issued to the same entity. An entity may however be issued with an

45 http://www.mca.org.mt/filesystem/pushfile.asp?id=565&source=3&pin=

46 http://www.mca.org.mt/filesystem/pushfile.asp?id=1121&source=3&pin=

additional Commercial Broadcast Content authorisation.

TV programming channels will be expected to devote a significant portion of their time to programmes that qualify as being of general interest, that is, programmes that qualify as meeting Core Public Service Obligations (CPSOs) and Extended Public Service Obligations (EPSOs).

GIO broadcasts will need to meet a set of eligibility criteria that will be drawn up by the Broadcasting Authority, the NRA responsible for broadcasting (content).

Analogue TV authorisations expire between 25 February and 31 December of 2010, whereas DTT expires by 2021. SAB/SAP is authorisation exempt.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used

It is a domestic priority for Malta to ensure pluralism and the availability of diverse programme content that reflects the Maltese culture and identity. The policy and strategy for digital broadcasting that meets General Interest Objectives currently in consultation phase is guided by this priority.

Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)

The current legislation requires all free-to-view analogue television broadcasts to be carried by pay-TV operators under the 'must-carry' rules which are based on the assumption that all such broadcasts meet General Interest objectives. The situation will be different after analogue switch-off.

GO plc was awarded spectrum for the operation of a DTT network through a beauty contest. The beauty contest was preceded by a public consultation and policy.[47] The said consultation also reserved frequencies for the purposes of GIO broadcasting.

Should the coordination process with neighbouring EU and non-EU neighbouring countries yield positive results, the form of future spectrum awards is not yet decided. This will be decided in MCA's review on the digital dividend which takes into account international developments and EU policies and, or direction on the subject.

47 See the Policy and Implementation Strategy regarding DTT, 3G and BWA.

Co-ordination issues with countries outside the EU	Coordination issues in the case of Malta are not limited to countries inside of the EU. Consequently, any additional UHF spectrum would require coordination with countries from both outside and inside the EU. As mentioned above, the coordination process initiated by the MCA is proving difficult, so far, with both EU and non-EU neighbouring countries.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	Cable is at present the most diffused platform. However, DTT has gained substantial popularity since its launch in 2005, and when combined with the number of viewers who still depend on analogue TV, the terrestrial platform has gained significance importance. Satellite is regarded as a complementary rather that substitutable platform (when compared with cable or DTT) in Malta, especially since no local content is available on this platform. No IPTV services have been launched as yet in Malta.

A.16 Netherlands

A.16.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	All of UHF bands IV and V, with exception of Channels 37, 38, 59 and 63, was used for analogue TV. White spaces within these channels frequencies were and are used for "other service" (like SAB/SAP and medical use).
VHF channels used for analogue TV	VHF band III channels were used for analogue TV and white spaces within the channels were and are used for "other services".
UHF channels reserved for other uses (e.g. radio astronomy, the military)	Channel 38 was used for radio astronomy and Channel 63 for SAB/SAP.
UHF channels not used, or unusable because of co-ordination requirements	Channels 37 and 59 were not used in the Netherlands because of coordination requirements.

Historical television broadcasting

Historically, there were three analogue terrestrial TV programming channels in the Netherlands owned by the public service broadcaster.

Other uses accommodated within the UHF band

Figure A.39 summarises the SAB/SAP uses that were accommodated within the UHF bands IV and V prior to the launch of DTT in the Netherlands.

Frequency band	*Usage*
470–557MHz	Licence exempt 50mW (SRD)
557–562MHz	Generic licence 10W
562–563MHz	Short licence (two weeks), exclusive use
563–570MHz	Generic licence 10W
570–571MHz.	Short licence (two weeks), exclusive use
571–578MHz	Generic licence 10W
578–579MHz	Short licence (two weeks), exclusive use
579–586MHz	Generic licence 10W
586–587MHz	Short licence (two weeks), exclusive use
587–594MHz	Generic licence 10W
594–595MHz	Short licence (two weeks), exclusive use
595–602MHz	Generic licence 10W
602–603MHz	Short licence (two weeks), exclusive use
603–606MHz	Generic licence 10W
614–618MHz	Generic licence 10W
618–619MHz	Short licence (two weeks), exclusive use
619–626MHz	Generic licence 10W
626–627MHz	Short licence (two weeks), exclusive use
627–630MHz	Generic licence 10W
630–637MHz	Licence exempt 50mW (SRD)
637–638MHz	Generic licence 10W
638–701MHz	Licence exempt 50mW (SRD)
701–702MHz	Generic licence 10W
702–862MHz	Licence exempt 50mW (SRD)

Figure A.39: SAB/SAP uses accommodated in the UHF band in the Netherlands [Source: Ministry of Economic Affairs, January 2009]

A.16.2 The transitory situation (as of December 2008)

Current television broadcasting

In the Netherlands, DTT is viewed mostly on second TV sets, with primary set viewing dominated by the cable and satellite platforms.

Dutch regulators have had a market-led approach, leaving operational decisions regarding DVB multiplexes to the authorisation holders.

The Ministry of Economic Affairs has however imposed portable reception requirements, which means that the multiplexes use 16QAM modulation with a relatively low capacity.

In December 2006, the Netherlands was the first European country to undergo ASO. The early ASO date was aided by a high dependency on cable, with only 74 000 out of the 7 million Dutch TV households relying on analogue terrestrial as their primary means of receiving television.

Currently, there are five DTT multiplexes in the Netherlands: one free-to-view multiplex reserved for the public service broadcaster NOS and four pay-TV multiplexes (although one private multiplex is currently used for mobile TV). In total, 30 SDTV programming channels are currently broadcast on a national basis.

Figure A.40 summarises the distribution of current DTT programming channels in the UHF.

MUX	*Digital national TV programming channels*	
	Public	*Private*
1	3	0
2	0	9
3	0	9
4	0	9
Total	**3**	**27**

Figure A.40: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: Ministry of Economic Affairs, January 2009]

End of 2008, the total number of DTT households was about 7.24 million with a total of about 13.6 million TV-receivers in the Netherlands.

More than 90% of Dutch households are connected to cable TV, where a total of about 88% of the household are actually using cable TV. About 10% of the households use satellite TV and also about 10% use DTT or IPTV.

Dutch policy is supports competition in the TV programming channel distribution market.

Such information is summarised in Figure A.41 below, which illustrates the primary type of television signal received in the Netherlands.

Primary type of television signal received	*% of households*
Analogue terrestrial	0
Digital terrestrial	4.89
Analogue cable	65.63
Digital cable	22.11
DTH/SMATV	5.88
IPTV	1.49

Figure A.41: Current households primary TV signal typology [Source: European Audiovisual]

Timetable for switchover

The analogue switch-off was done on 11 December 2006 in the Netherlands.

Other uses accommodated within the UHF band

There are already five multiplexes (one public broadcast and four KPN/Digitenne), including mobile television awarded in Netherlands for DTT.

The Ministry of Economic Affairs expect that the digital switchover will affect the SAB/SAP. Frequencies available for new uses in Netherlands after switchover are under discussion.

A.16.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

After the analogue switch-off five multiplexes are used for DTT, which are licensed till 2017. All five multiplexes cover the whole of the Netherlands.

One of the five multiplex is licensed to the public broadcaster for three national TV (plus radio) programming channels and for the distribution of the regional television (and radio) TV programming channels. There are four private multiplexes (KPN/Digitenne) offering national, commercial programmes and foreign programmes (amongst others Belgian, UK (BBC) and German programmes).

One of the multiplexes of KPN/Digitenne with national coverage is used for mobile television (DVB-H technology), which includes ten TV programming channels, including those of the public broadcaster.

Figure A.42 below summarises the expected DTT programming channels in the UHF band after ASO.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	4	0	n/a	n/a
2	0	5	n/a	n/a
3	0	8	n/a	n/a
4	0	8	n/a	n/a
5	0	5	n/a	n/a
Total	**4**	**26**	**n/a**	**n/a**

Figure A.42: Overview of DTT programming channels in the UHF band after the ASO (population coverage in parentheses) [Source: OPTA]

Technological evolution affecting the use of the spectrum for broadcasting

Technologies currently deployed for DTT are:

- SFN
- DVB-T with MPEG-2 technology and DVB-H with MPEG-4

- HDTV is not currently available, however a decision for introduction is left to the authorisation holder.

Dutch regulators have had a liberal approach regarding DTT and the power to decide technical evolution is left to the multiplex operators. The broadcast regulator and government do not suggest, encourage or mandate broadcasters to upgrade their technological standards. Therefore, as the multiplex operator, Digitenne, can make technological decisions based on commercial reasons, it is not expected to upgrade transmission or compression technology to meet a government-set standard.

While there are currently five multiplexes in Holland, it is likely, in two to three years time, that there will be a further two multiplexes, taking the total to seven. It is possible that these two additional multiplexes will broadcast SDTV programming channels. Pay-DTT operator Digitenne will want to maximise its TV programming channel offering to DTT-only homes rather than to offer HDTV programming channels, which are already offered on the cable platform.

Set-top boxes in the Netherlands are predominantly rented as part of the subscription to Digitenne’s pay-DTT service. Therefore, along with the low installed base of DTT receivers, the cost and difficulty of upgrading set-top boxes from MPEG-2 to MPEG-4, and DVB-T to DVB-T2 technology would be lower than in other countries. For this reason, the Dutch Ministry of Economic Affairs views it as possible for DTT in the Netherlands to migrate to both MPEG-4 and DVB-T2, provided that there is a commercial incentive for these changes.

In the long term, should the entire UHF spectrum be utilised for broadcast, the Dutch Ministry of Economic Affairs views it possible to have seven DTT multiplexes using MPEG-4 and DVB-T2 technology over local SFNs. In addition, there is the possibility of using one VHF multiplexes (although this is not being considered at the moment). This would allow 135 SDTV programming channels on DTT.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	More available spectrum is expected in 2012. How to use this spectrum is up to political decisions still to be made.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Decisions still to be made.

Will there be any restrictions on the type of organisations that can bid for the available spectrum	Decisions still to be made.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	This decision has to be made –at least partly- by the authorisation holder (up to 2017) of the five multiplexes. This authorisation allows the use of DVB-T technology, including DVB-H. For the spectrum that will become available in 2012 (political) decisions still have to be made

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

An external study was completed in July 2008. The results of this study have not yet been made publicly available.

A.16.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

No specific legal texts underlying the switch-off process were required. There has been an amendment to the National Frequency Plan (a legal Act) to allow digital terrestrial transmission in the UHF band as a replacement of the analogue use of this frequency band.

For DTT, a new authorisation has been issued on the basis of a beauty contest. DTT/mobile TV (public broadcast and Digitenne/KPN) authorisations expire by 2017.

Specific issues affecting the future use of the UHF bands

Some decisions currently under discussions in the Netherlands regarding DTT are driven by the dominance of UPC on the cable market.[48]

Domestic policy priorities and laws that constrain how the UHF frequencies are used	No specific information provided.

[48] http://www.opta.nl/download/201541Draft+decision+RTV+broadcasting+UPC+-+management+summary.pdf

Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	No specific information provided.
Co-ordination issues with countries inside the EU	No specific information provided.
Co-ordination issues with countries outside the EU	No specific information provided.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	No specific information provided.

A.17 Portugal

A.17.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

The situation before the first DTT tender and until 1999 is summarised in the table below.[49]

UHF channels used for analogue TV	Analogue TV used UHF Channels 21–60.
VHF channels used for analogue TV	Analogue TV also used VHF Channels 5–11.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	The UHF Channels 61–69 were used by military applications and by local radio broadcasters for the studio-to-transmitter links (STL).
UHF channels not used, or unusable because of co-ordination requirements	All the UHF channels were used for broadcasting in Portugal.

Historical television broadcasting

Figure A.43 below summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services in Portugal.

[49] In 2000 a licence for DTT was granted but the operator did not start the service and the licence was returned to the regulator.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
2 (98%)	2 (95%)	2	0
2	**2**	**2**	**0**

Figure A.43: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: European Audiovisual Observatory]

Other uses accommodated within the UHF band

The interleaved spectrum was used for radio microphones and in-ear monitors. The bands available both for SAB/SAP and non-professional use were 174–216MHz and 470–862MHz.

A.17.2 The transitory situation (as of December 2008)

Current television broadcasting

DTT in Portugal was originally launched in 2001 when a consortium, Platforma de Televisão Digital Portuguesa (PTDP) was awarded an authorisation to operate the platform. However, it subsequently lost its authorisation in 2003 due to its failure to launch. The whole licensing process has been re-launched.

Six multiplexes were already awarded for DTT in Portugal. Three of them will be nationwide and the remaining three will cover only the Portuguese coastal area. One nationwide multiplex (MUX A) will be used for free-to-view services only, and the other five (MUXs B to F) will be used for pay-TV services. There has been no multiplex awarded for another use.

Figure A.44 summarises the distribution of current DTT programming channels in the UHF.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1 (free-to-view)	2	3	0	0
2 (pay TV)	n/a	n/a	n/a	n/a
3 (pay TV)	n/a	n/a	n/a	n/a
4 (pay TV)	n/a	n/a	n/a	n/a
5 (pay TV)	n/a	n/a	n/a	n/a
6 (pay TV)	n/a	n/a	n/a	n/a
Total	**n/a**	**n/a**	**n/a**	**n/a**

Figure A.44: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: ANACOM]

Figure A.45 below illustrates the primary type of television signal received in Portugal.

Primary type of television signal received	*% of households*
Analogue terrestrial	60
Digital terrestrial	0
Analogue cable	18
Digital cable	9
DTH/SMATV	10
IPTV	3

Figure A.45: Current households primary TV signal typology [Source: ANACOM]

Timetable for switchover

The switch-off date has not yet been decided in Portugal but it is foreseen for 2012.

Other uses accommodated within the UHF band

Three multiplexes will use nationwide SFNs, as a result Channels 60, 67 and 69 are no longer available for radio microphones and in-ear-monitors.

No frequencies have been identified as available for new uses in Portugal.

A.17.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

It is not yet determined how the remaining spectrum of the UHF bands will be used after the switch-off. A public consultation is anticipated on the digital dividend in the beginning of 2009, that will contribute to the decisions to be taken on this issue.

In RRC-06, Portugal received ten DVB national layers. The three multiplexes for the coastal areas are not included in this figure. In total there are thirteen multiplexes planned in UHF band in Portugal. The six multiplexes already awarded will start being used in the second quarter of 2009. The three nationwide multiplexes will cover nearly 87.2% of the population and the three multiplexes for the coastal areas will cover nearly 60% of the population.

In MUX A, five TV programming channels will be distributed. Two public TV services and three private TV services.

In RRC-06 three of the ten layers were planned for DVB-H. However these layers will be available only after the switch-off; the conditions for its use are not yet defined.

Technological evolution affecting the use of the spectrum for broadcasting

The six multiplexes already awarded will be based on SFNs in Channels 60 and 65 to 69. For these multiplexes the technology will be DVB-T and the compression format will be MPEG-4. There will be HDTV programming channels distributed in some multiplexes.

The broadcast regulator ANACOM considers the free-to-view aspect of DTT to be important as it caters for the proportion of the population that are unable to afford a cable or satellite subscription. Therefore, ANACOM wants to maximise the quality of service available through the free-to-view multiplex; hence the option to the operator of the free-to-view multiplex to provide HD content.

ANACOM cannot mandate technology standards, but they have encouraged the DTT authorisation bidders, who have subsequently agreed, to use MPEG-4 technology. ANACOM takes the position that, while they cannot mandate technology for the multiplex, they will encourage the multiplex operators to use the most efficient technology available in order to maximise capacity. It is then up to the multiplex operators to decide whether it is in their commercial interest to use the encouraged technology standards.

There are no regulations or legislation preventing the multiplex operators from launching HDTV programming channels on the pay-DTT multiplex and so the decision will be made on commercial grounds. For the multiplex operators, it is a trade-off between offering HD with fewer TV programming channels on their multiplexes, or more in SD. It is likely that SDTV programming channels will predominantly be favoured, so multiplex operators can maximise the carriage fees received from TV programming channels broadcast on their multiplex. ANACOM foresee HD being introduced on the DTT platform in the second quarter of 2009 with HD-specific multiplex likely to be introduced after ASO.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	There are not yet plans for awarding the spectrum made available by the digital switch-over for new uses.
What type of award process is expected to be used (e.g. beauty contest, auction)?	No decision has been made.

Will there be any restrictions on the type of organisations that can bid for the available spectrum	No decision has been made.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	No decision has been made.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

There have been no studies completed or commissioned on this issue.

A.17.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

Concerning the digital switchover and the digital dividend, the Portuguese legal framework is presently defined by:

- Decree- Law nr 309/2001 the 7th December (publishes ANACOM's Statutes) which determines that ANACOM has competence to assure management of the radio spectrum, including planning, the assignment of spectrum resources and their supervision (article 6º, n.1.c)[50]
- Law nr 5/2004, the 10th February (which establishes the legal regime applicable to electronic communications networks and services and to associated services, and defines the assignments of the national regulatory authority in this field, in respect of the transposition of Directives nr 2002/19/EC, 2002/20/EC, 2002/21/EC and 2002/22/EC, all of the European Parliament and of the Council of 7 March 2002, and of Directive 2002/77/EC of the Council of 16 September). According to this law, ANACOM is charged with the management of spectrum: Under this

50 http://www.anacom.pt/render.jsp?contentId=10518&languageId=1

competence ANACOM has to plan frequencies in accordance with the following criteria: a) Availability of radio spectrum; b) Guarantee of conditions of effective competition in the relevant markets; c) Effective and efficient use of frequencies. ANACOM must also promote the harmonised usage of frequencies in the European Union. (article 15º).[51]

Regarding the digital switchover the following should also be considered:

- Law nr. 27/2007, the 30th July (aims to regulate the access to and performance of the television activity, transposing into national law a part of the provisions of Council Directive no. 89/552/EEC, of 3 October, as amended by Directive 97/36/EC of the European Parliament and of the Council, of 30 June). Please see article 94º according to which when granting rights of use for frequencies for the terrestrial digital television service of national coverage with unrestricted free-to-view access, transmission capacity has been reserved for television programme services broadcasted by terrestrial means in analogue mode provided by operators holding authorisations or concessions in force at the date of entry into force hereof[52]

- Regulation nr. 95-A/2008, the 25th February (regulation concerning the public tender for the allocation of a right to use frequencies on a national basis for the DTT broadcasting service). Please see article 19º concerning the obligation, imposed to the winner of the beauty contest, to reserve capacity for the transmission of television programme services broadcasting in analogue.[53]

Regulatory instruments used to switch analogue broadcasting into digital

Concerning the rights of use of frequencies, the three Portuguese television operators broadcasting in analogue frequencies had their rights of use (for analogue) recently renewed. All under the following condition (independently from the term of renewal): once the switch-off date is fixed, and the National Frequency Allocation Plan altered in conformity, ANACOM will be able to recover the rights of use recently renewed with no charges whatsoever.[54]

ANACOM has no information considering potential modifications on the authorisations for unrestricted free-to-view television programme services granted by Regulatory Entity for the Media.

The end date of the authorisations for analogue TV is 2022. However once the switch-off date is fixed, and the National Frequency Allocation Plan altered in conformity, ANACOM will be able

51 http://www.anacom.pt/render.jsp?contentId=159011&languageId=1

52 http://www.anacom.pt/render.jsp?contentId=506380&languageId=1

53 http://www.anacom.pt/render.jsp?contentId=560528&languageId=1

54 http://www.anacom.pt/render.jsp?categoryId=287163

to recover the rights of use recently renewed with no charges whatsoever. The end date of the DTT authorisations is 2023.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	**Law nº. 27/2007, of 30 of July – Television Act, which regulates the access to and performance of the television activity** Purposes of the television activity The following shall be deemed as purposes of the television activity, according to the nature, subject-matter and coverage area of the television programme services made available: a) To contribute towards public information, education and entertainment; b) To promote accurately and independently the right to inform and to be informed, without impediments or discrimination; c) To promote citizenship and democratic participation as well as to respect political, social and cultural pluralism; d) To spread and promote the Portuguese culture and language, Portuguese creators, artists and scientists, as well as values that express national identity. **Resolution of the Council of Ministers no. 12/2008, of 22 of January**[55] It underlines, in its preamble, that "High definition transmission (HDTV) might constitute a further factor in the differentiation of DTT, through increased sound and image quality over the current analogue system, creating a new experience in television reception and giving impetus to migration and also echoing the aspirations put forward, during the public hearing, by the licensed television operators". It adds that "The constraints of the spectrum will remain until the closure of analogue television broadcasting, while subsequently continuous high-definition transmission of the programme services of licensed and concessionaire operators might be possible".

55 http://www.anacom.pt/render.jsp?contentId=551934&languageId=1

It further stresses, that "The adoption of high definition with a platform of free access will allow discrimination to be avoided in respect of access to these transmissions by citizens who, by choice or as a result of socio-economic restrictions, do not have access to other television distribution networks".

DTT will be introduced in Portugal in the second quarter of this year; at the moment there are no specific issues to mention that will affect the use of the UHF band. We think that one of the key issues will be the acceptance of the service by the public/population.

Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)

Law no. 5/2004, of 10 of February - Electronic Communications Law[56]

Although this law is not applied to "Services which provide or which exercise editorial control over content transmitted over electronic communications networks and services, including audio-text services", as mentioned in its article 2, it should be referred the number 9 of article 5, which stresses that "The NRA may contribute, within the scope of its remit, to ensuring the implementation of policies aimed at the promotion of cultural and linguistic diversity, as well as pluralism, in particular in respect of the media". The definition of such policies is however outside of the scope of competences of ANACOM.

Following the publication of the new Television Act – see above –, Portugal promoted, between the 31st of July and the 15th of October of 2007, a public consultation on the introduction of DTT[57], including network and content issues.

Further to this public consultation two beauty contest tenders, for free-to-view (Multiplexer A) and Pay TV (Multiplexers B to F) DTT services, were launched respectively by the Regulation no 95-A/2008 and Administrative Rule no 207-A/2008, both of 25 February 2008.[58]

In this context, the digital terrestrial platform will carry (in frequencies already previously reserved for digital terrestrial broadcasting):

– in Multiplex A, whose associated frequency usage right, in a national basis, has already been granted, the free-to-view services currently transmitted in the analogue platform (4 with national scope and 2 with

56 http://www.anacom.pt/render.jsp?contentId=159011&languageId=1

57 http://www.anacom.pt/render.jsp?categoryId=251123&languageId=1

58 http://www.anacom.pt/render.jsp?categoryId=269182&themeMenu=1#horizontalMenuArea

	regional scope in the Autonomous Regions of Azores and Madeira) plus a new free-to-view service to be licensed in 2009, and whose beauty contest tender was launched by the Administrative Rule no 1239/2008, of 31 of October 2008 – in Multiplexes B to F, pay TV services (in a national basis in Multiplexes B and C and part of the territory in Multiplexes D to F). The coverage associated with Multiplexes B to F represents an extension of broadcasting services in the terrestrial platform, which will make use of the digital dividend, strengthening the offer of television services.
Co-ordination issues with countries inside the EU	No information received from ANACOM on this issue.
Co-ordination issues with countries outside the EU	In the south of Portugal mainland we have to coordinate the spectrum also with Morocco, besides Spain. Any changes of the planned frequencies will certainly involve time consuming coordination activities.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	The importance of the terrestrial platform as a means of delivering TV in Portugal is high, since as it can be seen in question 2.2, more than a half of the population (60%) rely on terrestrial analogue TV. Moreover, the secondary TV sets are also relevant, since they rely on the terrestrial platform.

A.18 Romania

A.18.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	In UHF IV/V band Channels 21–60 were used for analogue TV.
VHF channels used for analogue TV	In VHF III band Channels 5–12 were used for analogue TV.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	In UHF IV/V band Channels 61–69 were used for defence systems.
UHF channels not used, or unusable because of co-ordination requirements	There were no unused spectrum channels in UHF IV/V band in Romania.

Historical television broadcasting

Figure A.46 summarises the distribution of analogue TV programming channels in the UHF band IV and V before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
2 (87%, 95%)	2 (40%, 52%)	1	>30
2	**2**	**1**	**>30**

Figure A.46: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: NRCTI]

Other uses accommodated within the UHF band IV and V

In Romania, radio microphones are allowed to be used in the following frequency bands (MHz).

UHF frequency bands	
646–647	710–711
654–655	718–719
662–663	726–727
670–671	734–735
678–679	742–743
686–687	750–751
694–695	758–759
702–703	

Figure A.47: UHF frequencies allowed to be used by radio microphones in Romania [Source: NRCTI]

Radio microphones can be used on an authorisation-exempt basis, on the condition of non-interference and non-protection with regard to television, and provided that some technical parameters are observed. These parameters are included in a radio interface technical specification.

Low-power feeder links, on short distances, for sound broadcasting transmitters use in the UHF bands IV and V as well. This equipment is used on an authorisation basis and it has a secondary status with regard to analogue television and DTT. These kind of links are spread throughout the frequency band 470–766MHz, taking into account that no interference shall be caused to the application having a primary status of use.

A.18.2 The transitory situation (as of December 2008)

Current television broadcasting

Currently, there are no multiplexes awarded for DTT in Romania.

The NRCTI expect that terrestrial reception will increase with the DTT introduction.

Figure A.48 below illustrates the primary type of television signal received in Romania.

Primary type of television signal received	*% of households*
Analogue terrestrial	19
Digital terrestrial	0
Analogue cable	49
Digital cable	≈1
DTH/SMATV	27
IPTV	0.01

Figure A.48: Current households primary TV signal typology [Source: NRCTI]

Timetable for switchover

The date for switch-off is expected to be 1 January 2012. The strategy will be approved in Q1 2009.

Other uses accommodated within the UHF band

There are no multiplexes already awarded in Romania for other uses than DTT (although the NRCTI is looking into this opportunity).

The current licensed uses in the UHF spectrum (other than television) are granted on a secondary basis, i.e. no interference should be caused to the application having a primary status of use and no protection is requested from that application. If DTT causes harmful interference to feeder links, or experiences harmful interference, the frequency assignments of the feeder links will be changed in due time, in the same band, in order to eliminate the interference. As for the authorisation-exempt use, these equipments will remain in the UHF band, provided that the radio interface technical specification is observed.

The most likely frequencies that have been identified as available for new uses in Romania are in Channels 61–69.

A.18.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

It is expected that there will be five multiplexes deployed for DTT. The strategy that will be defined in Q1 2009 will establish the date of putting into operation each multiplex. There should be 4 public and 44 private TV programming channels with both national and regional coverage.

Technological evolution affecting the use of the spectrum for broadcasting

- Initially there should be MFN plans, and then SFN plans.
- In the short term (before 2012) DVB-T/MPEG-4 technologies should be deployed. After 2012, technologies will evolve depending on market request.
- TV programming channels will be broadcasted in standard definition. However, HDTV is likely to be available through one multiplex.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	No decision yet, depending on market request.
What type of award process is expected to be used (e.g. beauty contest, auction)?	No decision yet, depending on market request.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	No decision yet, depending on market request.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	No decision yet, depending on market request.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

No studies yet.

A.18.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

No legislation yet. The strategy will be approved in the Q1 2009 and the related legislation will be adopted accordingly.

Regulatory instruments used to switch analogue broadcasting into digital

New authorisations are provided to switch analogue broadcasting into digital. The current licensed secondary uses of UHF spectrum (i.e. feeder links for sound broadcasting transmitters) will remain in the UHF bands IV and V. As long as no interference problems are reported, in either direction, the validity of the relevant authorisations shall be extended without restrictions. If harmful interference is experienced (either by television or by feeder links), the assignments for feeder links will be modified in order to solve the interference cases.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	There is no constraint in the Romanian legislation or in the strategy document regarding the future use of the broadcasting spectrum. In the strategy document there are specific issues regarding pluralism, increase of DTT population coverage, HDTV, but one multiplex in Channels 61–69 should be assigned to the digital dividend.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	Depending on the market request, the administration will establish if the spectrum available for digital dividend will be used for mobile TV.
Co-ordination issues with countries inside the EU	None mentioned by the respondent.
Co-ordination issues with countries outside the EU	The coordination process will be difficult in Romania because it has three non-EU neighbouring countries, which will probably cease analogue TV in 2015 (i.e. later than the EU expectations).
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	In the strategy document is stipulated that two multiplexes will be free-to-view (about 16 TV programmes channels). Taking into account the other of the multiplexes, DTT could be a cheaper alternative to other TV platforms (cable, satellite, IPTV).

A.19 Slovakia

A.19.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Spectrum Channels 21–59 within the UHF bands IV/V were used for analogue TV.
VHF channels used for analogue TV	All channels within the VHF band III were used for analogue TV.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	No UHF bands IV/V channels were reserved for other uses than television.
UHF channels not used, or unusable because of co-ordination requirements	Channels 60–66 are not used for military reasons.

Historical television broadcasting

Figure A.49 summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
STV1 (96%)	TV MARKÍZA (86%)	n/a	n/a
STV2 (89%)	TV JOJ (61%)	n/a	n/a
n/a	TA3 (38%)	n/a	n/a
2	**3**	**0**	**0**

Figure A.49: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Telecommunication Office of the Slovak Republic]

Other uses accommodated within the UHF band

Some spectrum within the UHF bands IV and V is used for radio microphones: 174.3–174.6MHz and 863–865MHz.

A.19.2 The transitory situation (as of December 2008)

Current television broadcasting

There are currently no multiplexes awarded for DTT in Slovakia.

Figure A.50 below illustrates the primary type of television signal received in Slovakia.

Primary type of television signal received	*% of households*
Analogue terrestrial	53.3
Digital terrestrial	0
Analogue cable	29.1
Digital cable	1.5
DTH/SMATV	15.6
IPTV	0.5

Figure A.50: Current households primary TV signal typology [Source: Telecommunication Office of the Slovak Republic, Analysys Mason]

Timetable for switchover

The ASO is due to happen by the end of 2012.

Other uses accommodated within the UHF band

- No multiplexes already awarded in Slovakia for other uses.
- The digital switchover will affect SAB/SAP users.

- The frequencies 790–862MHz have been identified as available for new uses after 2015 in Slovakia.

A.19.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

A strategy for DTT introduction approved by the government in 2001 suggested that Slovakia could eventually have between five and six multiplexes, two of which would be national, one regional/local, one or two for HDTV programming channels, and a final multiplex for additional data services. It is foreseen that a pay-DTT service will operate alongside a free-to-view service.

Technological evolution affecting the use of the spectrum for broadcasting

To provide DTT services in Slovakia, there will be SFN and/or MFN (after 2012) plans. Regarding DTT technologies and compression technologies, DVB-T/DVB-T2 and MPEG-2/MPEG-4 will be deployed depending on the agreement between the network providers and the broadcasters.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	The spectrum will be awarded after 2015.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Beauty contest has been selected.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	Restrictions from the telecommunication law and the digital law.

Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Wireless broadband should be viable candidates for the use of spectrum made available as a result of analogue switch-off.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

The main study is "Strategy of Transition from analogue to terrestrial TV broadcasting in the Slovak Republic", approved by Resolution of the Government of SR.[59]

No other studies on future uses of the UHF spectrum in the Slovak Republic have been completed.

A.19.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The law on digital broadcasting of programme services (digital law) 220/2007.

Regulatory instruments used to switch analogue broadcasting into digital

New authorisations for DTT and mobile TV that expire in 2029 will be provided. Any SAB/SAP authorisation expires in 2012.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	Policy priorities are to increase DTT population coverage, launching HDTV, and awarding the digital dividend.

59 http://www.telecom.gov.sk/index/index.php?ids=20431&lang=en

Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	The process to implement the extension of broadcasting services will be a beauty contest.
Co-ordination issues with countries inside the EU	n/a.
Co-ordination issues with countries outside the EU	There are co-ordination issues with Ukraine.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	Slovakia expects that the terrestrial platform will keep being dominant over cable, satellite and IPTV, but its market share should decrease.

A.20 Slovenia

A.20.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 21–69 within the UHF bands IV/V are used for analogue TV.
VHF channels used for analogue TV	Channels 5–12 within the VHF band III are used for analogue TV as well.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	n/a.
UHF channels not used, or unusable because of co-ordination requirements	n/a.

Historical television broadcasting

In Slovakia there are two public nationwide and three public regional TV programming channels and three private nationwide and 14 private local TV programming channels.

Figure A.51 summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
TV Slovenija 1 (95%)	POP TV (72%)	n/a	n/a
TV Slovenija 2 (90%)	Kanal A (69%)	n/a	n/a
n/a	TV 3 (39%)	n/a	n/a
2	**3**	**3**	**14**

Figure A.51: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Post and Electronic Communications Agency of the Republic of Slovenia, January 2008]

Other uses accommodated within the UHF band

Frequencies from the whole UHF bands IV and V can be used for SAB/SAP as secondary basis.

A.20.2 The transitory situation (as of December 2008)

Current television broadcasting

Currently there are two multiplexes awarded to DTT in Slovenia, which should be launched in June 2009. In the transitory situation there will be seven national TV programming channels (three public – 95%, four commercial – 90%).

Figure A.52 below illustrates the primary type of television signal received in Slovenia.

Primary type of television signal received	*% of households*
Analogue terrestrial	26
Digital terrestrial	0
Analogue cable	48.4
Digital cable	3.6
DTH/SMATV	10
IPTV	12

Figure A.52: Current households primary TV signal typology [Source: Analysys Mason, Post and Electronic Communications Agency of the Republic of Slovenia, January 2008]

Timetable for switchover

According to the Digital broadcasting Act, 1 June 2009 is the starting date of simulcast between DTT and analogue terrestrial TV. This simulcast will last at most 18 months. Switch-off is hence due by the end of 2010.

Other uses accommodated within the UHF band

Currently there are no multiplexes already awarded in Slovenia for other uses than DTT.

For new usage, there are no frequency identified for the moment.

A.20.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

After switch-off, there will be seven multiplexes deployed (two of which are for private broadcasters only and one for the public broadcaster only). Public TV programming channels will need to cover 95% of the population whereas private ones will need to cover 90% of the population.

Currently there are no plans for mobile TV in Slovenia.

Technological evolution affecting the use of the spectrum for broadcasting

The following defines at a high level the DTT features that will be deployed:

- SFN plans
- DVB-T (DVB-T2 maybe in the longer term)
- MPEG-4
- HDTV: trial starting, maybe in service in the longer term.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum.

What is the timetable for awarding this spectrum	No timetable yet decided.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Probably a beauty contest.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	Currently no plans.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Currently no plans.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

There are no studies on future uses of the UHF spectrum in Slovenia so far.

A.20.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The DSO is defined by the Digital Broadcasting Act.

Regulatory instruments used to switch analogue broadcasting into digital

The DSO is based on authorisation replacement with the right for digital broadcasting (DTT) on the equivalent territory. The authorisation for DTT is issued for ten years and can be reissued after expiration.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	n/a.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	n/a.
Co-ordination issues with countries inside the EU	n/a.
Co-ordination issues with countries outside the EU	Co-ordination issues with countries outside the EU according to the GE-06 agreement.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	n/a.

A.21 Spain

This information in this section is up to date to January 2009, when we received Spain's response to our questionnaire regarding the 470–862MHz band. However, on 2 June 2009 the Spanish Minister of Industry, Tourism and Trade announced the objective of freeing up the 790–862MHz sub-band. Starting in 2015, the sub-band will be available for electronic communications services, such as mobile broadband. The official statement from the Ministry (in Spanish) can be found at: http://www.mityc.es/es-ES/GabinetePrensa/NotasPrensa/Paginas/dividendodigital020609.aspx

A.21.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	UHF band IV and V Channels 21–65 were used for analogue TV in Spain.
VHF channels used for analogue TV	VHF band III Channels 2–11 were used for analogue TV in Spain.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	UHF Channels 66–69 were used for fixed voice services in Spain.
UHF channels not used, or unusable because of co-ordination requirements	None.

Historical television broadcasting

Figure A.53 summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
2 (>98%)	4 (>96%)	1 (>98% in each region)	0
2	**4**	**1**	**0**

Figure A.53: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Ministerio de Industria, Turismo y Comercio, January 2009]

Other uses accommodated within the UHF band

Interleaved spectrum is used for temporary uses under specific authorisation (radio microphones; SAB/SAP etc.).

A.21.2 The transitory situation (as of December 2008)

Current television broadcasting

In Spain, only 20% of households currently access TV through cable and satellite, thus terrestrial is the strongest platform in the Spanish television market. As a consequence, DTT has become the largest digital TV platform and estimates suggest that there were 36% of TV households using DTT at the end of 2008, the majority of which use DTT for primary set viewing. A significant segment of the DTT market is for primary set viewing. Therefore, coverage and content are important factors to the present success of DTT in Spain. Currently, DTT multiplexes have 89% population coverage, and this is scheduled to increase to 98% for the public service broadcaster multiplexes and 96% for commercial multiplexes following ASO.

After the UK and Sweden, Spain was the third European country to launch a DTT service in May 2000. However, the service failed to generate sufficient consumer take-up and was closed in 2002 due to important debts.

In 2005 a new DTT technical plan was approved. The new technical plan had two primary features for DTT:

- it shifted the analogue switch-off date forward by two years to 2010
- it allocated DTT frequencies to the public broadcaster RTVE, as well as commercial TV programming channels Antena 3, Tele 5 and Canal Plus, and digital TV programming channels Net TV and Veo TV.

Although Spain, with the failure of the first launch of DTT, has fallen behind many of Europe's major TV markets in terms of DTT penetration, the re-launch and increasing penetration shows it is, so far, a success.

There is currently a total of between seven and nine multiplexes in Spain, comprising of five national (four SFN and one MFN), one regional and between one and three local multiplex. Each multiplex allow to broadcast an average of four TV programming channels each in SD.

Figure A.54 below illustrates the primary type of television signal received in Spain.

Primary type of television signal received	*% of households*[60]
Analogue terrestrial	44
Digital terrestrial	36
Analogue cable	5
Digital cable	10
DTH/SMATV	5
IPTV	0

Figure A.54: Current households primary TV signal typology [Source: Ministerio de Industria, Turismo y Comercio, January 2009]

Timetable for switchover

Switch-off is planned for 3 April 2010.

Other uses accommodated within the UHF band

In Spain, so far no multiplex and no frequencies have been awarded for other uses than DTT.

A.21.3 The situation after analogue signals are switched off throughout the European Union

After ASO, each broadcaster will be allocated a multiplex: RTVE will have two multiplexes and the 17 regions will have access to two shared multiplexes. The current Spanish network plan mandates 12 DTT multiplexes post-ASO, 8 of which will be national. Pre-ASO, spectrum was assigned by TV programming channel by the Ministry of Industry, Tourism and Trade, through a mix of direct award (established players) and 'beauty contest' (new entrants). This system will change, post-ASO, as spectrum will be assigned by multiplex for a better use of frequencies, avoiding problems with managing technical aspects and transmissions.

The Spanish government announced it is willing to allocate all digital dividends to broadcasting. Francisco Ros, Telecommunications General Secretary at the Ministry, stated that "these frequencies would not be given to telecoms operators to be used for wireless telecommunications, but rather all spectrum freed from TV's migration to digital would instead be claimed by

60 The share figure refers only to the viewing of the main free-to-view TV programming channels.

broadcasters”. The rationale behind this is that small broadcasters have been given analogue authorisations in the past due to the proliferation of TV programming channels, specifically on a regional and local basis. According to present legislation, these small broadcasters have the right to have enough frequencies to continue broadcasting in digital. With a restricted amount of UHF spectrum available, there is not sufficient spectrum for all services. Thus, the Spanish government has prioritised broadcasting.

Expected television broadcasting

The National Technical Plan for Digital Terrestrial Television envisages 12 multiplexes (13 in some regions or local areas). Seven multiplexes have already been awarded and the other will be awarded after the switch-off date. Coverage obligations are 98% of the population for the national and regional public TV programming channels, and 96% of the population for the national private TV programming channels.

The National Technical Plan for Digital Terrestrial Television envisages at least one multiplex for mobile TV.

Technological evolution affecting the use of the spectrum for broadcasting

Both SFN and MFN have been deployed in Spain; regulation does not establish the compression technology. MPEG-2 is currently used. Royal Decree 944/2005 establishes that operators will be able to use DTT multiplexes to provide HDTV services. Secondary legislation must be published by the government to allow the launch of HDTV services.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	There are not any plans at the moment.
What type of award process is expected to be used (e.g. beauty contest, auction)?	There are not any plans at the moment.
Will there be any restrictions on the type of organisations that can bid for the available spectrum	There are not any plans at the moment.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	There are not any plans at the moment.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

There are no studies.

A.21.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

- Royal Decree 944/2005, which approves the National Technical Plan for Digital Terrestrial Television[61]
- Agreement of the Cabinet of Ministers for the approval of the National Plan for the Transition to Digital Terrestrial Television.[62]

Following a Transition Plan for the DTT approved in September 2007, the analogue TV switch-off will take place progressively along 90 switchover areas. A pilot trial was carried out in the province of Soria, with 50.000 inhabitants switched-off from analogue TV since 23 July 2008.

Regulatory instruments used to switch analogue broadcasting into digital

The analogue TV authorisation expires on 3 April 2010.

61 http://www.boe.es/boe/dias/2005/07/30/pdfs/A27006-27014.pdf

62 http://www.televisiondigital.es/NR/rdonlyres/EB0C5444-4E10-41B5-BFCDB9A5CBA6F768/0/2NationalPlanforTransitiontoDTT_Spain_ENG.pdf

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	General interest objectives (Law 10/1988 of May 3, 1988 on private TV, Law 17/2006 of June 17, on public radio and TV[63]).
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	It is incumbent on the government to promote the use of the different official languages of the state through the DTT programming channels in the Spanish autonomous communities (Law 10/2005 of June 14, 2005 on urgent measures to boost digital terrestrial TV), liberalise cable and promote pluralism.[64]
Co-ordination issues with countries inside the EU	n/a
Co-ordination issues with countries outside the EU	Spain is facing co-ordination issues with countries outside the EU (e.g. Morocco, Algeria)
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	In Spain more than 98% of the population receive terrestrial TV

63 http://www.boe.es/boe/dias/2006/06/06/pdfs/A21207-21218.pdf

64 http://www.boe.es/boe/dias/2005/06/15/pdfs/A20562-20567.pdf

A.22 Sweden

Sweden was one of the first countries to complete its digital switchover. The shutdown of the analogue equivalent started in September 2005, and was finalised in October 2007. It already has five operational DTT multiplexes using UHF spectrum, and plans a further two multiplexes using both UHF and VHF spectrum. Sweden was also the first country to allocate a sub-band to non-television use following the decision at WRC-07 to assign mobile communications as a co-primary use in Europe (Region 1) in the 790–862MHz sub-band. The national regulator, the Swedish Post and Telecom Agency (PTS), has preliminary decided to award this sub-band in auction on a service and technology neutral basis. However, its final approach is still contingent on resolving any interference and co-ordination issues with neighbouring states which are in turn influenced by the decisions on how to use this sub-band across Europe.

A.22.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF and VHF bands prior to the introduction of DTT

Prior to the introduction of DTT cable was and still is the dominant television platform in Sweden. In 2001, 58% of the households in Sweden had cable television while 18% turned to satellite and 24% were terrestrial viewers (see Figure A.55).

The offering on the analogue television network consisted of three TV programming channels: two publicly funded run by the national broadcaster Sveriges Television**,** SVT1 and SVT2; and one privately funded, TV3 (see Figure A.56). Three sites were used for local coverage over Stockholm for Finnish programs; there were no other regional services. The two SVT programming channels covered 99.8% of the population and TV3 covered 98%.

The analogue TV programming channels were broadcast using both UHF and VHF spectrum.

- All UHF channels in the 470–790MHz range were used for the broadcast of analogue terrestrial television, and a number of spectrum channels in the 790–862MHz range were also used. Nearly 800 sites were used to transmit the SVT programming channels to 99.8% of the population.

- VHF bands I (47–68MHz) and III (174–230MHz) were used for nearly all of the high-power transmitters required for transmission of SVT1, the public services broadcaster's primary TV programming channel; all the complementary (low-power) sites were in the UHF band.

From the 1950s to the 1980s, Channels 61–69 in the 790–862MHz frequency range were also used for fixed services. However, these fixed services were migrated away from the band prior in preparation for the launch of DTT.

The main use of interleaved spectrum in the UHF band was for SAB/SAP. As there was no distinction between professional or non-professional use, authorisations were required for all applications.

In Sweden, all UHF channels were subject to some degree of use.

Historical television broadcasting

Primary type of television signal received	*% of households*
Analogue terrestrial	3
Digital terrestrial	21
Analogue cable	56
Digital cable	2
Analogue satellite	5
Digital satellite	13
IPTV	0

Figure A.55: Historical households primary TV signal typology before the introduction of DTT [Source: Screen Digest, *2001]*

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
2 (99.8%)	1 (98%)	0	0

Figure A.56: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses) [Source: PTS, December 2008]

A.22.2 The transitory situation (as of December 2008)

Sweden completed its analogue switch-off in October 2007 after a seven-year period of simulcast. Digital terrestrial television was originally launched in April 1999 and received very poor uptake; this was due to issues with the TV programming channels available and the cost of set-top boxes. DTT was then relaunched in April 2000, with a significant increase in the number of TV programming channels available and enhanced services. In recent years, DTT penetration has grown rapidly, and terrestrial television now has a similar penetration to that before the launch of digital services.

The broadcasting landscape in Sweden is still very much orientated towards the terrestrial and cable markets. Figure A.57 shows how the technologies break down across all households; the total across all platforms exceeds 100%, as many households have multiple televisions. Looking ahead to 2012, the regulator expects no major changes to the relative penetration of platforms as they have been stable over the last year notwithstanding the advances in broadband and IPTV.

Figure A.57 below illustrates the primary type of television signal received in Sweden.

Primary type of television signal received	*% of households*
Digital terrestrial	37
Cable	57
Satellite	18
IPTV	3

Figure A.57: Penetration of different TV platforms [Source: PTS, 2007]

Sweden currently has five multiplexes deployed for DTT that collectively offer 34 TV programming channels. There is a large free-to-view offering supplemented by a subscription service run by Boxer that offers 23 TV programming channels. A sixth multiplex is currently in production, and broadcast licences have already been allocated; this will significantly improve the subscription offering providing up to 10 more TV programming channels. A seventh multiplex in the VHF band is being planned.

In contrast, there are three main operators in the Swedish cable market: Com Helm (the largest Scandinavian cable operator), Canal Digital (now owned solely by Telenor, the Norwegian incumbent operator) and Tele2Vision. Of these, Canal Digital also operates a satellite service but does not own its own television network. Tele2Vision has been slowest to adopt digital broadcasting and also has the smallest TV programming channel offering, only offering roughly 50 as opposed to the over 200 offered by the other two operators.

A.22.3 The situation after analogue signals are switched off throughout the European Union

Sweden completed its digital switchover in Oct 2007 with five multiplexes utilising spectrum in the 470–862MHz UHF band. Following the WRC-07 decision to make mobile communications a co-primary allocation in the 790–862MHz in Region 1 (Europe), the Swedish government decided on 19 December 2007 that the 790–862MHz sub-band will be cleared, making Sweden the first European country to set aside a sub-band in the digital dividend spectrum for non-television use.

The five multiplexes that were already broadcasting DTT would be moved exclusively to the 470–790MHz band and additional frequencies will be allocated to DTT between 2008–2015 as follows:

- the sixth multiplex will also be established in the 470–790MHz band; and
- if required, a multiplex could be established in the 174–230MHz band (VHF band III).

PTS has identified three steps to completing the award of the 790–862MHz sub-band:

- vacate terrestrial television from these frequencies
- harmonise spectrum arrangement in this band [with neighbouring countries]
- carry out the award process.

In 2008, PTS produced a nationwide schedule of digital television in order to grant frequencies in the 470–790MHz band for at least six multiplexes as well as a frequency space for a multiplex in the 172–230MHz band, thereby freeing up the spectrum in the 790–862MHz sub-band for non-DTT use. While the broadcasters are clearing out of the 790–862MHz sub-band, PTS is carrying out a study to investigate the possible interference between broadcasting and mobile in the UHF IV/V band, the results of which are expected in 2009.

In addition, while interleaved spectrum in the UHF IV/V band (470–790MHz) have traditionally been used for low-powered devices such as radio microphones and applications ancillary to broadcasting, PTS has stated that from 2010, spectrum authorisations for such uses of interleaved spectrum will me limited to the 470–790MHz frequency band.

Therefore, while there is no fixed timeframe for the award of spectrum authorisations in the 790–862MHz sub-band, PTS expects to award the 790–862MHz sub-band in the timeframe of 2009–2010, depends on the progress of harmonisation within Europe.

Expected DTT broadcasting

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1 (99.8%)	7	-	-	-
2 (98%)	2	5	-	-
3 (98%)	-	7	-	-
4 (98%)	-	7	-	-
5 (70%)	2	4	4	-
6*	-	Max 10	-	-
Total	**11**	**33**	**4**	**0**

**The sixth multiplex has not yet been launched*

Figure A.58: Overview of DTT programming channels in the UHF band after ASO (population coverage in parentheses) [Source: PTS, December 2008]

Technological evolution affecting the use of the spectrum for broadcasting

A combination of multi-frequency and SFNs will be used. The older multiplexes, 1–5, are currently broadcasting in MPEG-2 and the new sixth multiplex is designed to broadcast in MPEG-4 when it comes online. There are plans for simulcast of MPEG-2/MPEG-4 during the upgrade process but the timetable for the upgrade process has not yet been announced. All the multiplexes use DVB-T; there are no plans regarding DVB-T2, but it has been mentioned as a possible technology for the VHF band multiplex currently being planned. There are test-transmissions of HDTV in the Stockholm area; however there are no decisions as to whether standard or high definition will be used in the future. High definition has been suggested, however, for the VHF band multiplex if DVB-T2 is used. Regarding the remaining multiplexes, there is a concern that HDTV will not be viable on these multiplexes as well as the VHF multiplexes owing

to the high bandwidth requirements, and the constraints this would place on the number of TV programming channels available.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

PTS were tasked in 2005 with studying the possible uses of spectrum after the switch-off of terrestrial analogue television.[65]

A.22.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The Swedish Parliament decided in May 2003 that there should be a transition to digital television, to be finalised by 1 February 2008 at the latest. The analogue switchover was completed in October 2007.

A digital TV commission was appointed by the government to implement and monitor the transition. This included planning, coordinating and providing information to the public.

Regulatory instruments used to switch analogue broadcasting into digital

The licences previously requiring the use of analogue television have continuously been replaced by new licences relating to the transmission of digital technology. The authorisation periods were set to match the decided dates for the analogue switchover. During the analogue switchover in phases (region by region) the coverage requirements have been adjusted accordingly.

- DTT authorisations for public service broadcasting expire on 31 December 2009.
- DTT authorisations for private companies expires on 31 March 2014.
- Authorisations for SAB/SAP are given for a period of one to three years.

Specific issues affecting the future use of the UHF bands

PTS presented the results of a study on creating and managing the 790–862MHz sub-band in the UHF IV/V band to the Swedish government at the end of 2007, and on 19 December 2007 the Swedish government announced their decisions on the matter.

65 This report is available at http://www.pts.se/en-gb/Industry/Radio/Overgangen-till-digital-TV/

"On 19 December 2007, the Government decided to make the following broadcasting space available for TV broadcasts that require a licence according to the Swedish Radio and Television Act (1996:844) from 1 April 2008 to 31 March 2014:

1. Five frequency channels for the entire country, or provided that no television is broadcast on frequencies higher than 790 MHz, a larger number of frequency channels that can be made available in frequency band 470-790 MHz.

2. An additional frequency channel for the entire country, provided that frequency space can be made available in the 174-230 MHz band.

The above mentioned Government decision also entails the following. On 21 December 2006, the Government granted Sveriges Television AB (SVT) a licence to broadcast television. According to the licence, SVT has the right to broadcast television programmes throughout the entire country, and together with Sveriges Utbildningsradio AB (UR), to broadcast television programmes around the clock. This means that all of the available transmitting capacity on one frequency channel is used. SVT also has the right to use the transmission capacity that is made available by another party to broadcast television programmes, even if the combined capacity exceeds what was previously indicated. The broadcasting licence went into effect on 1 January 2007, and applies until 31 December 2009.

In the appropriation directions for 2008, the Government tasked the Swedish National Post and Telecom Agency with producing a nationwide schedule for digital terrestrial TV in order to grant space for at least six transmitter networks for frequency space 470-790 MHz, as well as a transmitter network in frequency space 174-230 Mhz. This means that no TV broadcasting takes place in frequency space 790-862 Mhz. To the extent possible, the schedule shall be harmonised with the relevant authorities in neighbouring countries. The assignment will be presented to the Government (Ministry of Enterprise, Energy and Communications) by 15 December 2008 in a report that outlines the solution as well as any ascertained geographical limitations." [66]

[66] PTS decision on applicants for broadcasting licences, Mar 2008, Reg. no. 361/2008 etc. http://www.rtvv.se/_upload/Tillstånd/pdf/Licence%20to%20broadcast%20TV%20programmes.pdf

A.23 UK

A.23.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 21–35 (470–590MHz), 37 (598–606MHz) and 39–68 (614–854MHz) were used for analogue TV transmissions.
VHF channels used for analogue TV	No VHF channels were used for analogue TV transmissions.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	Channel 36 (590–598MHz) was and is currently used for aeronautical radar. It will be cleared of this use during 2009. Channel 38 (606–614MHz) was and is currently used for radio astronomy. It will be cleared of this use by the end of 2012. Channel 69 (854–862MHz) was and is currently used for SAB/SAP.
UHF channels not used, or unusable because of co-ordination requirements	No UHF channels were not used or unusable nationwide because of coordination requirements. However, some local restrictions applied to certain channels for this reason. The complete (current) UK frequency allocation table is available at the regulator Ofcom's website.[67] The allocations listed above are the same as the pre-DTT allocation table.

Historical television broadcasting

There were five analogue TV programming channels: BBC One, BBC Two, ITV1, Channel 4/S4C and Five. S4C is the regional variant of Channel 4 in Wales and carries some Welsh-only programming. There are currently eight local TV programming channels in the UK, although none were broadcasting before DTT was launched in the UK in 1998.[68]

67 http://www.ofcom.org.uk/radiocomms/isu/ukfat/ukfat08.pdf

68 http://www.ofcom.org.uk/tv/ifi/tvlicensing/rtsl/

- BBC One and BBC Two are operated by the BBC, a public corporation, publicly funded by a 'TV licence' fee.
- ITV1 is a commercial channel privately owned by ITV plc.
- Channel 4 and S4C are publicly owned but commercially financed. S4C receives partial government grant funding.
- Five is privately owned by RTL.

98.5% of the population receive analogue broadcasts of BBC One, BBC Two, ITV1 and Channel 4/S4C. Five's analogue service covers 80% of the population.[69]

Figure A.59 summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
BBC One (98.5%)	ITV1 (98.5%)	S4C (98.5%)	n/a
BBC Two (98.5%)	Five (80%)	n/a	n/a
Channel 4 (98.5%)	n/a	n/a	n/a
3	**2**	**1**	**n/a**

Figure A.59: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses) [Source: Ofcom, DTT Coverage Factsheet]

Other uses accommodated within the UHF band

SAB/SAP is the main use of interleaved spectrum in the UK. Subject to local usage by TV transmitters, they can access Channels 21–68 (with further restrictions in Channels 36 and 38).[70]

Individual SAB/SAP authorisations are granted by a private organisation, JFMG, under statutory delegation from Ofcom.[71]

Some interleaved spectrum is currently used for local analogue TV programming channels. There are currently eight such TV programming channels operating in various locations across the country.

69 See 'DTT Coverage Factsheet No2', p. 2 http://www.ofcom.org.uk/research/tv/reports/dsoind/factsheets/no2factsheet.pdf

70 http://www.jfmg.co.uk/pages/freq/TVChannelFrequencies.htm

71 http://www.jfmg.co.uk/pages/licence/licence.htm

A.23.2 The transitory situation (as of December 2008)

Current television broadcasting

There are currently six DTT multiplexes in the UK. Details of the five authorisations are available at Ofcom's website.[72] Multiplex 1 is operated by the BBC under their Royal Charter and Agreement with the Secretary of State for Culture, Media and Sport and therefore does not have a similar authorisation.

Figure A.60 the distribution of current DTT programming channels in the UHF.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	8	0	0	0
2	4	4	2	0
3	0	18	2	2
4	3	1	0	0
5	1	5	0	0
6	1	8	0	0
Total	**37**	**36**	**4**	**2**

Figure A.60: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: Ofcom[73]]

Figure A.61 below illustrates the primary type of television signal received in UK.

Primary type of television signal received	*% of households*
Analogue terrestrial	14.91
Digital terrestrial	38
Analogue cable	0.1
Digital cable	12.7
DTH/SMATV	36.4
IPTV	0.7

Figure A.61: Current households primary TV signal typology [Source: Ofcom]

On DTT service, Freeview, there are currently six multiplexes, evenly split between three public broadcasters and three commercial. Two of the public multiplexes are operated by the BBC and the third by D3/4. For the commercial multiplexes, two are operated by National Grid Wireless (NGW) and one by SDN (which is owned by independent broadcaster ITV). Currently 31 TV programming channels are available on free-to-view DTT, however in effect the number is higher since many channels share streams and only broadcast for a set portion of the day (for example, CBBC and BBC3 share a stream on Multiplex A, with CBBC broadcasting during the day until

72 http://www.ofcom.org.uk/tv/ifi/tvlicensing/muxlicensees/

73 http://www.dtg.org.uk/retailer/dtt_channels.html

19.00 and BBC3 broadcasting from 19.00 onwards for the rest of the evening). Taking into account stream sharing, there are 40 TV programming channels available on DTT, including the three take-up TV programming channels.

Timetable for switchover

The date for the Channel Islands' switchover has changed from 2013 to the second half of 2010. As a result, DSO will be fully complete in the UK and the Crown Dependencies by the end of 2012. The ASO due between 2008 and 2012 region by region.

Other uses accommodated within the UHF band

There are currently no multiplexes awarded for other uses in the UK in UHF bands IV and V. Several DAB (digital audio broadcasting) multiplexes operate in the VHF band, on both a local and a national basis.[74]

Although not a direct result of switchover, the incumbent aeronautical radar user of Channel 36 (590–598MHz) will clear the channel during 2009 and radio astronomy will clear Channel 38 (606–614MHz) by the end of 2012. These changes will allow the UK to increase the amount of spectrum in its lower digital dividend from 64MHz (Channels 31–35, 37 and 39–40) to 80MHz (Channels 31–40).

Ofcom is releasing 128MHz of cleared spectrum and awarding it on a technology- and service-neutral basis. The cleared spectrum falls into two bands. The lower band comprises Channels 31–40 (550–630MHz) and the upper band Channels 63–68 (806–854MHz).

A.23.3 The situation after analogue signals are switched off throughout the European Union

Ofcom has carried out public consultations to develop its thinking on the migration to advanced technologies. The results from the consultation focusing on efficiency improvements to the DTT platform were published in April 2008. Its outcome was that Ofcom believed that there should be a partial migration to MPEG-4 and DVB-T2 technology over time. However, the migration must be managed for a number of key reasons. Firstly, technology migration requires the coordination of a number of different parties including multiplex operators, broadcasters, and broadcast infrastructure suppliers (each of whom have their own objectives and incentives). Secondly, Ofcom considers it important that existing multiplexes continue to be universally available to subscribers. Finally, Ofcom believes that any further adoption of technical standards should be considered on a case-by-case basis evaluating the benefits to consumers and broadcasters of all proposed changes.

74 http://www.ofcom.org.uk/radio/ifi/rbl/dcr/

At present, Ofcom has recommended to the government that the four HDTV programming channels should be introduced on a single universal coverage multiplex, Multiplex B, which will use MPEG-4 and DVB-T2 technology to accommodate three HDTV programming channels from 2009 and a further TV programming channel from 2012. These technological changes are estimated by Ofcom to increase the capacity of the multiplex to at least 31.4Mbit/s without any loss of coverage.

Additionally, at ASO, it has been recommended that the BBC and National Grid Wireless multiplex upgrade from 16QAM to 64QAM which would further increase capacity on the multiplex. This incurs a cost for the multiplex operators who will have to build more transmitters in order not to lose coverage when the modulation is changed. Ofcom does not have the ability to mandate upgrading technology on existing multiplexes, although it is able to reject changes to the technologies used by these multiplexes. NGW and BskyB have proposed that they should be able to make DVB-T and MPEG-4 available on their capacity immediately, but they are unable to do so without agreement from Ofcom.

Following the introduction of the HD multiplex and the migration from 16QAM to 64QAM on four of the six multiplexes, there will be 38 TV programming channels in total available on DTT in the UK: 34 in SD and 4 in HD.

The spectrum retained for DTT supports six national multiplexes. All six multiplexes have been active since the launch of DTT in November 1998.

It is expected that the core, public service broadcaster multiplexes (Multiplexes 1 and B operated by the BBC and Multiplex 2 operated by Digital 3&4) will cover 98.6% of the UK population at switchover, slightly above their analogue equivalents' coverage of 98.5%. Under the Communications Act 2003 the public service broadcasters are required to substantially match the coverage of their analogue services. The three commercial multiplexes (Multiplexes A, C and D) do not have an equivalent obligation and are expected to achieve combined post-switchover coverage of 90% of the UK population, an increase from their current 73% coverage.[75]

The exact number of national TV programming channels distributed on these multiplexes is subject to regular change. Each of the three DVB-T, MPEG-2 commercial multiplexes can support between six and twelve video streams so it is difficult to specify exactly how many will be in service in future.

No spectrum has been retained for multiplexes supporting mobile TV.

75 http://www.ofcom.org.uk/research/tv/reports/dsoind/factsheets/no2factsheet.pdf

Expected television broadcasting

Figure A.62 below summarises the expected DTT programming channels in the UHF band after the ASO.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	8	0	0	0
2	3	7	1	0
3	0	17	0	2
4	1	1	1	0
5	1	5	0	0
6	1	8	0	0
Total	**16**	**38**	**2**	**2**

Figure A.62: Overview of DTT programming channels in the UHF band after the ASO (population coverage in parentheses) [Source: Ofcom[76]]

Technological evolution affecting the use of the spectrum for broadcasting

There will be 15 SFNs in the UK DTT network involving 33 transmission stations as shown in Figure A.63 below. Most of the UK's network of 1160 stations operate as MFNs. The decision to use an SFN or MFN is down to the multiplex operators themselves so we cannot accurately predict what future usage will look like.

76 http://www.dtg.org.uk/retailer/dtt_channels.html

Stations within SFN	*UHF IV/V Channels*
Bromsgrove, Larkstoke, The Wrekin	23, 26, 30, 41, 44, 47
Black Hill, Strathyre Link	43, 46, 50
Blaenplwyf, Beddgelert Link	27, 24, 21
Beacon Hill, Budleigh Salterton	53, 57, 60
Charmouth, Weymouth	47, 44, 41
Divis, Killowen Mt	27, 24, 21
Darvel, Lochgoilhead AD	22, 25, 28
Broadstairs, Dover, Margate	50, 53, 51
Heathfield, Tunbridge Wells	49, 52, 47, 42, 44, 41
Bethesda, Llanddona	57, 60, 53
Mynydd Machen, Pontypool	23, 26, 29
Beary Peark, Jurby VP, Port St Mary	43, 46, 50
Rosemarkie, Tomich Link	45. 49, 42
Rouncefall, Sudbury	41, 44, 47
Dychliemore Link, Torosay	22, 25, 28

Figure A.63: Planned DTT SFN networks [Source: Ofcom]

Of the six existing DTT multiplexes, five will continue to use DVB-T technology and MPEG-2 compression at least until 2012. The sixth multiplex, Multiplex B, will shift from DVB-T and MPEG-2 to DVB-T2 technology and MPEG-4 compression in line with the UK's digital switchover programme. It will initially carry three HD services by the end of 2009, possibly adding a fourth by the middle or end of 2010.

As mentioned above, one existing DTT multiplex will be adjusted to carry at least three HD programming channels from public service broadcasters. It will change at switchover in each region from 2009. To enable some regions which are switching later in the overall process to access HD content through DTT earlier, Ofcom have proposed using some interleaved frequencies as a temporary measure in the interim.[77]

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum.

[77] http://www.ofcom.org.uk/consult/condocs/interleaveduhf/interleaved.pdf
http://www.ofcom.org.uk/radiocomms/digital/hd_on_dtt/
http://www.ofcom.org.uk/consult/condocs/dttfuture/statement/statement.pdf

What is the timetable for awarding this spectrum	The most up to date public timetable envisages awarding the spectrum in 2010.
What type of award process is expected to be used (e.g. beauty contest, auction)?	To maximise the efficiency of the award outcome we have decided to conduct it through an auction process.[78] Since the award is taking place on a service- and technology-neutral basis, Ofcom have decided to use a combinatorial clock auction, to allow package bidding.[79]
Will there be any restrictions on the type of organisations that can bid for the available spectrum	The only restriction is that the bidder must be a body corporate.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Likely candidates for the spectrum were examined in previous consultation documents and statements.[80] They include: • DTT multiplexes (free-to-view or subscription-based) offering SD and/or HD services • local TV services • mobile broadband • mobile TV • wireless broadband.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

Ofcom has commissioned a number of technical reports about future uses of the UHF band.[81]

Other DDR technical documents are available.[82]

78 Sections 5 and 8 of this document explain Ofcom's reasoning: http://www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf

79 Full details of our auction design are included in Section 8 of this document: http://www.ofcom.org.uk/consult/condocs/clearedaward/condoc.pdf

80 See Section 4, http://www.ofcom.org.uk/consult/condocs/ddr/ddrmain.pdf
See pp.15–17, http://www.ofcom.org.uk/consult/condocs/ddr/statement/statement.pdf

81 http://www.ofcom.org.uk/radiocomms/ddr/documents/

82 http://www.ofcom.org.uk/consult/condocs/ddr/statement/ddrannex.pdf
http://www.ofcom.org.uk/consult/condocs/clearedaward/
http://www.ofcom.org.uk/consult/condocs/ddrinterleaved/reports/

Ofcom market research and associated conclusions about some potential future uses of the spectrum are available.[83]

A.23.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The UK Government has a dedicated website for its policies and initiatives on digital television.[84]

From 2001–05, industry and government worked together on digital switchover through the Digital Television Project. This resulted in the development of a detailed Digital Television Action Plan setting out the various tasks that had to be completed to enable the government to make decisions on the timescale for switchover and the strategy. The last version of the Digital Television Action Plan was published in October 2004. The report of the Digital Television Project was published in March 2005. A large range of reports are available at Ofcom's website.[85]

- The Communications Act 2003 enabled Ofcom to issue Digital Replacement Licences for the existing analogue broadcasters.[86]
- Section 214 of the Communications Act (as well as Section 215(4) and paragraph 47 of Schedule 18 to the Communications Act) apply to the Channel 3 (ITV) and Channel 5 (Five) authorisations.
- Section 221 of the Communications Act applies to the authorisation for the public teletext provider.
- Section 231 of the Communications Act applies to Channel 4's authorisation.
- The Wireless Telegraphy Act 2006 empowers Ofcom to award the digital dividend.[87]

Regulatory instruments used to switch analogue broadcasting into digital

Each of the analogue broadcasters' authorisations ceased at the end of 2004 and were replaced by authorisations authorising provision of the services in digital form, which set out the schedule for switching off the analogue signals (Digital Replacement Licences).[88]

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83 http://www.ofcom.org.uk/radiocomms/ddr/documents/research07/
http://www.ofcom.org.uk/consult/condocs/ddr/statement/

84 http://www.digitaltelevision.gov.uk/index.html

85 http://www.digitaltelevision.gov.uk/publications/pub_actionplan.html

86 http://www.opsi.gov.uk/ACTS/acts2003/ukpga_20030021_en_1

87 http://www.opsi.gov.uk/acts/acts2006/pdf/ukpga_20060036_en.pdf

88 http://www.ofcom.org.uk/consult/condocs/dtt_changes/statement/statement.pdf
http://www.ofcom.org.uk/consult/condocs/pods1/main/statement/statement.pdf

UK Statutory Instrument 2008-No1420 'The Television Multiplex Services (Reservation of Digital Capacity) Order 2008' allows for the adjustments to Multiplex B so that it can carry DVB-T2, MPEG-4 HDTV programming channels.

Mobile TV

There are no existing mobile TV authorisations.

SAB/SAP

Ofcom's proposals for awarding spectrum to a band manager with obligations toward SAB/SAP are available at their website.[89]

DTT

- Multiplex 2's authorisation expires in December 2010.
- Multiplex A's authorisation expires in November 2010.
- Multiplex B, C and D's authorisations expire in October 2014.

The licensees have the option to renew their authorisations for a further 12 years.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	The HD Order active from July 2008 reorganised the existing DTT multiplexes to allow for HD services and gives an upgrade path for UK DTT. It is critical to the future of DTT as a competitive TV platform. There are requirements on the existing users of the UHF band (public service television broadcasters) relevant to the content they provide. Details are available in the BBC's Charter and Agreement, and the authorisations issued to each of the Ofcom licensed public service broadcasters (linked above). The future use of the digital dividend will not be constrained other than as a result of the need to protect existing and new users of UHF bands IV and V from interference. The auction of the digital dividend will be technology and service neutral. Spectrum acquired through this award process will be tradable. See the link above to Ofcom's Digital Dividend Review.

89 http://www.ofcom.org.uk/consult/condocs/bandmngr/

Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	The UK Government is currently conducting its own review of the communications sector, entitled 'Digital Britain'. It is due to issue interim findings in January 2009.[90] Ofcom is also in the second phase of its review of Public Service Broadcasting.[91] Ofcom expect to publish a statement on Phase 2 of the public service broadcaster review in January 2009.
Co-ordination issues with countries inside the EU	None.
Co-ordination issues with countries outside the EU	None.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	DTT is a vital platform for delivering TV in the UK. Its key advantages are the near universal coverage within the UK and the high proportion of free-to-view content on it, making it a very popular platform for primary TV sets within many households but even more so for secondary/tertiary/etc TV sets.

90 http://www.culture.gov.uk/what_we_do/broadcasting/5631.aspx

91 http://www.ofcom.org.uk/consult/condocs/psb2_phase2/

Annex B: A review of the situation regarding the digital dividend in neighbouring countries

This annex is an inventory of national situations regarding the digital dividend in neighbouring countries Croatia, Norway, Russia, Switzerland and Turkey. It is based on extensive desk research as well as informal discussions with national regulators or national public bodies.

B.1 Croatia

The digital dividend in Croatia will be implemented after switching off the analogue transmission (1 January 2011). Partial implementation of the digital dividend can be done in the Croatian "counties" as the transition process is completed.

Croatia is considering the following uses of the digital dividend:

- additional national DTT programming channels in either standard definition or high definition
- local DTT programming channels
- television services for mobile phones and other types of mobile video and multimedia
- mobile communications, such as voice calls and data
- broadband wireless applications
- radio microphones for theatres, television and radio production and live music events
- low-power wireless applications, such as Wi-Fi in the home
- public safety services, such as wireless communications for the emergency services.

According to the Croatian Agency for Post and Electronic communications, the size of the digital dividend in Croatia is quite big due to the fact that only four nationwide analogue TV services are transmitted. Only the first nationwide multiplex is required to support current broadcasting services. Local transmission can be done on local additional frequencies. In such a situation, all multiplexes other than the first can be considered as a digital dividend. It means that five nationwide multiplexes, and in some counties additional UHF local multiplexes, are the digital dividend in Croatia.

The five nationwide multiplexes may be used for additional broadcasting offers (additional SDTV and/or HDTV services), for mobile TV, mobile services and other applications. Such a size of digital dividend may introduce enough additional TV services.

The split of the digital dividend in Croatia may be as follows:

Service	*Identified band/frequencies*
Mobile services (two-way)	Frequency range 790–862MHz.
Mobile TV (one-way)	1 multiplex (layer) in the whole country using where possible wide area Single Frequency Networks.
New broadcasting services (new SDTV services and HDTV services	The rest of the GE-06 multiplexes should be used as an additional television offer in the frequency range 470–790MHz. It means that four to five nationwide multiplexes could be achieved as well as additional countywide multiplexes in some counties.
Additional transmission on a secondary services basis	“White spaces” areas: such additional transmission should be used in order to increase spectrum usage on a non-interference non-protective basis.
High speed mobile in-car reception	VHF frequency range (174–230MHz) which is very attractive for the 1.5MHz systems should be used (T-DAB/TDAB+/T-DMB). The DVB-T VHF layer in such a case may be divided into 4×1.5MHz layers.

Figure B.1: Expected split of the digital dividend in Croatia [Source: Croatian Agency for Post and Electronic communications]

B.2 Norway

DTT in Norway was launched in 2005 with regional ASO planned for completion at the end of 2009. 470-790MHz has been allocated to DTT use while the 790–862MHz sub-band is currently being use for simulcasting of analogue TV programming channels as the switchover takes place. This sub-band has been assigned as the digital dividend though no definite decision has been made on what the digital dividend will be used for. Military services and maritime communications have requested use of the digital dividend spectrum and considerations have also been made about allocating it for additional DTT use.

B.2.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

In Norway, terrestrial television had a relatively high market penetration, with 30% of households having a terrestrial television as their primary set. Cable had a penetration of just over 40% and satellite penetration was about the same as that of terrestrial analogue television. There were three national TV programming channels on the analogue television network: two, NRK1 and NRK2, operated by the public service broadcaster, Norsk Rikskringkasting (NRK), and one further channel, TV 2, operated by the eponymous leading Norwegian private broadcaster, TV 2. NRK1 had 99% population coverage, NRK2 had 30% coverage and TV 2 had 90% coverage. There were also some private regional TV programming channels available.

Terrestrial analogue television was broadcast using VHF bands II and III and UHF bands IV and V:

- Channels 21–69 in the UHF band were used
- Channels 2–11 from the VHF band were also used.

There were 10 spectrum channels in the UHF band (predominantly above Channel 60) used for fixed services and reporting.

SAB/SAP services used interleaved spectrum in the 800–820MHz sub-band and the upper 1MHz in the spectrum channels closest to 470MHz.

All spectrum channels in the UHF/VHF band were subject to some degree of use.

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Channels 21–69 were used.

VHF channels used for analogue TV	Channels 2–11.
UHF channels reserved for other uses (e.g. radio astronomy, the military)	10 (1 for reporting, 9 for "fixed services")
UHF channels not used, or unusable because of co-ordination requirements	All channels were used.

Historical television broadcasting

Primary type of television signal received	*% of households*
Analogue terrestrial	<30
Digital terrestrial	0
Analogue cable	>40
Satellite	30
Digital cable	No data
IPTV	No data

Figure B.2: Historical households primary TV signal typology before the introduction of DTT [Source:dvb.org, 2003 data]

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
1 (90%)	1 (90%)	10	
1 (30%)			
2	**1**	**10**	**NA**

Figure B.3: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: NPT, January 2009]

B.2.2 The transitory situation (as of December 2008)

Current television broadcasting

DTT was launched in 2005 and the ASO has been underway in Norway for some time on a regional basis. So far analogue TV broadcasting has been switched off in Rogaland (March 2008),

Østfold (April 2008), Oslo, Akershus (May 2008), Buskerud, Vestfold, Telemark (September 2008), Hordaland (September 2008) and Møre og Romsdal (October 2008). This is due to be completed in December 2009. The penetration of terrestrial television as compared to that of cable of satellite is so far unaffected by the switchover process.

There are currently three national digital terrestrial multiplexes, these are operated by Norges televisjon (NTV) which is a joint venture between NRK, TV3 and Telenor (Norway's largest telecommunications company). These offer 4 free-to-view TV programming channels on the first multiplex and 23 commercial TV programming channels spread across the other two multiplexes. There are 10 free-to-view regional services available on the first multiplex.

The other major technology in the Norwegian telecommunications market is cable, which holds a significantly higher market share than terrestrial television. The main cable provider to Norway is Canal Digital Kabel TV (a subsidiary of Telenor), who hold a roughly 53% share of the market. Canal Digital offers 77 TV programming channels.

There as also two major satellite providers in Norway, Canal Digital and Viasat. Of the two, Canal Digital has the largest market share but both companies compete for TV programming channels and do not offer their rival's TV programming channels. This has led to a significant number of satellite households purchasing two subscriptions. Viasat offers a total of 70 TV programming channels whereas Canal Digital offers 77.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1	4		10	
2		23 over 2&3		
3		23 over 2&3		
Total	**4**	**23**	**10**	**0**

Figure B.4: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: NPT, January 2009]

Figure B.5 below illustrates the primary type of television signal received in Norway.

Primary type of television signal received	*% of households*
Analogue/digital terrestrial	30
Analogue/digital cable	45
Satellite	25

Figure B.5: Current households primary TV signal typology [Norway NPT, January 2009]

Other uses accommodated within the UHF band

The lower UHF channels will no longer be available for SAB/SAP use. SAB/SAP services are also likely to have problems with using the 800–820MHz band in the future but no decision has been reached on where to relocate these services to.

B.2.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

Norway have been granted 7 multiplexes under RRC-06, they plan to also put a multiplex in the VHF band for DTT. The frequency allocated to the top two multiplexes (790–862MHz) will be used for simulcast during the ASO period and then allocated as the digital dividend. NTV has been awarded the entirety of the 470–790MHz band allocated to DTT and will operate all five multiplexes.

Technological evolution affecting the use of the spectrum for broadcasting

Norway currently utilises a mix of SFN and MFN networks, this is unlikely to change in the future. DVB-T and MPEG-4 compression with 64QAM modulation is used on all multiplexes, allowing a maximum of 20–23 SDTV programming channels. NTV are currently planning to switchover to DVB-T2 around 2012, but this is not a fixed. No current plans for HDTV have been made but deployment is very likely to depend on how the digital dividend is eventually allocated and what technologies are used for the broadcast of DTT.

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	There is, as of yet, no timetable for the award of the digital dividend spectrum.
What type of award process is expected to be used (e.g. beauty contest, auction)?	The most likely form of award is a beauty contest.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Further TV programming channels and mobile services are considered likely candidates. The Norwegian military have requested some of the available spectrum also. Maritime communications uses have similarly been considered.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

Internal study (in Norwegian only): Report on Digital Dividend.[92]

The report was sent on public enquiry last summer. The responses are still being processed in the relevant Ministries.

B.2.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The Electronic Communications Act was used to facilitate the digital switchover, this was an already existing act.

Regulatory instruments used to switch analogue broadcasting into digital

NTV were awarded the authorisation for the entire DVB system originally on a 10-year authorisation, this was later renegotiated to 15 years due to more complex and demanding rollout requirements than were originally expected.

Specific issues affecting the future use of the UHF bands

The Electronic Communications Act governs the use of all spectrum use and will apply to any use of the UHF frequencies.

92 http://www.regjeringen.no/nb/dep/sd/dok/hoeringer/hoeringsdok/2008/horing---rapport-om-digital-dividende-i-.html?id=509383

B.3 Russia

B.3.1 The transitory situation (as of December 2008)

Until 1992, terrestrial television was the only platform to watch television in the Russian Federation. The domination of terrestrial television which has about 70% penetration is in part motivated by the high-quality content available on the free-to-view terrestrial network. There are as many as 19 analogue TV programming channels available in the largest cities; Figure B.6 below describes the availability of the number of TV programming channels across Russia.

The digitalisation of the Russian Federation is very low, with only 4.8% of TV households subscribing to a digital television service.[93] The penetration of other television platforms such as cable and satellite are currently still low but growing. It is estimated that about a third of households in 2007 are on non-terrestrial television platforms. Figure B.7 describes the platform share distribution in Russia and the relative level of digitalisation across platforms.

Russia decided in 2003 that it would adopt the European DVB-T standard for its DTT platform. RBC has been agreed that the first DTT multiplex will carry the TV services Channel One, Rossiya, Vesti plus, Kultura, Sport, NTV, Fifth Channel and a kids channel combining programming from Channel One and VGTRK. There will eventually be 3 multiplexes with a total of between 20 to 24 TV programming channels, all available free of charge to viewers. The first multiplex will be developed by the state-owned operator Russian Television and Radio Broadcasting Network and the other two with private funding. The total cost of digitalisation is expected to be around RUB100 billion (EUR2.19 billion), with 60% obtained from the federal budget and the remainder from private sources. ASO in Russia is set for a relatively late 2015.

The Russian Federation currently uses some spectrum channels for aeronautical radionavigation services as well as military communications, these are therefore unusable in any of the countries bordering with the Russian Federation. It is unlikely that the usage of these spectrum channels (61–69), will change before the Russian ASO which, optimistic estimates suggest, will happen in 2015.

93 Groteck for the European Audiovisual Observatory (2008), "Digital Television in Russia".

Current television broadcasting

Channels available	*To Percentage of Population*
0	1.2%
1	98.8%
2	96.2%
3	73.1%
4	62.3%
5	33.0%

Figure B.6: Overview of the availability of television channels [Source: 'Digital television in Russia', Edited by Groteck Co., Ltd, 2008]

Delivery	*Households (million)*	*Digital households (million)*	*Level of digitalisation (%)*
Terrestrial TV	48.5	0.1	0.2
Cable TV (including MMDS)	~17	2	11.8
Satellite	2.5	2.5	100
Mobile	0.2	0.2	100
Total	**49**	**~4.8**	**~10**

Figure B.7: The level of digitalisation across platforms in Russia in 2008 [Source: Groteck (2008)]

B.4 Switzerland

B.4.1 The situation before the introduction of digital terrestrial television (DTT)

The use of UHF bands IV and V (470–862MHz) and VHF band III (174–230 MHz) prior to the introduction of DTT

Prior to the introduction of DTT, the UHF spectrum was allocated as described in the table below.

UHF channels used for analogue TV	Primary service: analogue TV Secondary services: professional radio microphone systems
VHF channels used for analogue TV	Primary service: analogue TV and T-DAB (according to WI-95)
UHF channels reserved for other uses (e.g. radio astronomy, the military)	Channel 38 is reserved for radio astronomy (no military services).
UHF channels not used, or unusable because of co-ordination requirements	Several spectrum channels above 790MHz were used in France and Germany by military services. Those channels could not be used in border regions of Switzerland for other primary services.

Historical television broadcasting

Only the public TV programming channels were distributed by terrestrial means on a regional basis (three major language regions), resulting in three to four analogue TV programming channels per language region.

Figure B.8 summarises the distribution of analogue TV programming channels in the UHF before the introduction of DTT services.

Analogue national TV programming channels		*Analogue regional TV programming channels*	
Public	*Private*	*Public*	*Private*
0	0	9 to 12 (95%)	n/a
0	**0**	**9 to 12 (95%)**	**n/a**

Figure B.8: Overview of analogue TV programming channels in the UHF band before the introduction of DTT (population coverage in parentheses, total in bold) [Source: Federal Office of Communications]

Other uses accommodated within the UHF band

The interleaved spectrum was mainly used by SAB/SAP for temporary events (e.g. a big sport event). For example, during the European Soccer Championship EURO'08, 415 SABP/SAP links were used in the UHF band for the opening game on 7 June 2008 in Basel. Taking into account that around 10 to 12 good quality links can be packed into one 8MHz channel (due to limitations caused by intermodulation products and interference) the peak demand for the opening game in Basel was 35 UHF channels.

B.4.2 The transitory situation (as of December 2008)

Current television broadcasting

One national multiplex for DVB-T (DTT) and up to four additional local multiplexes in mountainous areas are deployed, as well as one national multiplex for DVB-H. Figure B.9 summarises the distribution of current DTT programming channels in the UHF.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1 French (>90%)	4	0	0	0
2 Italian (>90%)	4	0	0	0
3 German (>90%)	5	0	0	0
4	0	0	n/a	n/a
5	0	0	n/a	n/a
6	0	0	n/a	n/a
7	0	0	n/a	n/a
Total	**13**	**0**	**n/a**	**n/a**

Figure B.9: Overview of the current DTT programming channels in the UHF band (population coverage in parentheses) [Source: Federal Office of Communications]

Figure B.10 below illustrates the primary type of television signal received in Switzerland.

Primary type of television signal received	*% of households*
Analogue terrestrial	0
Digital terrestrial	0–10
Analogue cable	77
Digital cable	13
DTH/SMATV	0–10
IPTV	2

Figure B.10: Current households primary TV signal typology [Source: Federal Office of Communications, European Audiovisual Observatory, Analysys Mason]

Timetable for switchover

Analogue switch-off is finalised in Switzerland (apart of some low-power transmitters in mountainous areas which will be switched off in spring 2009).

Other uses accommodated within the UHF band

Currently there is one national multiplex for DVB-H deployed, in Switzerland.

The digital switchover resulted in a reduction of the spectrum for SAB/SAP applications.

In November 2008, a political decision was taken to allocate the sub-band 790–862MHz to mobile communication services. The implementation is however not possible before 2015.

B.4.3 The situation after analogue signals are switched off throughout the European Union

Expected television broadcasting

There will be two nationwide coverage DVB-T multiplexes, each split into three language regions that will distribute seven or eight public TV programming channels. No private TV programming channels are part of those two public multiplexes. Private content providers will be able to use the capacity of the remaining available multiplexes (based on GE-06 allocation). Figure B.11 below summarises the expected DTT programming channels in the UHF band after the ASO.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1 French (>90%)	7–8	0	0	0
2 Italian (>90%)	7–8	0	0	0
3 German (>90%)	7–8	0	0	0
4 French (>90%)	7–8	0	0	0
5 Italian (>90%)	7–8	0	0	0
6 German (>90%)	7–8	0	0	0
Total	**42–48**	**0**	**0**	**0**

Figure B.11: Overview of DTT programming channels in the UHF band after the ASO (population coverage in parentheses) [Source: Federal Office of Communications]

Figure B.12 below summarises the expected mobile TV programming channels in the UHF band after the ASO.

MUX	*Digital national TV programming channels*		*Digital regional TV programming channels*	
	Public	*Private*	*Public*	*Private*
1 (60%)	n/a	n/a	n/a	n/a
2 (60%)	n/a	n/a	n/a	n/a
Total	**20 pay-TV programming channels**		**n/a**	**n/a**

Figure B.12: Overview of mobile TV programming channels in the UHF band after the ASO (population coverage in parentheses) [Source: Federal Office of Communications]

Technological evolution affecting the use of the spectrum for broadcasting

For the nationwide networks (or language region networks) SFNs are implemented. The local networks are still running on MFNs but will be migrated to SFN.

For the DVB-T networks the MPEG-2 and DVB-T standards are used. No decision has been taken so far regarding the migration from MPEG-2 to MPEG-4 or DVB-T to DVB-T2.

The distribution of HDTV services via DTT is currently not an issue in Switzerland. For the moment HDTV services are distributed via satellite only.

Existing plans to release the digital dividend spectrum

The table below summarises the current plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	The first DVB-H authorisation has been granted until 2017. A political decision has been taken to make the spectrum above 790MHz available for mobile services before 2015. The remaining capacity will be awarded on a request basis.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Most likely the spectrum above 790MHz will be auctioned
Will there be any restrictions on the type of organisations that can bid for the available spectrum	This is not decided yet.
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	Regarding the primary usage: The UHF-spectrum has been split by the WRC-07 decision into two parts. The lower part for “broadcasting” services only, the upper part for “broadcasting or mobile” services on a co-primary basis. Switzerland will allow the use of mobile services in the upper part before 2015. In the spectrum 470–862MHz all services that are in line with the GE-06-Plan are possible (broadcasting, mobile TV, multimedia services) as long as they are in line with the provisions of the plan (e.g. the mask concept). Regarding secondary services: There is a growing need for SAB/SAP. New secondary services will only be allowed if they do not cause interference to licensed secondary services (and of course do not interfere with primary services), such as SAB/SAP.

Summary of studies (internal or external) that have been completed or commissioned concerning future uses of the UHF band

Regarding the "digital dividend" extensive discussions took place within OFCOM. But no written studies or documents are available.

B.4.4 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

The "National Frequency Allocation Plan".

Regulatory instruments used to switch analogue broadcasting into digital

- For the public broadcaster: authorisation modification of 28 November 2007.
- For private broadcasters: new authorisations.
- The "mobile TV" authorisation lasts until 2017.
- The authorisation for the public broadcaster has a duration of ten years and would also last until 2017.
- Stationary SAB/SAP links (e.g. in TV studios) are renewable on a yearly basis.
- For specific events SAB/SAP frequencies are assigned on a temporary basis.

Specific issues affecting the future use of the UHF bands

Domestic policy priorities and laws that constrain how the UHF frequencies are used	In November 2008 a political decision has been taken to allocate the sub-band 790–862MHz.
Extension of the scope of the general interest objective (multi-pluralism, increased population coverage, etc)	This is covered by the national radio and TV law.
Co-ordination issues with countries inside the EU	A successful co-ordination with neighbouring countries is a key factor regarding the implementation of new primary services in the UHF band. Although the analogue switch-off has been finalised in Switzerland it will not possible to use the "digital dividend" capacity during the coming years due to co-ordination difficulties with neighbouring administrations.

Co-ordination issues with countries outside the EU	n/a.
The importance of a terrestrial platform as a means of delivering TV, compared to cable, satellite and IPTV	Relatively low.

B.5 Turkey

Broadcasters formed new transmission company to roll-out DTT, in 2007. This transmission company Anten AS was formed by members of the Television Broadcasters Association (TVYD) to build and operate the DTT platform. The network is expected to begin in 13 major cities in 2008 and then gradually extended to other areas.

The national public broadcaster TRT and the private broadcasters Kanal D, Show TV, ATV, Star, Kanal 7, STV, Fox TV, Cine 5, NTV, CNN Turk, CNBC, Kanal 1, Kral TV, TV8, Kanal Turk, Kanal A, Sky Turk and Izmir TV are the members of the TVYD. They will offer digital terrestrial broadcasts in parallel with their existing analogue services during a transition period.

The Communications High Council has confirmed the DVB standard for Turkey. Transition will be taking place in three phases, test, simulcast and digital (analogue switch-off) with a 10-year transition period tentatively agreed (i.e. ASO by 2018).

Annex C: A review of the situation regarding the digital dividend in non-European countries

This annex is an inventory of national situations regarding the digital dividend in other relevant countries China, Japan, South Korea and the USA. It is based on extensive desk research as well as informal discussions with national regulators or national public bodies.

C.1 China

In 2008, China broadcasted the Beijing Olympics to the world through HDTV programmes, and by 2010, the existing cable television in cities in eastern and central parts of China as well as in most of cities in western parts will be digitalised. By 2015, the terrestrial signals within the country will be generally stopped. In the meantime, the policies emphasise the continued amalgamation of the three networks of Internet, television and telecoms.

To realise the above goals, NDRC, MII and SARFT will be responsible for organising special projects for implementing digital television services. Support will be given to DTT-related enterprises' listings and more investment will be made in them.

According to China's national strategy, the country aims to shift from a major television manufacturer to a digital television leader during the development of digital television industry. The policies show that by 2010, the annual sales of China's digital television sets and related products will reach RMB250 billion and the export volume will reach USD10 billion.[94] By 2015, China's digital television industry scale and technology level will rank among the top in the world and it will become one of the world's largest digital television set and key components development and production bases.

94 http://media.corporate-ir.net/media_files/irol/21/213930/companynews/Six_Chinese_Ministries_Promote_D.pdf

C.2 Japan

C.2.1 The transitory situation (as of December 2008)

Current television broadcasting

The television broadcasting landscape is composed of 6 national analogue TV programming channels, two of which being public service channels (NHK). 370MHz are allocated to analogue terrestrial TV in UHF and VHF bands.

Digital broadcasting services are provided using the ISDB-T (Integrated Services Digital Broadcasting-Terrestrial) technology. The ISDB-T technology uses spectrum channels of 6MHz and enables channels segmentation. Each channel of 6MHz is divided in 13 segments, one of them being used for mobile broadcasting. The other 12 segments are used either for broadcasting one HD programme or three SD programmes.

The level of penetration of cable and satellite is relatively high: 77%. In 2006, 37% of the population used cable as a main TV reception mode and 40% used satellite.

Timetable for switchover

The analogue switch-off will take place on 24 July 2011. A transition period will occur between 24 July 2011 and 24 July 2012. During this transition period, the technical preparation for the migration of the sub-band will be handled. Help and guidance will also be provided to consumers through awareness and support programmes. From 25 July 2012, the frequencies freed by the switchover will be available to be used for new services, provided authorisations have already been granted to operators.

The transition to terrestrial digital broadcasting has been progressing smoothly as planned. The target for households with receivers was 22 million as of March 2008. The actual number of households with receivers is 22 million as of March 2008. The coverage is 44%. In July 2008, Japan’s Ministry of Internal Affairs and Communications allocated YEN220 billion in order to support the transition programme.

Other uses accommodated within the UHF band

Each year, the Ministry of Internal Affairs and Communications (MIC) carries out a review of the use of the spectrum (Actual Usage Survey) in order to assess the efficiency of the spectrum management.

In July 2001, the MIC and the Council for radio regulation decided to allocate 40 spectrum channels (Channels 13–52) to digital broadcasting services. It has also been decided that Channels 53 and 54 formerly allocated to TV broadcasting will not be used for broadcasting services anymore from the end of the analogue switch-off.

The MIC assessed that 130MHz (90–108MHz, 170–222MHz, 710–770MHz) will be freed up in the UHF band after switching off analogue diffusion. 70MHz (90–108MHz and 170–222MHz) will be freed up in the VHF band. The reallocation decision was reached on 6 December 2007, following the guidelines issued by the MIC in 2003.

For UHF frequencies it was decided to allocate the 710–770MHz frequencies, formerly allocated to analogue broadcasting, to electronic communications services. 10MHz of these frequencies have been allocated to ITS (Intelligent Transport System).

For VHF frequencies, the following decisions were reached.

- 35MHz (170–205MHz) will be allocated to "private communications" services such as public security.
- 35MHz (90–108MHz and 205–222MHz) will be allocated to "broadcasting services other than fixed TV", such as digital radio services or mobile TV.

Like the USA, Japan has freed up a contiguous sub-band in order to be able to develop innovative services and in particular services other than broadcasting services.

C.2.2 The situation after analogue signals are switched off throughout the European Union

Technological evolution affecting the use of the spectrum for broadcasting

Policy priorities in Japan are to promote HD and mobile TV. As far as the promotion of HD is concerned, broadcasters are obliged to broadcast in HD mode at least 50% of the time. No increase in the number of TV programming channels currently broadcasted as a result of the digital switchover is planned, nor the introduction of new pay-TV programming channels.

The policy in favour of the development of HD seems to be linked to its industrial policy of promotion of the ISDB-T technology. Thanks to this technology, it is possible to broadcast HD programmes on SDTV sets without having to ensure a simulcast SD/HD.

The policy on mobile TV is to reserve one of the 13 segments of a 6MHz channel used by each multiplex for mobile TV broadcasting. At present, programming for mobile TV services is identical to the one for fixed TV set. However, a law adopted in 2007 enables broadcasters to differentiate the programming of mobile services.

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum	The analogue switch-off will take place on 24 July 2011. The technical preparation for the migration of the sub-band will happen before the 24 July 2012. From 25 July 2012, the frequencies freed by the switchover will be available to be used for new services, provided authorisations have already been granted to operators. As of February 2009 the timetable for awarding the spectrum was not yet fixed.
What type of award process is expected to be used (e.g. beauty contest, auction)?	Frequencies freed up could be awarded though technologically neutral auctions. However, as of February 2008, decisions regarding the award procedure had not been reached.

C.2.3 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

In January 2004, the MIC consulted with the Information and Communications Council for "appropriate usage of terrestrial digital broadcasting in the future and the role of the administration in its penetration" to examine issues and solutions regarding future usage of terrestrial digital TV in various fields and a complete conversion to digital broadcasting by 2011. The Council issued the third report in August 2006. Furthermore, in December 2006, the National Council for the Promotion of Terrestrial Digital Broadcasting issued the "Action Plan for the Promotion of Digital broadcasting (NO.7)".

Regulatory instruments used to switch analogue broadcasting into digital

All analogue broadcasters have been granted an authorisation to use a channel of 6MHz for digital broadcasting. The holders of such an authorisation are free to broadcast SD, HD or mobile services. The only conditions they have to meet are (i) to respect conditions specified in their authorisation; and (ii) to broadcast in HD mode at least 50% of the time.

C.2.4 Information and Communications Japan's policy

The White Paper 2008[95] presents Japan's information and communications policy which is based on five main goals:

95 http://www.soumu.go.jp/joho_tsusin/eng/whitepaper.html

- the promotion of national strategy
- the promotion of the "u-Japan policy" as a systematic policy for realising a ubiquitous society
- the promotion of reform in communication and broadcasting fields
- the enhancement of international competitiveness – promotion of the Program for Enhancement of International Competitiveness
- to develop the ICT productivity acceleration programme.

As part of Japan's plans for the development of affluent and vital ubiquitous network society, the MIC formulated the "next generation broadband strategy 2010" in August 2006. Among the main targets listed are the promotion of optic fibre and the elimination of zero-broadband regions by 2010, poor radio reception zones for mobile phone and the digital divide. At present, the MIC continues to deliberate on the measures for establishing the usage environment for broadband technology.

Japan is also promoting the development of the e-government and e-administration.

C.3 South Korea

A National Assembly committee responsible for broadcasting and communications has confirmed that analogue switch-off will take place by 31 December 2012.[96] It is based on the analogue transition plan proposed by the Ministry of Information and Communication and the Korean Broadcasting Commission in 2006.

South Korea is assessing the future use of the digital dividend for new services including mobile multimedia services. South Korea identified the digital dividend being 54MHz (from 752–806MHz).[97]

Figure C.1 and Figure C.2 below illustrate the current and the expected split of the UHF and VHF spectrum in South Korea.

Band	*Frequency bands*	*Use*
VHF	54–72MHz	Analogue TV
VHF	76–88MHz	Analogue TV
VHF	174–216MHz	Analogue TV/DMB
UHF	470–752MHz	Analogue TV/DTT
UHF	752–806MHz	Temporary band

Figure C.1: TV Spectrum (at present) in South Korea [Source: Korean Broadcasting System]

Band	*Frequency bands*	*Use*
VHF	54–72MHz	Not defined
VHF	76–88MHz	Not defined
VHF	174–216MHz	DMB (CH7~13)
UHF	470–752MHz	DTT (CH14~60)
UHF	752–806MHz	Not defined

Figure C.2: Planned TV Spectrum (after switch-off) in South Korea [Source: Korean Broadcasting System]

96 www.advanced-television.com

97 CEPT Report 21 (1 July 2008).

According to Broadband TV News[98], mobile TV and DMB subscribers are as follows.

- The number of mobile TV subscribers in South Korea grew by almost 60% in 2008 following aggressive marketing campaigns and the Beijing Olympics, reports the Yonhap News Agency.

- The number of DMB users totalled 17.25 million at the end of 2008, up 59.9% from a year earlier, according to the Terrestrial-DMB Special Committee. South Korea started the world's first DMB service in 2005, operated through terrestrial and satellite broadcasts.

According to the committee, which represents six service carriers, 15.4 million terrestrial DMB devices, including mobile phones, were sold as of the end of 2008, up 70% from the previous year. The number of subscribers to the satellite platforms (S-DMB) rose 45% annually to 1.85 million last year.

98 Broadband TV News (15 January 2009).

C.4 USA

C.4.1 The transitory situation (as of December 2008)

Current television broadcasting

The percentage of population relying solely on analogue terrestrial broadcasting is 15%. The level of penetration of cable and satellite is high: in 2006, 58% of the population used cable as main TV reception mode and 26% used satellite. This strong preponderance of cable and satellite viewing, and relatively small market share of FTA broadcasting led to broadcasters having less influence over policy decisions affecting the allocation of the digital dividend spectrum compared to telecommunications entities.

Timetable for switchover

The US first planned for the analogue switchover to occur as of 31 December 2006 provided that 85% of the population was able to receive DTT. Since this condition was not met on time, the switchover was delayed until 17 February 2009, and then further delayed to 12 June 2009. As part of the transition, the US Commerce department was tasked to subsidise digital TV set-top boxes for consumers up to a USD1.34 billion funding limit.

Other uses accommodated within the UHF band

108MHz of the UHF band (Channels 52–69, corresponding to 695-806MHz) formerly used for TV broadcasting are reallocated for other uses. Within the 108MHz freed-up, 24MHz (Channels 63, 64, 68 and 69) are reallocated to public safety services. The other 84MHz (Channels 52–62 and 65–67), are allocated to commercial fixed, mobile or broadcasting services. These commercial frequencies were awarded through auctions organised by the FCC which took place between September 2000 and March 2008.

Auctions related to 22 of the 84MHz reallocated to commercial services took place between September 2000 and July 2005 (Auctions n°33 in September 2000, n° 38 in February 2001, n°44 in August/September 2002, n°49 in May/June 2003 and n°60 in July 2005).[99] Auctions related to the other 62MHz took place from January to March 2008 – this was Auction n°73 related to the "700MHz" band.

[99] FCC auctions are numbered consecutively starting from 1994. An auction summary page providing information on all auctions is available at http://wireless.fcc.gov/auctions/default.htm?job=auctions_all

With respect to the 700MHz band, the FCC split the available spectrum into five blocks based on geographic divisions designed to enable both national and regional entities to obtain access. Thus, the "A" and "E" blocks corresponded to 176 local and regional areas offering 2x6MHz and 1x6MHz unpaired licences; the "B" block covered slightly smaller areas permitting local service with 2x6MHz blocks; the "C" block consisted of 12 Regional Economic Area Groupings offering national coverage with 2×11MHz bands and was considered the most valuable; the D block offered two 5MHz blocks of spectrum for nationwide service dedicated to a public safety/private partnership.[100]

The FCC relied on series of new auction rules connected with these bands. It allowed bidders to package bids for block C and submit bids anonymously, and it established reserve pricing. Auction 73 raised a total of USD19 120 378 000 in winning bids and USD18 957 582 150 in net winning bids (reflecting bidders' claimed bidding credit eligibility),

The FCC also applied "open access" conditions on the C block spectrum, primarily in response to strenuous lobbying by companies such as Google. These open access conditions included rules to allow consumers to use any applications or service they wanted on the available spectrum, as well as requirements for the licensees to offer wholesale access to third party resellers. The FCC adopted only the first part of these type of rules.

Companies such as Google and others (manufacturers such as Intel, Microsoft and Dell) also lobbied strongly for white space usage. In November 2008, the FCC adopted a Second Report and Order that would allow wireless devices to operate in broadcast television spectrum on a secondary basis at locations where that spectrum is open, i.e. in the white spaces. These rules require white space devices to include a geolocation capacity as well as access to Internet data base directories of incumbent services. Further, the devices must use spectrum sensing technology (cognitive technology) to detect other operating equipment.

C.4.2 Situation after analogue signals are switched off

Existing plans to release the digital dividend spectrum

What is the timetable for awarding this spectrum?+ What type of award process is expected to be used (e.g. beauty contest, auction)?	84MHz (Channels 52–62 and 65–67) of the 108MHz of the UHF band freed up were allocated through auctions organized by the FCC. Auctions related to the 700MHz band took place from January to March 2008 (Auctions n°73). Important build-out requirements apply to the largest blocks in this band; for example, in the "C" band, operators must achieve 40% coverage within four years and 75% coverage within ten years.

[100] See: http://wireless.fcc.gov/auctions/data/bandplans/700MHzBandPlan.pdf

Where there any restrictions on the type of organisations that could bid for the available spectrum	Auctions procedures have to meet several general interest objectives provided by law such as the development of new technologies and services in rural areas, the promotion of competition and diversity, the efficient use of scarce resource and legal certainty. With respect to the "D" block of spectrum, bidders had to purchase the spectrum under a public safety/private safety partnership, under which public safety entities must be given priority access to part of the band, thus being able to pre-empt commercial traffic. Notably the auction for this spectrum block failed due to the perceived unworkability of the partnership rules. During Auction n°73 more than half of candidates to be granted an authorisation were small or medium companies. However, the main winning bidders were large telecommunications companies (AT&T, Verizon, Qualcom and Echostar).
Which services are believed to be viable candidates for the use of spectrum made available as a result of analogue switch-off?	For the frequencies available for commercial services, mobile services are believed to be the most viable candidates for the use of the spectrum. First, mobile services have benefited from a major economic growth in the past recent years. Verizon and AT&T are presumed to use the spectrum for wireless mobile services; Qualcom is presumed to used spectrum in a number of large metropolitan areas for mobile TV (MediaFlo).

C.4.3 Information pertaining to the legal and regulatory process

Legislation to prepare for the digital switchover and future uses of this spectrum

In 1997, the US Congress adopted the Act 47 U.S.C. § 337 providing for the reallocation of Channels 60–69 of the UHF band formerly allocated to TV broadcasting to other services. In addition to the reallocation of Channels 60–69, the FCC decided in 2001 to reallocate Channels 52–59 to new wireless services (*Reallocation and Services Rules for the 698–749MHz spectrum band* (Channels 52–59), GN Doc 01-74, Report and Order, 17 FCC Rcd 1022 (2002)).

In 2006, the "Digital Television Transition and Public Safety Act" was adopted in order to speed the transition to digital television by establishing a system of consumer subsidies for the required hardware. This legislation set forth a programme implemented and administered by the National Telecommunications and Information Administration (NTIA) though which households in the USA may obtain coupons that can be applied towards the purchase of digital-to-analogue set-top boxes (NITA Coupon Program Final Rule, 72 FR 12097§2; V.47 C.F.R.§301.1)

Regulatory instruments used to switch analogue broadcasting into digital

Existing analogue broadcasters were granted an authorisation to use a channel of 6MHz for digital broadcasting. The holders of such an authorisation are free to broadcast SD, HD or mobile services. The only conditions they had to meet were (i) to broadcast at least one free programming service with a quality of service at least equivalent to the one of the analogue service provided; and (ii) to pay fees for the use of the spectrum if they offer chargeable services.

In November 2008, the FCC adopted a Second Report and Order that established rules to allow use of television white spaces. See discussion above.

Desk research sources for Annexes A–C

In addition to those sources referenced in footnotes, the Consortium used the following sources of information during the desk research for Annexes A–C:

Cocom (2009), "Information from Member States on switchover to digital TV Cocom09-01"

ComReg (2007) Broadcasting (Amendment) Act 2007

ComReg (2008), Irish Communications Market Q3 2008 Quarterly Key Data Report

Digitag (2005), "Analogue switch-off strategies in Western Europe"

Digitag (2006), "Digital terrestrial television in Central and Eastern Europe"

European platform of regulatory authorities (December 2008) "WG III: Regulatory Approach to Digital TV Experiences and Lessons learned Information paper on status of digital television"

Federal Networks Agency (2008) Frequency usage plan

Independent.ie (2008), "The death of analogue TV is nigh, long live digital"

International Law Office (2008) "Digital Dividend: Disputes over Future Use of Broadcasting Frequencies"

PTS (2006), "The use of radio spectrum following the switch-off of analogue terrestrial television broadcasting"

Screen Digest, European Broadband Cable 2008

WIK Consult for Motorola (April 2008), "Safety First - Reinvesting the Digital Dividend in Safeguarding Citizens"

Annex D: Glossary

The definitions given here explain the principal meaning of the terms as used in this report.

2G	Second generation, referring to how advanced a technology is. See *3G*
3G	Third generation, referring to how advanced a technology is. See *2G*
ACI	See *adjacent channel interference*
ACLR	See *adjacent channel leakage ratio*
adjacent channel interference	The situation in which a service operating in a particular frequency channel interferes with reception of another service operating in an immediately adjacent channel, or beyond
adjacent channel leakage ratio	A parameter that relates to the signal level that a radio transmitter is allowed to produce in adjacent channels, relative to the power level of is intended transmission
adjacent channel selectivity	A parameter that relates to a radio receivers ability to select the intended transmission, and to reject others
allocation (of spectrum)	Determining the type of use that particular blocks of spectrum can be put to (i.e. what services can be provided using that spectrum). Restrictions on the technologies used to provide the service(s) may also be specified. Also, allocation is the entry of a given frequency band into the Table of Frequency Allocations for a purpose under specified conditions Compare *assignment of spectrum*
antenna gains	Antenna gain is measured in decibels (dB) and is the ratio of the power intensity of an antenna in a given direction compared to the intensity of a hypothetical idea antenna radiating equally in all directions (isotropic).
ASO	Analogue switch-off. See *switch-off*
assignment (of spectrum)	Determining which organisation can use particular blocks of spectrum. An initial (primary) assignment mechanism grants rights to specific users when spectrum rights are first created. Compare *allocation of spectrum*
auction	One of the main competitive mechanisms used by spectrum management authorities to initially assign spectrum to specific users. Bids are primarily assessed on the applicants' willingness to pay.
authorisation	Permission to use spectrum – previously known as a licence
AVC	Advanced Video Coding
band (frequency band)	A contiguous block of radio spectrum, constituting a specific range of frequencies. Spectrum has been divided on an internationally agreed basis into a number of frequency bands, which are identified for use by one or more types of service (such as mobile telephony or defence).
bandwidth	The width of a communications channel, which may be expressed in terms of the range of frequencies occupied within a specific block (band) of spectrum. For example, the 470–862MHz band in Europe is divided into channels each with a bandwidth of 8MHz.
beauty contest	An informal term for comparative selection
bit rate	The rate at which data is transmitted, usually measured in bits/s

bit error rate	The ratio of the number of incorrectly transmitted bits to the total number of transmitted bits
block edge mask (BEM)	A technical mask that defines the permitted power levels that a radio system that transmit within its own band and in neighbouring bands, specified as a field strength within a defined channel width, without prescribing any specific technology types
broadband	A generic term for mass-market high-speed data transmission, which allows the effective transmission of multiple simultaneous signals (e.g. voice, data and video) via a single (e.g. fibre, copper wire, satellite, spectrum) channel. For the user, this effectively means a high-speed Internet connection which allows communications of greater than dial-up speeds
broadcast mobile TV	Linear TV content sent to a mobile device
CDMA	Code division multiple access, a technique used in some cellular phone systems (and wireless local area networks), whereby each phone call is combined with a code that only the receiving cellular phone recognises. This is an efficient way of dividing up the block spectrum available to the service provider
CEPT	Conférence Européenne des Administration des Postes et des Télécommunications, a major international spectrum coordination body in Europe
channel	A block of radio frequencies used to create a communications path between two or more points
co-channel interference	Interference between systems operating in the same frequency band but in different geographic areas
cognitive technology	Cognitive devices that can detect spectrum that is unused and transmit over it, thereby avoiding causing harmful interference
the Commission	The European Commission
the consortium	Analysys Mason Limited, DotEcon Limited and Hogan & Hartson LLP
DAB	Digital Audio Broadcast, a technology for transmitting audio digitally
discounted value	The sum of discounted cash flows, often referred to as the net present value
digital dividend	As defined by the Commission: *“the spectrum over and above the frequencies required to support existing broadcasting services in a fully digital environment, including current public service obligations”.*
DMB	Digital Multimedia Broadcast, a broadcast mobile technology based on the DAB digital radio standard
downlink	Transmission by a base station to a receiving device. Compare *uplink*
downstream	This refers to different levels in the value chain for a service. In this context, downstream means markets for supplying services to end-users.
DSL	Digital subscriber line, a family of similar technologies (e.g. ADSL) which allow ordinary telephone lines to be used for high-speed broadband communications
DSO	Digital switchover. See *switchover*
DTT	Digital terrestrial television
DVB-H	Digital Video Broadcasting for Handhelds, a broadcast mobile technology based on the DVB-T standard
DVB-SH	Digital Video Broadcasting – Satellite services to Handhelds

DVB-T	Digital Video Broadcasting, a digital terrestrial television standard widely used throughout Europe
DVB-T2	Digital Video Broadcasting – a Second Generation Terrestrial digital terrestrial television standard. Compare *DVB-T*
EBU	European Broadcasting Union
ECC	Electronic Communications Committee, a committee of *CEPT* that provides structures for spectrum management
EIRP	Effective isotropic radiated power
end-user	A consumer or business that purchases telecoms services; they are thus the final user of the radio spectrum which has been used to provide the service
EU	European Union, comprising 27 *Member States*
EUR	Euros
European dimension	The term used for the rationale for European-level action. Such action may be taken in order to meet EU policy goals, or to increase the total benefit to Member States over and above that which would be realised if Member States took uncoordinated action.
externalities	An economic side effect. Externalities are costs or benefits arising from an economic activity that affect somebody other than the people engaged in the economic activity and are not reflected fully in prices
FCC	Federal Communications Commission, the national telecoms regulator and spectrum management authority in the USA
FDD	Frequency division duplex, a transmission method requiring paired spectrum – one half of the pair for the downlink and the other half for the uplink. See *TDD*
fixed	In a fixed telecoms system, both the transmitting party and the receiving party are in a fixed location. The system may use wires/cables or radio (wireless) technologies
fixed wireless access (FWA)	A technology used to connect to the public telephone network using radio signals; both the transmitting device and the end-user's receiving equipment are fixed in position. Both telephony and high-speed data services are supported. Also called wireless local loop (WLL)
FM38	A project team of the CEPT Working Group Frequency Management
Framework Directive	The Electronic Communications Regulatory Framework comprises a suite of directives covering a wide range of issues in the regulation of communications within the European Union. Member States were required to implement these directives by 24 July 2003.
free-to-view	Subscription-free, usually refers to TV programming channels
FWA	See *Fixed wireless access*
GE-06	ITU Regional Radio Conference in 2006
GHz	Gigahertz, a unit of frequency equal to 1000 million Hertz (cycles per second)
GSM	Global System for Mobile communications, a second-generation digital global mobile telecommunications system
GSM-R	Private GSM systems used by railway companies
guard band	An amount of spectrum that should lie idle between two used portions of spectrum, in order to mitigate interference

harmonisation	The coordination of spectrum allocations across markets
HD	High-definition, referring to TV image quality
HDTV	High-definition TV
HSPA	High Speed Packet Access, a collection of two mobile telephony protocols High Speed Downlink Packet Access (HSDPA) and High Speed Uplink Packet Access (HSUPA), that extend and improve the performance of UMTS.
HSPA+	An enhancement to High Speed Packet Access defined in 3GPP release 7. Also known as: Evolved HSPA, HSPA Evolution, I-HSPA or Internet HSPA. See *HSPA*
interference	A problem with radio communications systems when the receivers are unable to precisely separate the signals they are supposed to receive from other radio transmissions also picked up by the antenna. Interference occurs when different users are using a similar frequency, are within close geographical proximity to each other, or transmitting at the same time.
interleaved spectrum	Spectrum geographically shared on a co-channel basis with DTT MFN networks. Often referred to as w*hite space*
ITU	International Telecommunication Union, the body established by the United Nations to oversee the delivery of international telephone calls. It has an important role in devising standards, and regulates the international allocation of radio frequencies
ITU-R	ITU Radiocommunication Sector
kHz	Kilohertz, a unit of frequency equal to 1000 Hertz (cycles per second)
liberalisation	The liberalisation of spectrum use, namely mechanisms by which holders of usage rights can change the use of the spectrum (e.g. service or technology), including possible reconfiguration of existing usage rights
licence	Historically a spectrum licence gave an organisation or individual the right to use spectrum frequencies in a specific band. ‘Licence’ is now referred to as a *usage right* or specifically an *authorisation*
licence-exempt	Bands of spectrum for which no usage licence/authorisation is required.
linear	A form of service delivery, usually refers to TV, where a broadcast is made at a particular time to all users. The opposite of on-demand.
marginal	The difference made by one extra unit of something, in this case spectrum. The *marginal value* of spectrum is the extra value a user gets from using an additional unit of spectrum
MBMS	Multimedia Broadband Multicast Services, an enhancement to UMTS/HSPA networks and enables an operator to broadcast the same data to all users within in a particular cell.
Member State	One of the 27 nations that are members of the European Union
MFN	Multiple frequency network, where each multiplex uses different frequencies for each transmitter site across the Member State
MHz	Megahertz, a unit of frequency equal to 1 million Hertz (cycles per second)
MIMO	Multiple input and multiple output. A performance improvement system using multiple transmitting and receiving antennas
mobile	Description of a service that is available when moving.
modulation scheme	The technical process used for transmitting messages through a wireless radio channel. Example include QPSK or 64QAM
MPEG-2	A compression standard used for digital video

MPEG-4	An advanced compression standard used for digital video
MSS	Mobile satellite system
multicast	Referring to mobile TV, this is content streamed to many devices simultaneously, similar to non-mobile broadcast TV. See *unicast*
multiplex	The service that carries multiple signals (thereby multiple TV programming channels) over a particular frequency range(s)
MUX	Abbreviation for *multiplex/es*
nomadic	Description of a service that that is available in several locations, but not when in motion, also known as portable. Compare *fixed* and *mobile*
NRA	National regulatory authority, a generic term for a national body (or group of bodies) responsible for spectrum management in a country. This role may be fulfilled by a government department or split across a number of organisations
OFDM	Orthogonal frequency division multiplexing, a frequency division multiplexing scheme used by DTT networks in which data is carried by means of a large number of orthogonal sub-carriers closely spaced together, called symbols. Time spreading of signal levels into adjacent symbols gives rise to inter-symbol interference
one-way	Refers to the application requiring transmission in just the downlink direction. Compare *two-way*
opportunity cost	The opportunity cost, in relation to spectrum, is the value associated with the best alternative use/user of the spectrum
packaging	The way in which available spectrum frequencies are divided up between usage rights
PPDR	Public protection and disaster relief
radio spectrum	That part of the electromagnetic spectrum that lies between the frequencies 3kHz and 3000GHz. With present technology it is only practical to exploit spectrum below 100GHz
re-allocate	Changing the type of use that particular blocks of spectrum can be put to. This may include the technologies that can be used or the services provided. See *allocation*
re-farm	The process in which spectrum management authorities take possession of radio spectrum from existing users and reallocate it to a new service and/or a new technology
regulator	A national regulatory authority responsible for telecoms, broadcasting or other communications issues. See *NRA*
RR	Radio Regulations of the ITU. See *ITU*
RSC	Radio Spectrum Committee, established by the European Commission to assist in the development and adoption of technical implementing measures aimed at ensuring harmonised conditions for the availability and efficient use of radio spectrum, as well as the availability of information related to the use of radio spectrum
RSPG	Radio Spectrum Policy Group, established by the European Commission to provide greater harmonisation of spectrum management and coordination of policy approaches between Member States
S-band	Spectrum from 2GHz to 4GHz
SAB/SAP	Services ancillary to broadcasting and services ancillary to programme-making

SD	Standard-definition, referring to TV image quality
SDTV	Standard-definition TV
secondary trading	The trading of spectrum in a secondary market, i.e. the market that may arise once the spectrum usage rights have been assigned to specific users in the primary assignment process
SFN	Single frequency network, where the same frequency is used across large regions or the entire Member State
simulcast	The simultaneous transmission of analogue and digital services during the period of the digital switchover. See *DSO*
spectrum	Used in this report to mean radio spectrum as a whole, or some block of frequencies within this
spectrum trading	The transfer of spectrum usage rights between parties in a secondary market. The actual trade may take a number of forms, including sale, lease or options
statistical multiplexing	An alternative to fixed bit rate coding within DTT systems and allows the available bit rate per multiplex to be dynamically shared between different services on a multiplex. An algorithm in the multiplexing equipment allows the bit rate to be dynamically allocated where required. This reduces the average bit rate allocated to any one service but enables additional services to be added to the multiplex.
switch-off	The point at which analogue transmission cease to be used throughout a country/region
switchover	The transition from analogue TV transmission to digital TV transmission
TDD	Time division duplex, a transmission method that does not require paired spectrum. See *FDD*
terrestrial broadcasting	The provision of communications services (e.g. television) using only equipment on Earth – as opposed to using a communications satellite
TETRA	A digital Professional Mobile Radio standard, typically used for communications between fleets of vehicles
TETRA Enhanced Data Service (TEDS)	A TETRA high-speed data service
TETRAPOL	A digital Professional Mobile Radio standard, as defined by the Tetrapol Publicly Available Specification (PAS), in use by professional user groups, such as public safety, military, industry and transportation organisations
threshold	An interference threshold defines the maximum permitted level of interfering radio emissions
topology	The configuration of a network
two-way	Refers to the application requiring transmission in two directions i.e. both a downlink and an uplink. See *one-way*
UHF	Ultra high frequency, a band of frequencies in the range 300MHz–3GHz used for communications systems such as television and mobile services, as well as non-communications services such as radar, space research, radio astronomy and telemetry. Includes frequency band 470–862MHz also known as UHF band IV/V
UMTS	Universal mobile telecommunications systems – a name for 3G mobile telecoms
unicast	Referring to mobile TV, this is content streamed just to one device at a time. See *multicast*

unlicensed spectrum	Spectrum which can be used without the need for an authorisation
uplink	Transmission by a communications device to a base station receiver. Compare *downlink*
USD	US Dollar
usage right	The right to use a specific band of radio spectrum. Typically such rights have associated rights and obligations, for example in regard to interference
WAPECS	Wireless Access Policy for Electronic Communication Services, the initiatives to apply service and technology neutral licensing conditions to different spectrum bands used for wireless broadband services, based on the concept of BEM rather than technology specific usage conditions
WCDMA	Wideband CDMA a 3G wireless technology; another name for UMTS
white space	Spectrum geographically shared on a co-channel basis with DTT MFN networks. In this report referred to as interleaved spectrum
WiMAX	Worldwide Interoperability for Microwave Access, a family of broadband wireless access technology based on the IEEE 802.16 standards
wireline	A network that uses wires or cables to transmit signals, rather than wireless technologies

Annex E: Stakeholders' Hearings summary

The summary of the Stakeholders' Hearings on 6 March 2009, as issued on 22 April 2009 (reference number 13496-174), is attached below.

Report for the European Commission

‘Exploiting the digital dividend’ – a European approach

Summary of the Stakeholders’ Hearings

22 April 2009

13496-174

Contents

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1 Introduction

This document is a summary of the Stakeholders' Hearings held in Brussels on 6 March 2009 on a coordinated European approach to the digital dividend. The Hearings were part of the study being carried out for the European Commission ("the Commission") by the consortium comprised of Analysys Mason, DotEcon and Hogan & Hartson.

Mr Antti Peltomäki (Deputy Director-General, DG INFSO) chaired the Hearing Panel and was assisted by Mr Daniel Pataki (Chairman, Radio Spectrum Policy Group (RSPG)), Mr Amit Nagpal (Partner, Analysys Mason) and Mr Gerry Oberst (Partner, Hogan & Hartson).

There were two principal objectives of the Hearings. Firstly, to enable the Commission and the consortium to gain a comprehensive understanding of the issues that are most important to spectrum users, over and above the issues already well publicised through existing reports and study material. Secondly, to provide potential and existing users of digital dividend spectrum with an opportunity to offer their views, particularly on what action may be required at a European level to ensure that the full benefits of the digital dividend are realised and to minimise possible negative effects for existing users.

The Hearings comprised three distinct sessions (one for the broadcasting industry, one for the telecoms industry and one for other spectrum users). Each session was split into three parts: the Hearing Panel gave a brief introduction to the session; the stakeholder panels then presented answers to a set of pre-announced questions and themes; then there was an open discussion during which all attendee stakeholders (including representative associations, members of the RSPG and members of the Commission) were invited to contribute.

The objective of this document is to provide a summary of the main views offered by the stakeholders. It is not intended to provide a detailed account of all the issues discussed.

The consortium would like to thank all participants in the Hearings for their attendance and contributions during the discussions, as the views expressed during the Hearings will be a formal input to the consortium's study.

2 Session 1 – Broadcasting industry

This section summarises discussions held during Session 1 with stakeholders from the broadcasting sector.

2.1 The stakeholders

Figure 1 below lists the stakeholders that participated in the panel in Part 2 of Session 1 (responses to pre-announced questions).

Company	*Sub-sector*
BBC	Public broadcaster
France Télévisions	Public broadcaster
Canal+	Private broadcaster
Mediaset	Private broadcaster
RTL	Private broadcaster
Sky Italia	Private broadcaster
TF1	Private broadcaster
Abertis	Network operator
ORS	Network operator
TDF	Network operator
Teracom	Network operator
Thomson	Equipment manufacturer

Figure 1: The stakeholder panel for the broadcasting sector

Figure 2 below lists the other stakeholders that attended Session 1 and participated in Part 3 of this session (open discussion).

Company	*Sub-sector*
Broadcasting Center Europe	Private broadcaster
Panasonic	Equipment manufacturer
ACTE	Broadcasting representative association
BEUC	Broadcasting representative association
Broadcast Mobile Convergence Forum	Broadcasting representative association
EBU	Broadcasting representative association
HD Forum	Broadcasting representative association

Figure 2: The other stakeholders that attended Session 1

All stakeholders were invited to participate in Part 3 of the session, including the stakeholder panel, representative associations, members of the RSPG and members of the Commission. The summary below includes information gathered from Parts 2 and 3 of the session.

2.2 Summary of main discussions

The stakeholders discussed five themes during this session:

- the value of the digital dividend to the broadcasting sector
- the benefits of new technologies/standards such as DVB-T2 and MPEG-4
- the benefits of single frequency networks (SFNs)
- the potential for the digital dividend to be used by other services
- suggested actions for the Commission.

A summary of the discussions on each theme is provided below.

The value of the digital dividend for the broadcasting sector

All sub-sectors (broadcasters, network operators, and equipment manufacturers) emphasised the need to preserve and extend broadcasting services. Stakeholders noted the unique value that broadcasting generates, including benefits to consumers and society as a whole. One stakeholder highlighted that broadcasters provide socially important programming such as news, current affairs and cultural content. It was highlighted that this has been recognised by the Commission in its Communication 531.

Emphasis was also placed on the importance of the DTT platform. It is the main source of free-to-view content in many Member States. It was also noted that the terrestrial platform has a stable base of existing viewers, and that the interests of these viewers should be protected. Further, there is no suitable spectrum available for DTT other than UHF bands IV/V. However it was pointed out that the situation in each Member State, and therefore the potential value of the digital dividend for DTT, differs widely between Member States.

Stakeholders pointed out that it was important for DTT to provide an enhanced service compared to that offered by analogue terrestrial TV (through more channels and/or through providing high-definition (HD) services). Further, the DTT platform needs a minimum number of channels to compete with other platforms (25 to 30 channels was quoted by one stakeholder, 40 by another). However, there was no consensus between stakeholders. Indeed one stakeholder stated that it very much depended on the situation within a specific Member State.

Some broadcasters mentioned that adding more channels to the DTT platform would not always financially benefit the broadcasters since revenues (e.g. from advertising) are largely fixed. However, it can increase viewing time (increasing

from an average of 3 to 3.5 hours per day in one Member State, between 2007 and 2008). For instance in France, an increase from 6 free-to-view analogue TV programming channels to 18 free-to-view DTT programming channels (as well as 11 subscription DTT programming channels) did not increase the total advertising revenue. However, other broadcasters highlighted the benefits of more TV programming channels include greater employment and greater cultural diversity.

Several stakeholders emphasised the importance of HD services being on the DTT platform, particularly because the DTT platform in primarily free-to-view in many Member States. One stakeholder stated that a survey in the UK revealed that 85% of consumers were highly interested in HD services. It was noted that the provision of HD services is a central element in some national plans (in France for example).

According to a network operator, "HD is a must on DTT – as soon as possible".

Stakeholders agreed that HD is essential for DTT and that broadcasters should be allowed to broadcast HD if they wish, but it should not be mandatory.

It was also noted that it will be important to find the right means to implement HD (whether MPEG-4 and/or DVB-T2 will be required) and also to manage the transition from standard definition (SD) to HD carefully. One broadcaster illustrated this with the "success of HD in France" where there are already five HD DTT programming channels and it is mandatory by law to sell HD-capable receivers.

Some stakeholders commented that digital dividend spectrum should be made available for broadcast mobile TV networks, and that any economic analysis should not omit this service.

The benefits of new technologies and standards such as DVB-T2 and MPEG-4

One stakeholder estimated that using MPEG-4 and DVB-T2, and without using spectrum identified in the 790–862MHz sub-band, it would be possible to broadcast around 30 HD TV programming channels.

Stakeholders noted that the increase in transmission efficiency is much greater when moving from MPEG-2 to MPEG-4, than moving from DVB-T to DVB-T2 (potentially just an improvement of between 20% and 25% in transmission capacity in the latter case). One stakeholder also mentioned the fact that MPEG-4 is a established technology, while DVB-T2 is still in development. Even so, DVB-T2 may be needed in order to offer sufficient HD TV programming channels on the DTT platform, particularly if the 790–862MHz sub-band is used for other services and if the remaining

spectrum is already used to provide SD TV programming channels.

There were differences of opinion on whether action is required at a European level regarding MPEG-4/DVB-T2. Some stakeholders believe that coordinated European action could help realise the benefits from economies of scale, particularly regarding MPEG-4 (DVB-T2 harmonisation was seen as less desirable). However, one stakeholder stated that the technical standards and pace of any technical migration should be left to Member States.

One stakeholder noted that consumers had already been subject to disruption due the digital switchover; further migrations (such as to MPEG-4 and particularly DVB-T2) could cause more disruption. Consumers should not be subject to too many instances of such disruption.

The benefits of single frequency networks (SFNs)

Stakeholders underlined the need for more information/time in order to quantify the benefits of SFNs.

One network operator stated that SFNs were just one way to improve frequency planning, but not the only one. Further, SFNs might not work in all countries. Also it is not always possible to provide local content on SFNs.

One stakeholder highlighted that Spain has four nationwide SFN multiplexes in the proposed 790–862MHz sub-band and how this is a very spectrally efficient method of providing these services.

One stakeholder highlighted that using SFNs may mean that a significant number of consumers may need to upgrade to wideband antennas. This is because consumers in some areas would not be able to receive transmissions due to the type of aerial they have. The resulting cost should be taken into account.

The potential for the digital dividend to be used by other services

Several stakeholders indicated that they appreciate that it may be beneficial for some of the digital dividend to be used for services other than broadcasting (e.g. potentially in the 790–862MHz sub-band), as long as the spectrum is actually used. One stakeholder emphasised that Member States need to make sure that spectrum is not allocated to "hypothetical" services. A broadcaster urged the Commission to take action to ensure the development of services (taking the example of some frequencies under-used by the telecoms sector).

One stakeholder stated that the negative environmental impact of using the digital dividend for dense networks (rather than for DTT) should be considered.

There was concern expressed that reallocating DTT assignments in order to free up the 790–862MHz sub-band would be costly to broadcasters. One broadcaster also underlined the fact that DTT is still a young platform and that it is not yet mature enough to bear such additional costs ("Don't throw the baby with the bath water"). There was also concern regarding who would pay for these reallocations (including any required upgrades to MPEG-4 and/or DVB-T2).

There was consensus between stakeholders that another regional planning exercise (similar to GE-06) in order to free up spectrum in the 790–862MHz sub-band was not desirable. Instead bilateral or multilateral negotiations would be more productive.

Suggested actions for the Commission

There was broad consensus between most of the stakeholders on seven recommendations:

- Equipment standards are needed for receivers. In particular:
  - radio performance standards, to ensure that out-of-band noise is effectively filtered out
  - all receivers should be prepared for HD services: a number of stakeholders recommended that HD and MPEG-4 capable tuners should be mandated in all DTT receivers.
- MPEG-4 transmission standards and a date for transition should not be mandated.
- A regional planning exercise (such as GE-06) is not desirable, bilateral/multilateral negotiations are likely to be sufficient and more effective. However, the Commission could assist is setting timeframes for such negotiations, and support negotiations with non-EU countries.
- Broadcasting transmissions should be protected from interference from new services using digital dividend spectrum.
- An allocated sub-band for broadcast mobile TV networks is not desirable.
- A framework should be set to allow Member States who want to allocate the 790–862MHz sub-band to telecoms to do so ("Full coordination but not full harmonisation" was mentioned).
- Broadcasters should not have to pay for any additional costs that are incurred in freeing up spectrum in the 790–862MHz sub-band. Coordinated European action to ensure this would be welcomed.

3 Session 2 – Telecoms industry

This section summarises discussions held during Session 2 with stakeholders from the telecoms sector.

3.1 The stakeholders

Figure 3 below lists the stakeholders that participated in the panel in Part 2 of Session 2 (responses to pre-announced questions).

Company	*Sub-sector*
Mobilkom	Mobile operator
Orange	Mobile operator
Telefonica/O2	Mobile operator
TeliaSonera	Mobile operator
T-Mobile	Mobile operator
Telenor	Fixed/mobile operator
Tele2	Fixed/mobile operator
BT	Fixed operator
UPC Ireland	Cable operator
Cisco	Equipment manufacturer
Ericsson	Equipment manufacturer
Nokia/Nokia Siemens Networks	Equipment manufacturer
Qualcomm	Equipment manufacturer

Figure 3: The stakeholder panel for the telecoms sector

Figure 4 below lists the other stakeholders that attended Session 2 and participated in Part 3 of this session (open discussion).

Company	*Sub-sector*
LGI	Cable operator
BEUC	Telecoms representative association
ECTA	Telecoms representative association
ETNO	Telecoms representative association
GSMA	Telecoms representative association

Figure 4: The other stakeholders that attended Session 2

All stakeholders were invited to participate in Part 3 of the session, including the stakeholder panel, representative associations, members of the RSPG and members of the Commission. The summary below includes information gathered from Parts 2 and 3 of the session.

3.2 Summary of main discussions

The stakeholders discussed five themes during this session:

- the value of the digital dividend for the telecoms sector
- the amount of digital dividend spectrum required for telecoms services
- the costs/benefits of harmonisation (including economies of scale)
- potential options for incentivising Member States to free up the sub-band
- suggested actions for the Commission.

A summary of the discussions on each theme is provided below.

The value of the digital dividend for the telecoms sector

All stakeholders agreed that there is real economic value in terms of GDP and job creation from using digital dividend spectrum for telecoms services. A mobile operator made reference to existing published studies by SCF, Spectrum Value Partners, Analysys Mason and the Commission. One stakeholder noted that telecoms services, including mobile broadband, generate significant social benefits.

The majority of stakeholders said that they were interested in using digital dividend spectrum for mobile broadband services. However, one stated that it would consider using the digital dividend to provide fixed broadband services. An equipment manufacturer thought that both fixed and mobile services could be offered using the same technology, therefore differentiating the spectrum between these services may not be necessary.

Digital dividend spectrum could be used to provide coverage to rural areas. This could be achieved using other, higher frequency bands, but would be much more costly. Using the 2.6GHz band could potentially be around six times more expensive than using the digital dividend (based on calculations of the cost of deployment at 2.4GHz and 600MHz).

Digital dividend spectrum could also be used to provide higher quality indoor coverage.

One stakeholder identified a joint study by Oxford and Oviedo universities that stated that all consumers would require a broadband speed of 11.25Mbit/s within three to five years. Currently only Japan is ready to deliver this. Digital dividend spectrum will be very beneficial to achieving this aim.

Another stakeholder stated that mobile technology is approaching Shannon's law (the theoretical maximum transmission rate using a limited amount of spectrum). Therefore, in order to offer higher speed services, more spectrum is required.

The amount of digital dividend spectrum required for telecoms services

Stakeholders felt strongly that 72MHz (i.e. using the 790–862MHz sub-band) may not be sufficient, and that spectrum below 790MHz should be considered.

One mobile operator stated that a total of 100MHz would be required as a "starting point". A mobile operator gave the example of a study in Germany that showed that to provide 6Mbit/s in rural areas, at least 160MHz of spectrum would be required.

One stakeholder indicated that if LTE is used to offer the highest speed broadband services, 2×20MHz of spectrum is required per network. Two such networks could not fit into the 72MHz available.

Some stakeholders suggested that the Commission should mandate CEPT to investigate opportunities and potential band plans for telecoms use below 790MHz.

The costs/benefits of harmonisation

One equipment manufacturer stated that if a market the size of Europe was to conform to one band plan for the digital dividend, then the bill of materials for the RF (radio frequency) components would be USD0.80 per device. If there were three different band plans, this would rise to USD3.80. Therefore, a harmonised band plan is very desirable.

Stakeholders highlighted that the proposed 790–862MHz sub-band is a different range to that identified in other parts of the world (particularly the USA or Asia). Hence, Europe will not benefit from economies of scale from sharing common frequencies with these regions/countries. Therefore, it is even more important that European Member States coordinate to develop a harmonised band plan, in order to generate economies of scale. Stakeholders indicated that if this weren't to happen Europe could lag behind the USA or Asian countries. This could potentially prevent the export benefits of European technologies (as realised with GSM).

National markets, as opposed to the European market, could greatly increase the cost of R&D and lead to some Member States being "stranded" (i.e. being subject to higher costs for devices and poor device availability). A mobile operator expressed concern about the fact that manufacturers are today focusing on the USA and not on Europe.

An equipment manufacturer pledged that the industry will still make equipment available even if just a sub-set of Member States make the sub-band available, though this will be more expensive. However, given the current economic climate, equipment manufacturers are very dependent on economies of scale, and therefore a coordinated European approach is crucial if manufacturers are to invest further in R&D.

From the consumer's perspective, economies of scale can have an impact on prices. For instance phone components can double the price of a handset, hence reaching a significant market size is key (a market of 100 million people was mentioned).

One mobile operator stated that they expect LTE equipment to be available for the sub-band by 2011, therefore, it would be ready to deploy a service in 2012 (when analogue switch-off is planned).

When asked why FDD technologies required a fixed duplex gap, one stakeholder responded that investments are being made in this area, however, mass-market frequency-agile technologies are not expected in the foreseeable future.

Potential options for incentivising Member States to free up the sub-band

One stakeholder suggested that hopefully all Member States will recognise the benefit of using the sub-band for mobile broadband, and therefore incentives will not be required.

Regarding the appropriate process for broadcasters to recover the incremental costs to free up the sub-band, a stakeholder suggested there was "no one size fits all" approach for Member States. Though for some Member States costs could be recovered through the revenues raised from auctions to award the sub-band.

Another stakeholder stated that costs to compensate SAB/SAP users for exiting the sub-band were not that great when compared to the benefits of mobile broadband using the sub-band.

Suggested actions for the Commission

There was broad consensus between stakeholders on five recommendations.

- The allocation of the 790–862MHz sub-band (or potentially other allocations) should not be mandatory. Instead "voluntary harmonisation" may be desirable for political reasons. One stakeholder suggested that mandating the freeing up of the sub-band could lead to delays.

- The Commission should encourage, coordinate and educate Member States on freeing up the sub-band. This could include developing road maps,

fostering national cost-benefit analyses or identifying best practice.

- The Commission should ensure that the analogue switch-off is completed on time in 2012. This would provide certainty to equipment manufacturers to invest in developing equipment for the sub-band. (However, there were differences in opinion as to whether "derogations" should be allowed. One stakeholder suggested that this may be lead to delays in the analogue switch-off and thus use of the digital dividend for mobile broadband).

- The Commission should assist cross-border coordination. This is especially the case with non-EU countries.

- The Commission should mandate CEPT to identify opportunities and develop band plans for use of frequencies below 790MHz.

4 Session 3 – Other uses

This section summarises discussions held during Session 3 with stakeholders representing other industries and potential uses of the digital dividend.

4.1 The stakeholders

Figure 5 below list the stakeholders that participated in the panel in Part 2 of Session 3 (responses to pre-announced questions).

Company	*Sector*
Google	Cognitive technology
Microsoft	Cognitive technology
Astrid	Public safety
DTRC (Belgian Police)	Public safety
EADS	Public safety
Motorola	Public safety
Inmarsat	Mobile satellite operator
NEM	R&D
Düsseldorf Congress	SAB/SAP
Audio Technica Europe	SAB/SAP
Shure	SAB/SAP
Sennheiser	SAB/SAP

Figure 5: The stakeholder panel representing other industries and potential uses of the digital dividend

Figure 6 below lists the other stakeholders that attended Session 3 and participated in Part 3 of this session (open discussion).

Company	*Sub-sector*
APWPT	Representative association
EICTA	Representative association

Figure 6: The other stakeholders that attended Session 3

All stakeholders were invited to participate in Part 3 of the session, including the stakeholder panel, representative associations, members of the RSPG and members of the Commission. The summary below includes information gathered from Parts 2 and 3 of the session.

4.2 Summary of main discussions

The stakeholders discussed three themes during this session:

- the value of the digital dividend for the other spectrum users
- the costs/benefits of harmonisation (including economies of scale)
- suggested actions for the Commission.

A summary of the discussions on each theme is provided below.

The value of the digital dividend for the "other" spectrum users

The SAB/SAP stakeholders expressed the following views.

- Strong concern was expressed over the prospect of SAB/SAP spectrum being made unavailable, particularly in the 790–862MHz sub-band, where many countries have nationwide allocations. This would cause disruption and would be costly as current equipment would become redundant.
- SAB/SAP equipment manufacturers stated that a period of three to five years is required for developing and marketing new products.
- The economic loss could be EUR3.5 billion to replace all equipment throughout the EU. This would dramatically increase the cost to end users.
- Services that use SAB/SAP equipment in this spectrum (which is mainly used for radio microphones) provide significant social and cultural benefits.
- SAB/SAP stakeholders believe that they cannot win digital dividend spectrum in an auction. Therefore, the loss of social benefits from SAB/SAP due to such an auction should be taken into consideration.

The public safety and satellite stakeholders expressed the following views.

- The value of public safety services goes beyond purely an economic one; therefore it is extremely difficult to quantify.
- The digital dividend could be used for mobile broadband services for public safety services. There are existing pan-European public safety networks (TETRA and Tetrapol), however these can only provide narrowband services.
- Stakeholders expressed mixed views on the amount of spectrum required although 2×15MHz was mentioned.

The mobile satellite operator stakeholder expressed the following views.

- Satellite providers already supply valuable services in 2GHz band (S-Band) including broadband for emergency and public services.
- Such satellite services should be viewed as an alternative to using the digital dividend for public safety services.

The cognitive technology industry expressed the following views.

- Cognitive technologies are a new, promising field. Stakeholders thought that they could be used to serve rural areas and other under-served places (as a complement to fibre roll-out). This is especially the case in Europe where there are gaps in coverage in rural areas.
- As cognitive technologies can use interleaved spectrum ('the white spaces'), they are very spectrally efficient.
- One stakeholder said that early estimates of the economic value generated by cognitive technologies could be as much as EUR200–300 million in one Member State (according to Ofcom's estimates).
- When asked what would happen to the cognitive technology industry if all Member States rolled out SFNs for DTT, thus significantly reducing the amount of white space, stakeholders answered that there is enough time between now and the hypothetical full implementation of SFNs to deploy products and make a return on their investments. Further, there will still be white spaces available where there is demand for local TV content.

The R&D community thought that the Commission must look at the long-term perspective (2020 and beyond).

The costs/benefits of harmonisation (including on economies of scale)

The SAB/SAP stakeholders welcomed the harmonisation of nationally available channels. They also acknowledged that it was not necessary to have exactly the same channel available in all Member States, availability within the tuning range of the equipment would be sufficient. However, the tuning range depends on the equipment.

- The tuning range can be widened, but at the cost of spectrum efficiency.
- Basic equipment (often used by many non-professional users) can tune over approximately two 8MHz channels.

Public safety stakeholders strongly support harmonisation ("the more harmonisation we can get the better"). This is for two reasons:

- there is a critical need for interoperability and roaming across borders
- a pan-European approach would bring economies of scale and thus significantly reduce costs (an example was provided indicating that economies of scale could lower the cost of device units from EUR2000 to EUR500).

One stakeholder stated that the success of the 380MHz decision 15 years ago demonstrates the value of harmonising spectrum for public safety services. However, doing this through Commission decisions might be a more appropriate approach.

Public safety stakeholders stated that priority access to public mobile broadband networks is insufficient, as such public safety systems will be required in many low user density areas. In these areas commercial systems are not viable. This is also why public safety users require access to spectrum below 1GHz to limit network costs.

Suggested actions for the Commission

The SAB/SAP community wants to be recognised as an existing user, and that the Commission should ensure that sufficient spectrum is available for existing users. There should also be certainty over which frequencies will be used for SAB/SAP and when this move will take place.

They also expressed the view that EU guidance regarding the harmonisation of SAB/SAP spectrum would be welcomed. The standardisation of SAB/SAP licensing schemes across Europe was thought to be beneficial. Finally, the SAB/SAP community should not incur any additional costs resulting from liberalising the use of digital dividend for other services.

Stakeholders also suggested that cognitive technologies should be subject to the appropriate CEPT and ETSI procedures in order to ensure that there is no interference for SAB/SAP users.

The public safety stakeholders requested that spectrum is harmonised for a public safely mobile service. However, the sector is currently defining its operational and spectrum requirements for such a service.

The cognitive radio community believes the Commission should follow the FFC's lead (the American regulator) in allowing the use of cognitive technologies and by defining a European framework.

Annex F: First Member States' workshop summary

The summary of the Member States' workshop on 15 April 2009, as issued on 5 May 2009 (reference number 13496-193), is attached below.

Report for the European Commission

‘Exploiting the digital dividend’ – a European approach

Summary of the Member States’ workshop

5 May 2009

13496-193

Contents

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1 Introduction

This document is a summary of the Member States' workshop held in Brussels on 15 April 2009 to discuss a coordinated European approach to the digital dividend. The workshop was part of the study being carried out for the European Commission ('the Commission') by a consortium comprising Analysys Mason, DotEcon and Hogan & Hartson. The workshop was hosted jointly by the Commission and the RSPG[1] Working Group on the digital dividend. During the workshop they were assisted by Mr Amit Nagpal (Partner, Analysys Mason), Mr Lee Sanders (Partner, Analysys Mason) and Mr Gerry Oberst (Partner, Hogan & Hartson) from the consortium.

The workshop had two principal objectives. First, to seek input from Member States on the consortium's initial views of the European dimension for potential uses of the digital dividend and the options for European coordinated action. Second, to allow Member States to participate in an open exchange of views on the scope, nature and timeframe of any action.

The objective of this document is to provide a summary of the main views put forward by the Member States. It is not intended to provide a detailed account of all the issues discussed. Member States were invited to submit written comments regarding the consortium's views; these comments are not included in this summary.

Participants attended from the Commission, the RSPG, 21 Member States and two countries from outside the EU: Norway and Switzerland. A list of participants from the Member States, Norway and Switzerland is provided in Annex A. The consortium would like to thank all participants in the workshop for their involvement and their contributions to the discussions. The views expressed during the workshop will be a formal input to the consortium's study.

For more information, please visit http://www.analysysmason.com/EC_digital_dividend_study. Here you can see an overview of the study and its timetable, find a schedule of events, download documents published during the study and the contact the study team.

[1] Radio Spectrum Policy Group.

2 Agenda and participants

- **Opening address by the Commission:** A brief overview was given of previous EU-level action, beginning with the Commission's Communication regarding the digital switchover (DSO)[2], which set a target analogue switch-off (ASO) date of 2012, and including the European Parliament's resolution of September 2008. Mr O'Donohue stressed the importance of direct involvement from Member States in the development of European-level action regarding the digital dividend, of which the workshop was an important part.

- **Presentation by the RSPG**: "RSPG Draft Opinion on the Digital Dividend". This presentation outlined the status of the RSPG's position paper on the digital dividend, its draft recommendations for the public consultation, and the next steps for the Working Group.

- **Presentation by the consortium**: "Exploiting the digital dividend: initial findings and options for action". In this presentation, the consortium summarised the initial findings of the study to date; identified why European actions may be required; and identified an initial range of options for such actions. As mentioned above, this presentation can be downloaded from: http://www.analysysmason.com/EC_digital_dividend_study.

- **Session 1**: What European action could be taken to encourage the efficient use of the 470–862MHz band by broadcasting networks?

- **Session 2**: What European action could be taken to facilitate wireless broadband use of the digital dividend?

- **Session 3**: What European action could be taken regarding the use of interleaved spectrum?

- **Session 4**: What European action could be taken regarding other potential uses of the digital dividend?

- **Session 5**: What other measures could be taken to encourage the more efficient use of the 470–862MHz band?

- **Closing comments from the Commission**: The "dynamic" dimension of the digital dividend policy was stressed, noting that the process will continue beyond the DSO. The importance of developing an overarching strategy for the digital dividend was emphasised, as policy decisions may need to be made that will influence competing uses of the same spectrum. Such decisions should be based on robust socio-economic analysis.

Each session opened with the consortium reiterating the theme under discussion and presenting a number of options for European coordinated action. In Sessions 1, 2 and 3, participants from

[2] COM(2005)04.

individual Member States gave brief presentations, in which they outlined their views on the theme of the session. In each session the summary from the consortium or presentation was followed by an open discussion involving all attendees. The sessions were chaired by Mr Amit Nagpal.

3 Session 1 – Increasing efficiency of use by broadcasting networks

3.1 Potential actions discussed

During Session 1 the consortium presented potential actions that could be undertaken at a European level in order to encourage the efficient use of the 470–862MHz band by broadcasting networks. These potential actions were related to three main topics:

Topic	*Potential options for action*
DTT transmission technologies	Share deployment plans for MPEG-4 and DVB-T2 (including timelines)
	Produce guidelines on the timeline for adoption of MPEG-4 and/or DVB-T2
	Mandate the timeline/requirement for adoption of MPEG-4 and/or DVB-T2
DTT receivers	Specify minimum standards for DTT receivers (interference, rejection, etc.)
	Produce guidelines for including MPEG-4 and/or DVB-T2 in all sold receivers
	Mandate the inclusion of MPEG-4 and/or DVB-T2 in all sold receivers
DTT deployment topologies	Share wider SFN[3] deployment plans
	Produce guidelines on the timeline for wider adoption/deployment of SFNs
	Mandate the wider adoption of SFNs (including timeline)

Figure 1: Potential options for action discussed during Session 1

3.2 Summary of the main discussion

This session included a presentation from the Italian telecommunications regulator, Agcom, regarding Italy's implementation of SFNs for DTT. This presentation led to an open discussion on the three topics given above; this discussion is summarised below.

DTT transmission technologies (MPEG-4 and DVB-T2)

Some Member States, in which DTT has already been deployed, were opposed to specific action to encourage the migration to DVB-T2 and to a lesser extent MPEG-4. Some indicated that any migration should be market-driven.

[3] Single frequency network.

- Some Member States highlighted that the DTT transmission technologies currently in use in a Member State are highly dependent on when DTT was launched in that country. Member States that launched DTT earlier typically use MPEG-2 and DVB-T, as these were the only technologies available at that time. According to these Member States, migrating to DVB-T2 and to a lesser extent MPEG-4 would raise legacy problems. Member States that were later in deploying DTT have mostly adopted MPEG-4 (though not DVB-T2) Similarly, most Member States that have yet to deploy DTT plan to use MPEG-4 (though not DVB-T2).

- Some Member States raised concerns regarding further DTT transmission technology migrations so soon after the successful completion of the ASO.

- One Member State pointed out that the GE-06 agreement is based on DVB-T technology. DVB-T2 has significantly different propagation characteristics to DVB-T. Therefore, a widespread migration to this technology would require extensive re-planning of GE-06 assignments. It was highlighted that such re-planning is not possible for many Member States at present as they are currently preoccupied with bilateral negotiations relating to the forthcoming digital switchover (DSO).

- On the other hand, one Member State noted that there may be benefits in encouraging the migration to both MPEG-4 and DVB-T2 at the European level.

DTT receivers (MPEG-4 and DVB-T2)

Member States mostly favoured European action to ensure that all sold DTT receivers are MPEG-4 compatible, but showed some concern over similar actions for DVB-T2.

- One Member State indicated that in contrast to the choice of DTT transmission technologies, which is a national matter, European action regarding DTT receivers may be beneficial. Television sets and set-top boxes are manufactured to be usable across major markets, such as the EU. Therefore, a mandate to have MPEG-4 compatible DTT receivers would be welcome. However, this Member State was less in favour of DVB-T2, stating that it had not been considered in its country. It also stressed that an impact analysis of the cost for consumers should be undertaken before taking any action.

- One Member State, which is planning one DVB-T2 multiplex, urged caution regarding a full migration to DVB-T2. However, encouraging one multiplex to be DVB-T2 (in order to enable HD transmission) may

make the DTT platform as a whole more attractive. It may also be beneficial if new multiplexes used DVB-T2.

- One Member State stated that it would favour guidelines regarding DTT receivers rather than mandatory action. It also stated that such guidelines should be complementary to the R&TTE[4] and EMC[5] Directives.

DTT deployment topologies (SFN)

Several Member States mentioned that they already use SFN topologies on a regional basis for some of their DTT multiplexes but only one Member State has deployed national SFNs, using a lower power, denser network.

Regional SFNs can be deployed using existing high-power, high-tower transmission sites. However, using this approach, there is a limit to the size of each SFN transmission area. Member States said that 120–170km was the maximum transmission-area size. Larger areas are prone to destructive interference from distant transmitters.

National SFNs are possible, but lower-power, denser networks are required. Such networks are more costly than high-power networks because significantly more transmission sites are required. One Member State illustrated this point by saying that in its country an SFN would need 160 transmitters to cover 80% of the population; more than 800 high/medium-power transmitters to cover 92% of the population; and more than 2000 high/medium/low-power transmitters to cover 96% of the population. Also, fixed links are required for the transmission feed, which are more expensive than for MFNs.[6]

Most Member States appeared not to favour action to encourage the wider adoption of SFNs.

- Some Member States noted that deploying national SFNs would require significant changes to existing regional SFNs or MFNs. This would include adding significantly more transmission sites. Therefore, SFNs would be a more costly option.

- Some Member States that have already deployed regional SFNs stated that in order to deploy more SFNs, further bilateral/multilateral negotiations would be required. In order to deploy national SFNs a large

4 Radio and Telecommunications Terminal Equipment: http://ec.europa.eu/enterprise/rtte/dir99-5.htm

5 Electromagnetic Compatibility: http://ec.europa.eu/enterprise/electr_equipment/emc/index.htm

6 Multiple frequency networks.

reorganisation of the 470–862MHz band would be required.

- Several Member States mentioned that SFNs make cross-border coordination more complex. This is especially the case for Member States with many neighbours.

- Another Member State commented that since national SFNs use the same frequency across entire countries and SFN multiplexes could be spread across the 470–862MHz band, households would require wideband antennas. Member States in which narrowband antennas are common, would need to ensure that these are replaced.

Some Member States commented on the benefits of SFNs.

- One Member State acknowledged that the use of DVB-T2 technology may allow SFNs to be deployed over large areas. DVB-T2 also enables the maximum area of regional SFN using high-power transmission sites to be increased.

- Another Member State highlighted that the implementation of SFNs may allow the release of a significant number of spectrum channels for new uses.

4 Session 2 – Facilitating wireless broadband use

4.1 Potential actions discussed

During Session 2 the consortium presented potential actions that could be undertaken at a European level in order to facilitate use of the digital dividend by wireless broadband. These potential actions were related to three main topics:

Topic	*Potential options for action*
The creation of the 790–862MHz sub-band	Share plans for creation of sub-band (including timing)
	Produce guidelines on timing of creation of sub-band
	Mandate the creation of a sub-band and mandate use of frequencies for medium-power services in all Member States
	Change GE-06 interference parameters to protect medium-power uses in 790–862MHz (including uplinks)
The renegotiation of DTT assignments for the 790–862MHz sub-band	Produce guidelines for Member States on bilateral negotiations (including negotiations with non-EU countries)
	Mandate a deadline for bilateral negotiations to be completed (including negotiations with non-EU countries)
The creation of additional sub-bands below 790MHz	Share plans for the creation of any additional frequency bands below the sub-band (including timing)
	Mandate CEPT[7] to develop band plans for additional frequency band(s)

Figure 2: Potential options for action discussed during Session 2

4.2 Summary of the main discussion

Session 2 included a presentation from the Czech Telecommunication Office that described the current roll-out of DTT in the Czech Republic and the actions taken to enable wireless broadband use in the digital dividend spectrum. This was followed by a presentation from the Spanish Ministry of Industry, Tourism and Trade that highlighted the difficulties that Spain faces in making any of the 470–862MHz band available for new uses. These presentations led to an open discussion on the three topics presented above; this discussion is summarised below.

The creation of the 790–862MHz sub-band

Many Member States appeared to favour non-mandatory European action to create a sub-band for wireless broadband services.

[7] European Conference of Postal and Telecommunications Administrations.

- Some Member States that have already decided to make the sub-band available indicated that they would favour European action to encourage other Member States to do the same.

- One Member State favoured no mandatory action regarding the services/technologies that can be used in the sub-band (for example FDD[8] or TDD[9]). Instead it suggested the sub-band should be made available on a service- and technology-neutral basis. It also asked for the Commission to move as quickly as possible in order to give confidence to the market.

However, some Member States, mentioned that they face many unresolved challenges, which currently make the release of the sub-band extremely difficult.

- For several Member States, neighbouring non-EU countries use the sub-band for other services (e.g. military, aeronautical). This may prevent them using the sub-band for wireless broadband. One Member State said that due to such issues, it was unable to make Channels 66–69 available for wireless broadband. Therefore, it was considering making Channels 61–65 available for TDD use. This however raises coordination issues with other neighbours that are planning FDD technologies.

- In one Member State, only one channel (Channel 64) is available for new uses. It expects that the remainder of the sub-band, which is currently used by the military, will be made available by 2015 at the earliest. Additionally, this Member State highlighted that in its country wireless broadband players had yet to request access to this spectrum.

- One Member State noted that due to its small population and its language, it does not have an attractive satellite TV platform. Therefore, DTT is an essential TV platform. Since future migration to HDTV will require a lot of spectrum, it is unattractive to release the sub-band for new uses, other than DTT. By contrast, another Member State noted that in its consultations on the digital dividend, no requirement for additional spectrum due to HDTV was identified.

8 Frequency division duplex.

9 Time division duplex.

Renegotiation of DTT assignments for the 790–862MHz sub-band

Several Member States indicated that they would favour European action to negotiate with non-EU countries, such as Russia.

One Member State mentioned that it is willing to release the sub-band after the ASO, however it is prevented from doing this until its non-EU neighbour completes the ASO in 2015.

However, another Member State that shares a border with a non-EU country stated that it is experienced in negotiating with this country, and believes that bilateral national negotiations regarding the sub-band are appropriate. However, it may be helpful if the Commission could clearly communicate to non-EU countries the value of creating the sub-band.

Creation of additional sub-bands below 790MHz

Currently, only the UK has announced official plans to release digital dividend spectrum below 790MHz for uses other than broadcasting.

Some Member States expressed concern regarding the creation of another sub-band below 790MHz. One Member State stated that considering a second sub-band would send a "wrong signal" to industry, as this may complicate and delay the release of the first sub-band (790–862MHz). Another Member State suggested that a second sub-band should only be pursued "opportunistically".

5 Session 3 – Supporting uses of interleaved ('white space') spectrum

5.1 Potential actions discussed

During Session 3 the consortium presented potential actions that could be undertaken at a European level in order to support the use of interleaved spectrum. These potential actions were related to two main topics. The consortium also invited comments from Member States regarding other potential uses of interleaved spectrum:

Topic	*Potential options for action*
SAB/SAP[10]	Produce guidance on a common set of channels which Member States could make available on a dedicated national basis for SAB/SAP
	Mandate a common set of channels that Member States could make available on dedicated national basis for SAB/SAP
Cognitive technologies	Produce guidance on a common frequency range for cognitive applications
	Mandate a common frequency range for cognitive applications
	Develop an agreed European Common Position regarding regulatory measures in order to introduce cognitive technologies for WRC-11

Figure 3: Potential options for action discussed during Session 3

5.2 Summary of the main discussion

This session included a presentation from the UK regulator, Ofcom, regarding the work it has undertaken on SAB/SAP and cognitive technologies as part of its Digital Dividend Review. This presentation led to an open discussion on the two topics given above; this discussion is summarised below.

SAB/SAP

One Member State pointed out that CEPT is currently studying technical issues regarding SAB/SAP use in the 470–862MHz band. In its view, the Commission's study should take this work into account

Another Member State highlighted that in the USA, SAB/SAP use will be required to exit spectrum in the 470–862MHz band below approximately Channel 48. Therefore, in its view, Europe should note the solutions that the USA develops in order to relocate SAB/SAP users.

10 **Services ancillary to broadcasting and programme making.**

One Member State noted that its market was too small to achieve economies of scale. Therefore, a European level solution would be welcome.

Another Member State highlighted the fact that SAB/SAP encompasses two types of user: professional and non-professional. The characteristics of these types are very different. For some events, professional users often require a large number of radio microphones (up to 40). This means that several 8MHz spectrum channels (at least 4) are required. This cannot be provided using one nationally available channel and therefore interleaved spectrum is required. It may not be possible to harmonise such spectrum.

One Member State expressed its concern regarding the use of the FDD duplex gap in the proposed 790–862MHz sub-band for SAB/SAP services. The nearest frequencies that would be available for SAB/SAP would be in Channel 60. This is a greater frequency separation (30MHz) than the typical tuning range of SAB/SAP equipment (16MHz to 24MHz). As a result, SAP/SAB users do not favour this option.

Cognitive technologies

Member States noted that there is a lot of uncertainty regarding the development of cognitive technologies and the services they may enable. Therefore, they are uncertain regarding the necessity of European level action. However, they are keen to ensure that Europe can benefit from a common market for equipment. One Member State indicated that the Commission should promote a common European standard for cognitive technologies.

On a related topic, one Member State highlighted that it was considering reserving digital dividend spectrum in order to support innovation. Spectrum reserved for this purpose is important for equipment manufacturers in order for them to develop and test new technologies. In its view, this should be considered as an additional potential use of the digital dividend.

6 Session 4 – Enabling other uses of digital dividend spectrum

6.1 Potential actions discussed

During Session 4 the consortium presented potential actions that could be undertaken at a European level in order to enable other uses of the digital dividend. These potential actions were related to two main topics. The consortium also invited comments from Member States regarding other potential uses of digital dividend not identified in the consortium's presentation.

Topic	*Potential options for action*
Broadcast mobile TV	Produce guidance on frequencies to be used by mobile TV
	Create a dedicated sub-band for one-way, medium-power services
	Ensure interference parameters for 790–862MHz enable use for broadcast mobile TV networks
PPDR[11]	Produce guidelines on using part of the sub-band for PPDR
	Mandate Member States to make part of the sub-band available
	Produce guidelines on an alternative sub-band/frequency range for PPDR
	Mandate the creation of an alternative dedicated sub-band for PPDR use

Figure 4: Potential options for action discussed during Session 4

6.2 Summary of the main discussion

A summary of the open discussion on the two topics given above is provided below.

Broadcast mobile TV

Member States did not feel that any additional European action was needed in relation to the use of broadcast mobile TV in the 470–862MHz band.

- Several Member States expressed the view that the use of broadcast mobile TV in the 790–862MHz range is not attractive, because devices integrated with GSM (and potentially other technologies such as UMTS and LTE) may experience interference. One Member State mentioned such interference would occur if frequencies above Channel 55 are used for broadcast mobile TV.
- One Member State, which has already deployed a broadcast mobile TV multiplex in the 470–862MHz band, stated that there is no need for

[11] Public protection and disaster relief.

European action to create either a dedicated frequency range for broadcast mobile TV or to use the 790–862MHz sub-band for this service.

PPDR

Most Member States did not support European action regarding PPDR in the 470–862MHz band, and indicated that other bands could be used to provide such services.

- One Member State highlighted that CEPT is considering the spectrum requirements for PPDR.
- Several Member States mentioned that they believe that spectrum below 470MHz and above 862MHz should be considered instead (e.g. the 400MHz band and the 2GHz band).
- Another Member State indicated that in a recent conference in Prague, no Member States identified a need in the foreseeable future for harmonised spectrum in the 470–862MHz band for PPDR.

During the discussion two Member States identified other potential uses of the 470–862MHz band.

- One Member State noted that part of this band is used by the military in its jurisdiction, and that this use should be considered as a future potential use of the band.
- Another Member State highlighted that it had received interest in the 470–862MHz band for a large number of other uses. The case for these uses having access to digital dividend spectrum should be given due consideration.

7 Session 5 – Other measures for improving long-term efficiency

7.1 Potential actions discussed

During Session 5 the consortium presented potential actions that could be undertaken at a European level in order to encourage more efficient use of the 470–862MHz band in the long term. These potential actions were related to two main topics:

Topic	*Potential options for action*
Reconfiguring assignments for MFN multiplexes so that they are close together	Make assignments for MFN multiplexes close together rather than spread across the entire band
Research into flexibly agile FDD technologies	Encourage research into flexibly agile FDD technologies

Figure 5: Potential options for action discussed during Session 5

7.2 Summary of the main discussion

The open discussion in this session became a general debate on how to encourage efficient use of the 470–862MHz band. A summary of the discussion is provided below.

One Member State suggested that spectrum efficiency may mean different things to different stakeholders. Another Member State suggested that not only should the efficient and flexible use of the 470–862MHz band be considered, but also why other spectrum bands are not used, and how they could be made more attractive. A third Member State emphasised that efforts should be focused on making digital dividend spectrum available in as attractive a way as possible, allowing the market to decide on the use.

There was an open debate regarding the appropriateness of another major regional reorganisation of the band (not dissimilar to GE-06).

- One Member State suggested that the study should consider the possibility of such a major reorganisation in order to achieve significant efficiencies through the wider adoption of SFNs, as well as new broadcasting technologies (e.g. DVB-T2).

- Another Member State emphasised that the life cycle of technical solutions for the 470–862MHz band is getting shorter: solutions quickly become obsolete (within a few years). Further, in the medium to long term, demand for certain services may change, for example demand for mobile services may grow. Therefore, the focus should be on ensuring that services can co-exist. This may mean that another replanning exercise needs to take place.

This Member State suggested that an appropriate time for such an exercise might be between 2015 and 2018.

- A third Member State suggested that though it may be beneficial to replan, it will be difficult. For example, at GE-06 it was clear which frequencies were under consideration (470–862MHz). Given that some Member States are freeing up the sub-band for other services, it is not clear which frequencies could or should be considered at a future replanning exercise.

- A fourth Member State suggested that the Commission may find making the sub-band available across Europe is a difficult task and therefore should focus on that task before attempting a more difficult replanning exercise.

One Member State said that the proposed 790–862MHz sub-band requires a band plan with a fixed duplex spacing, and making this sub-band available should be the top priority. It stated that equipment manufacturers have been working on flexible duplex technologies for decades, but they are still not in use. It is difficult to ask industry to invest in technologies that may only be required several years in the future. Flexible duplex technologies are therefore not suitable for the 790–862MHz sub-band, but may be considered in the longer term ("Putting too many things on the table may be counter productive, a balance is required").

One Member State suggested that it would be helpful for Member States to share the results of public consultations that they have conducted on the digital dividend. This would provide a better view of the European situation.

Annex A: Participating organisations from Member States, Norway and Switzerland

Country	*Organisation*
Austria	Regulatory Authority RTR-GmbH
Belgium	BIPT
Bulgaria	Permanent Representation of Bulgaria to the EU
Czech Republic	Czech Telecommunication Office
Denmark	National IT- and Telecom Agency
Estonia	Ministry of Economic Affairs and Communications
Finland	Ministry of Transport and Communications
Finland	Finnish Communications Regulatory Authority
France	CSA
France	ANFR
France	MEIE/DGCIS
France	ARCEP
France	Ministère de la Culture et de la Communication
Germany	Directors' Conference of the State Media Regulatory Authorities
Germany	Federal Ministry of Economics and Technology
Greece	EETT-Hellenic Telecommunications and Post Commission
Hungary	National Communications Authority
Italy	AGCOM
Latvia	Electronic Communications Office
Latvia	Ministry of Transport
Lithuania	PERM REP of LT
Lithuania	Communications regulatory authority
Luxembourg	ILR
Luxembourg	Service des Medias et des Communications
Malta	Malta Communications Authority

Netherlands	Ministry of Economic Affairs
Netherlands	Radio Communications Agency Netherlands
Republic of Ireland	DCENR
Republic of Ireland	Commission for Communications Regulation
Republic of Ireland	Broadcasting Commission of Ireland
Spain	Ministry of Industry, Tourism and Trade
Sweden	National Post an Telecom Agency
Sweden	Ministry of Enterprise
United Kingdom	Ofcom (UK)
Switzerland (non-EU country)	Ofcom (Switzerland)
Switzerland (non-EU country)	EFTA Surveillance Authority
Norway (non-EU country)	Norwegian Ministry of Cultural Affairs
Norway (non-EU country)	Norwegian Post and Telecommunications Authority
Norway (non-EU country)	Norwegian Ministry of Transport and Communications
Norway (non-EU country)	Norwegian Ministry of Government Administration and Reform

Figure 6: Organisations from Member States and non-EU countries that participated in the workshop

Annex G: Second Member States' workshop summary

The summary of the Member States' workshop on 26 June 2009, as issued on 15 July 2009 (reference number 13496-294), is attached below.

Report for the European Commission

‘Exploiting the digital dividend’ – a European approach

Summary of the second Member States’ workshop

15 July 2009

13496-294

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1 Introduction

This document is a summary of the second Member States' workshop held in Brussels on 26 June 2009 to discuss a coordinated European approach to the digital dividend. The workshop was part of the study being carried out for the European Commission ('the Commission') by a consortium comprising Analysys Mason, DotEcon and Hogan & Hartson. The workshop was hosted by the Commission, assisted by Mr Amit Nagpal (Partner, Analysys Mason), Mr Lee Sanders (Partner, Analysys Mason), Mr Toby Robertson (Managing Consultant, DotEcon) and Mr Gerry Oberst (Partner, Hogan & Hartson) from the consortium. The first Member States' workshop was held in Brussels on 15 April 2009; the summary of this workshop can be found in Annex B.

The second workshop had two principal objectives. First, to allow the consortium to present the socio-economic analysis conducted since the first Member States' workshop as well as a revised set of recommendations. Second, to allow Member States to participate in an open exchange of views on the scope, nature and timeframe of any recommended action.

The objective of this document is to provide a summary of the main views put forward by the Member States. It is not intended to provide a detailed account of all the issues discussed. Member States were also invited to submit written comments regarding the consortium's views; these comments are not included in this summary.

Participants attended from the Commission and 21 Member States. A list of participating organisations from Member States is given in Annex A. The consortium would like to thank all participants in the workshop for their involvement and their contributions to the discussions. The views expressed during the workshop are a formal input to the consortium's study.

For more information, please visit http://www.analysysmason.com/EC_digital_dividend_study. Here you can see an overview of the study and its timetable, find a schedule of events, download documents published during the study and contact the study team.

2 Agenda and participants

- **Opening address by the Commission**: A brief overview was given of the anticipated milestones in the Commission's work on the digital dividend. This overview stressed the importance of direct involvement from Member States in the development of EU-level action regarding the digital dividend, of which the second Member States' workshop was an important part.

- **Presentation by the consortium**: "Exploiting the digital dividend: Second Member States' workshop". In this presentation the consortium summarised the key findings from the first Member States' workshop.

- **Session 1**: High-level options for action and recommendations. This session was split into four parts; in the first three the consortium presented:

  - an overview of the economic analysis conducted since the first Member States' workshop
  - the high-level options for action regarding the digital dividend
  - the consortium's high-level recommendations.

  This was followed by an open discussion of the consortium's high-level recommendations chaired by Mr Amit Nagpal.

- **Session 2**: Detailed options for EU-level action and recommendations. This session was split into three parts, in the first two the consortium presented:

  - the options for specific actions for each sector (e.g. broadcasting, wireless broadband or SAB/SAP[1])
  - the consortium's specific recommendations.

  This was followed by an open discussion of the consortium's sector-specific recommendations chaired by Mr Amit Nagpal.

- **Closing comments from the Commission**: The participants were thanked for their valuable inputs and highlighted that the results of the study will be used for the Commission's impact assessment report on the digital dividend.

[1] **Services ancillary to broadcasting and programme making.**

The presentations given by the consortium in Sessions 1 and 2 were sections within the presentation titled: “Exploiting the digital dividend: Second Member States’ workshop”. This presentation can be downloaded from: http://www.analysysmason.com/EC_digital_dividend_study. This presentation represents the views of the consortium at the time it was presented in order to support the discussion with Member States; it does not reflect any official views from the European Commission.

3 Session 1 – High-level options for action and recommendations

3.1 Potential actions discussed

In Session 1 the consortium presented potential high-level actions that could be taken at the EU level. These potential actions were grouped into three areas:

Areas	*Potential high-level actions*
Creation of 790–862MHz sub-band suitable for medium/low-power services	Member States should be *required* to: • clear and award the 790–862MHz sub-band so that it may be used for wireless broadband • impose technical restrictions to prevent cross-border emissions exceeding medium-power uses (e.g. wireless broadband) • do so by 2015. Member States should be *encouraged* to: • award spectrum on a service- and technology-neutral basis • ensure that spectrum winners can deploy wireless broadband using the FDD band plan suggest by CEPT • if awarding specifically for wireless broadband, impose this band plan • share plans early with other Member States.
Further clearance of high-power DTT[2] from 470–862MHz	No action is currently needed to require or encourage further spectrum clearance. However, the consortium recommends a review in the short to medium term to: • assess the evidence to date and the likely evolution of wireless broadband and other uses, and estimate costs associated with partial or total clearance • decide whether it is appropriate to commence further clearance, and if so, its extent and timescale. Research may be initiated ahead of this review, including investigating costs and logistics and reviewing necessary platform upgrades.
Encouraging the use of interleaved spectrum	No action is needed to require or encourage Member States to reserve interleaved spectrum. No action is needed to encourage interleaved spectrum users to migrate to more spectrally efficient equipment or to use spectrum outside the 470–862MHz band. A review should be carried out alongside a review of possible further partial or total clearance of the 470–862MHz band.

Figure 1: Potential high-level actions discussed during Session 1

[2] Digital terrestrial television.

3.2 Summary of the main discussion

The presentations from the consortium led to an open discussion on the three areas given above; this discussion is summarised below:

Creation of the 790–862MHz sub-band suitable for medium/ low-power services

Member States generally welcomed the consortium's recommendations to require all Member States to clear and award the sub-band by 2015:

- One Member State mentioned its recent decision to clear the 790–862MHz sub-band. This decision was based on the momentum developing across Europe for the sub-band. Therefore, it fully supports the consortium's recommendation.

- A number of other Member States mentioned that they had either recently officially announced the clearance of the 790–862MHz sub-band, or that they were expecting to make such an announcement. They therefore also support this recommendation. Some also support adopting the band plan suggested by CEPT, as this would ease coordination across borders.

- One Member State suggested that it had preferred non-mandatory action to encourage the adoption of the sub-band, but that it would reconsider this in light of the consortium's recommendations.

- However, two Member States questioned the value of Member States being required to adopt the sub-band, given that increasing numbers of Member States are announcing decisions to adopt it. They suggested it would be interesting to see how the consortium's economic analysis would change if more Member States were assumed to adopt the sub-band in the Reference Scenario (the consortium's assumed scenario if no EU action is taken).

- One Member State highlighted that it is constrained in the use of the sub-band by military use of those frequencies in Russia. As a result, it cannot deploy FDD technologies in the sub-band. Only TDD technologies would be possible, but these are unlikely to be harmonised across Europe. It stated that Russia would like to share the cost of removing military use from the sub-band. Therefore, it would like to understand this cost.

- Another Member State highlighted that a recent summit had taken place between Baltic States, and following this, Russia's Communication Minister stated publicly for the first time that Russia may consider using the digital dividend for next-generation communications services.

Further clearance of high-power DTT from 470–862MHz

Although opinion was divided over the case for further clearance of the 470–862MHz band, most Member States expressed some concern about opening a debate on this subject at this time:

- Several Member States considered it premature to launch any EU-level activities to open up cleared spectrum below 790MHz. The demand for such spectrum is not sufficiently clear at the moment, as well as the possible mechanisms to do so without undermining the possibility of development of traditional terrestrial broadcasting
- One Member State expressed the view that care is needed in order that investigations into further clearance of the 470–862MHz band are not launched too early, and without clear long-term prospects. This may create uncertainty regarding the valuation of the 790−862MHz sub-band by operators
- In general, a large majority of Member States preferred to leave the option for further clearance until later, when initial steps will have shown the real benefits of EU coordination of the digital dividend.

Encouraging the use of interleaved spectrum

At this stage of the workshop only a few Member States commented on the recommendations regarding interleaved spectrum. (There was more discussion on this topic as part of Session 2):

- Two Member States noted that although the consortium does not recommend any action in the short term regarding interleaved spectrum, a solution to SAB/SAP's use of the 790–862MHz sub-band should be found.

4 Session 2 – Detailed options for action and recommendations

4.1 Potential sector-specific actions discussed

In Session 2 the consortium presented potential sector-specific actions that could be taken at the EU level. These potential actions relate to six topics:

Topic	*Potential options for action*
DTT	All sold DTT receivers in the EU are required to be MPEG-4 compatible as soon as possible and to conform to minimum interference rejection standards. Produce non-obligatory guidelines for the adoption of MPEG-4 transmission by Member States by 2015 Member States are requested to share deployment plans for MPEG-4 and DVB-T2. The Commission should make itself available as an neutral broker in negotiations between Member States, or between Member States and non-EU countries. A review takes place alongside a review of possible further partial or total clearance of the 470–862MHz band to consider: • including DVB-T2 in receivers • producing non-obligatory guidelines for DVB-T2 transmission • encouraging the adoption of advanced DTT deployment topologies
Broadcast mobile TV	No EU-level action is warranted for this use.
Wireless broadband	Research into the development of frequency-agile technologies should be encouraged. The Commission could consider options to prioritise flexible systems for future releases of digital dividend spectrum. However, it should reserve a decision on whether to implement such a priority until it is sure that there is a robust business case for flexible systems.
SAB/SAP	Research is undertaken to understand the optimal frequency range for dedicated channels. Guidelines could then be published to encourage Member States to use this range if making a dedicated channel available. No action is taken now to encourage SAB/SAP users to either migrate to digital equipment or to migrate to other bands. However, such action should be reconsidered alongside a review of possible further partial or total clearance of the 470–862MHz band.
PPDR[3]	No EU-level action is warranted for this use.

[3] Public protection and disaster relief.

Topic	*Potential options for action*
Cognitive technologies	A common approach is developed regarding the technical parameters (including frequency ranges) and regulatory conditions for the introduction of cognitive technologies in the 470–862MHz band. Member States are not required to either adopt this position or permit cognitive technologies.

Figure 2: Potential specific actions discussed during Session 2

4.2 Summary of the main discussion

The presentation from the consortium led to an open discussion on the six topics presented above; this discussion is summarised below:

DTT

A number of Member States fully supported the recommendation to define minimum interference rejection standards for DTT receivers:

- One Member State mentioned that standards should not be limited to interference rejection, they should also include an assessment of quality.

Member States were divided in their opinion about the consortium's recommendation to require all receivers to be MPEG-4 compatible:

- One Member State highlighted that there are a number of variants to the MPEG-4 standard; therefore, picking the appropriate variant may be complex.
- Another Member State suggested that requiring DTT receivers to adopt one technology may hinder further development in compression technologies. It emphasised that MPEG-4 is not the "end of the line", therefore, care should be taken over adopting legal requirements that would need to be amended at some point in the future.
- Some Member States stressed that most DTT receivers currently being produced are MPEG-4 compatible, and that market forces are already leading to the full adoption of MPEG-4 receivers. Therefore, they do not see a need for EU-level action.
- However, one Member State emphasised that the actions of some Member States to mandate MPEG-4 in all sold receivers may be the reason that the broadcasting industry is moving towards MPEG-4. Therefore, EU-level action may be beneficial.

- Another emphasised that the cheapest MPEG-4 receiver available in its country costs EUR70. Therefore, it supported action to require all sold receivers to be MPEG-4 compatible, as this would reduce the cost of such receivers.

- One Member State stated that it is going to require that all TV sets with screens larger than 21 inches are MPEG-4 compatible.

- Another mentioned that one motivation for the use of MPEG-4 is improving broadcasting efficiency; freeing up spectrum for other uses is therefore not the only motivation.

- One Member State asked the Commission to provide a legal framework to ensure it is possible to mandate MPEG-4 in receivers at a national level without any infringement of European law.

Regarding DTT transmission, most agreed with the consortium's recommendations not to take any immediate action, allowing broadcasters to choose the transmission technology that suits them best:

- One Member State mentioned that it recently identified two multiplexes for HD transmission. Broadcasters are being allowed to use MPEG-4 or DVB-T2 technologies as they see fit.

- Another Member State stressed that in its country there is no specific multiplex for HD transmission, rather the broadcaster can decide to launch HD when appropriate, using whatever technologies it feels is appropriate.

Member States generally agreed with the consortium's recommendation that no specific action should be taken in the short term regarding DTT deployment topologies:

- One Member State stressed that national SFNs are not the only way to ensure the efficient use of spectrum, citing the example of France where 14 multiplexes have been identified using MFN and regional SFN topologies.

- One Member State mentioned that national SFNs do not always free spectrum for other uses, and that they are extremely costly to implement.

- One Member State highlighted that a national SFN cannot currently be deployed because transmitters are too far away from each other. One solution is to implement DVB-T2 but this would result in high switching costs for broadcasters and consumers.

Broadcast mobile TV

All views expressed supported the recommendation that no EU-level action is warranted regarding broadcast mobile TV.

Wireless broadband

All indications were that the consortium's recommendations regarding wireless broadband are acceptable:

- One Member State suggested that encouraging frequency-agile technologies should also apply to SAB/SAP equipment. It should also be noted that SAB/SAP equipment could also use cognitive technologies.

SAB/SAP

Only minor comments were made about the consortium's recommendation to provide guidelines for a common frequency range for dedicated SAB/SAP channels, but mostly opposed the recommendations:

- One Member State said that it had concerns regarding a common frequency range for SAB/SAP, as there are specific national factors when determining the best frequency for dedicated channels. Further, given the small-scale benefits associated with a common frequency range, it thought it was not worthwhile taking action.
- One Member State preferred the idea of trying to increase the tuning range of SAB/SAP equipment rather than identifying a common frequency range across the EU.

PPDR

A number of Member States mentioned that there is no clear requirement for further spectrum for PPDR in their country:

- One Member State highlighted that the discussion regarding PPDR goes beyond the scope of the digital dividend debate, and that the Commission should also consider other current studies on this issue to make an informed decision. It also stated that although there could be a need to allocate further spectrum to this use, it should not be in the 470–862MHz band.

Cognitive technologies

A number of Member States were in favour of the consortium's recommendation to develop a common approach to the introduction of cognitive technologies in the 470–862MHz band:

- One Member State in favour of developing a common approach stated that although it may appear advantageous to use the recommendations of the American regulator (FCC) as a starting point, its own research had shown that the FCC's proposal is not applicable to the situation in Europe.

- Another Member State agreed with the development of common guidelines, but questioned whether developing a common approach was appropriate.

- One Member State highlighted that the Commission should also consider other current studies on such issue (e.g. those by CEPT) in order to make an informed decision.

- One Member State suggested that a "top-down" approach would be more appropriate, i.e. considering the role of cognitive technologies across a wider frequency range than just the 470–862MHz band.

Annex A: Participating organisations from Member States

Country	*Organisation*
Austria	BMVIT
Austria	Austrian Regulatory Authority for Broadcasting and Telecommunications
Czech Republic	Czech Telecommunication Office
Denmark	NITA
Estonia	Ministry of Economic Affairs and Communications
Finland	Permanent Representation
Finland	Finnish Communications Regulatory Authority
France	Directorate for Media Development
France	ANFR
France	CSA (Conseil sup&rieur de l'audiovisuel29
France	ARCEP
France	MEIE/DGCIS
Germany	Bundesnetzagentur
Greece	EETT-Hellenic Telecommunications and Post Commission
Hungary	National Communications Authority
Italy	AGCOM
Latvia	Electronic Communications Office
Lithuania	Communications regulatory authority
Luxembourg	Représentation permanente du Luxembourg auprès de l'UE
Malta	Malta Communications Authority
Netherlands	Ministry of Economic Affairs
Portugal	ANACOM
Republic of Ireland	Commission for Communications Regulation
Republic of Ireland	Broadcasting Commission of Ireland
Slovakia	Telecommunication Office of the Slovak Republic
Spain	Ministry of Industry, Tourism and Trade
Sweden	Ministry of Enterprise

Sweden	PTS
United Kingdom	Ofcom

Figure 3: Organisations that participated in the second Member States' workshop

Annex B: Summary of the first Member States' workshop

The following document (reference number 13496-193) is a summary of the first Member States' workshop held on 15 April 2009 in Brussels.