# CEPT Report 22

Report B from CEPT to the European Commission
in response to the Mandate on:

"Technical considerations regarding
harmonisation options for the Digital Dividend"

"Technical Feasibility of Harmonising a Sub-band of Bands IV and V
for Fixed/Mobile Applications (including uplinks),
minimising the Impact on GE06"

Final Report on 6 July 2007 by the:

CEPT ECC
Electronic Communications Committee

Electronic Communications Committee (ECC)
within the European Conference of Postal and Telecommunications Administrations (CEPT)

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## 0 EXECUTIVE SUMMARY

### Justification

Under Report 22 (CEPT Report B in response to the 1st Mandate on Digital Dividend), the CEPT was requested to address the possibility of harmonising a sub-band for mobile communication applications (i.e. including uplinks), assuming zero or minimum impact on GE-06 and with a view of deployment of such services throughout the EU. As requested by the Commission, the CEPT took the utmost account of Community law applicable and of the principles of technological neutrality, non-discrimination and proportionality insofar as technically possible, as well as the RSPG Opinion on the digital dividend.

### Findings

ECCTG4 concluded that the harmonisation of a sub-band of the UHF band for mobile communication applications (i.e. including uplinks) is feasible from a technical, regulatory and administrative point of view, provided that it is not made mandatory and any decision about use of the harmonised sub-band is left to individual Administrations, within the framework of the GE-06 Agreement, and without prejudice to existing national licence obligations.

ECC/TG4 concluded that the preferred sub-band for such harmonisation is the upper part of the UHF band, and should include, as a minimum, the range of channels 62 - 69 (798 - 862 MHz).The use of the harmonised sub-band for mobile communication applications should be subject to harmonised technical arrangements (e.g. band plans, options for the location of any duplex gap and spacing, and any guard bands required, for both FDD and TDD use). Appropriate technical arrangements will be set out in a subsequent Report of ECC/TG4. They should be as flexible as possible, within the limits of what is technically feasible, to facilitate the adoption of the harmonised sub-band by as many Administrations as possible, acknowledging the differing national circumstances that will be faced by individual Administrations.

### Consequences

It should be noted that the level of interference likely to arise from the implementation of GE-06 plan entries makes it virtually impossible for any country to start using a harmonised sub-band for mobile communications applications without the agreement of neighbouring countries, noting that these may not be members of the CEPT or EU/EEC in all cases. Implementation of this harmonised sub-band will therefore require bilateral or multilateral negotiations, under the procedures of the GE-06 Agreement, which have been designed to ensure equitable access to spectrum by all administrations. This process, although time consuming, will be required to maintain equitable access for all administrations, irrespective of the impact of any change of use of the harmonised sub-band on their existing broadcasting layers in the GE-06 Plan, by enabling them to either reconstitute those layers, or balance any loss of spectrum for broadcasting with the gain of spectrum for other services.

Administrations must continue to have the flexibility to implement, within this sub-band, broadcasting services or other services under the umbrella of broadcasting, in accordance with the GE-06 Agreement and Declaration 42.

### Issues requiring further studies

The use of the harmonised sub-band for mobile communication applications should be subject to harmonised technical arrangements. Appropriate technical arrangements will be set out in a subsequent Report of ECC/TG4.

Essential technical issues needing further studies in order to define the appropriate technical arrangements are: - band plans; - options for the size and the location of any duplex gap; - options for the duplex spacing; - guard bands required (for both FDD and TDD use).

Also, sharing studies are needed between mobile/fixed services and other services to which the sub-band is allocated according the RR in order to enable a new primary allocation for fixed/mobile services in this band.

**Reservations**

The administrations of Belgium, Portugal, Russia and Spain presented reservations to this report. Their statements can be found in Annex A7.

**Proposed Liaison Statement to CPG**

ECC/TG4 at its 4th meeting in Antalya 11-14 June prepared a liaison statement to the CPG. ECC/TG4 states that it is continuing technical studies for the sharing between broadcasting and other services. ECC/TG4 stresses that the studies in ECC/TG4 do not address the more complex situations which would arise under Agenda Item 1.4 of WRC 07.

The full text of the Liaison Statement can be found in Annex A8.

**Glossary of Terms (Abbreviations)**

| | |
|---|---|
| 3GPP | 3rd Generation Partnership Project |
| ARNS | Aeronautical Radionavigation Service |
| Band III | VHF Channels 5 - 12 (174 - 230 MHz) |
| Band IV | UHF -21 - 34 (470 - 582 MHz) |
| Band V | UHF Channels 35 - 69 (582 - 862 MHz) |
| CDMA | Code Division Multiple Access |
| CEPT | European Conference of Postal and Telecommunications Administrations |
| DVB-H | Digital Video Broadcasting to Handheld |
| DVB-T | Digital Video Broadcasting – Terrestrial |
| EC | European Commission |
| ECC | Electronic Communications Committee |
| ETSI | European Telecommunications Standards Institute |
| FDD | Frequency Division Duplex |
| FDMA | Frequency Division Multiple Access |
| GE-06 | The Geneva 2006 Agreement and Plan |
| IMT | International Mobile Telecommunications |
| ITU | International Telecommunications Union |
| ITU-R | ITU Radiocommunication sector |
| LTE | Long Term Evolution |
| OFDMA | Orthogonal Frequency-Division Multiple Access |
| PWMS | Professional Wireless Microphone Systems |
| RN | Reference Network |
| RPC | Reference Planning Configuration |
| RR | Radio Regulations |
| RRC-06 | Regional Radiocommunication Conference, Geneva 2006 |
| SAB/SAP | Services Ancillary to Broadcasting and Programme making |
| TDD | Time Division Duplex |
| TDMA | Time Division Multiple Access |
| UHF | Ultra High Frequency, within the context of this CEPT Report refers to 470 - 862 MHz as covered by the GE06 Agreement |
| UMTS | Universal Mobile Telecommunications System |
| VHF | Very High Frequency |
| WiMAX | Worldwide Interoperability for Microwave Access |
| Wi-RAN | Wireless Rolling Area Network |
| WRC | World Radio Conference |

# 1 INTRODUCTION

Historically the UHF band (470 - 862 MHz) has been allocated to broadcasting on a primary basis. The regulatory and technical frameworks for digital VHF and UHF broadcast transmissions are established by the Geneva 2006 (GE06) Agreement [1]. Digital broadcast transmissions make more efficient use (estimated to be 4x more efficient) of spectrum in comparison with analogue transmissions and therefore existing analogue transmissions in the UHF 470 - 862 MHz Band could be fit, digitally, into a smaller part of the spectrum, leaving some of the released spectrum (the 'digital dividend') for broadcast or other terrestrial applications.

The RSPG in its Opinion #7 “EU spectrum policy implications of the digital dividend” [2] considers several potential non-broadcasting users of the digital dividend. Among new services fostering growth and innovation, broadband fixed/mobile services, such as IMT, are seeking access to the UHF spectrum to facilitate coverage provisions.

Throughout the present Report, fixed/mobile applications are understood as two-way communications systems (such as mobile communications using cellular or broadband wireless access technologies) that require and make use of both downlink and uplink transmission paths. It should be noted here that the uplink paths are not covered and, consequently, not protected by the GE06 Agreement, because such use is not in accordance with the current allocation for this frequency band in the Radio Regulations.

Another related issue is connected to potential adjacent channel interference from fixed/mobile services into DVB-T service. In fact, the uplink services operating on adjacent channels may cause specific interference problems due to the fact that they originate from a mobile device and may not in general enable the operator to mitigate any interference being caused by techniques that would be suitable for fixed installations (as described for high field-strength downlink applications in Report A to the ECC [3]).

This Report studies the possibility of harmonising, or co-allocating, a sub-band for fixed/mobile communication applications, assuming zero or minimum impact on the GE06 Plan. The report is prepared in response to the mandate issued by the EC.

## 1.1 Motivation

Mobile communication services could provide substantial value to the economy of European countries namely they could lead to significant benefits for consumers and citizens in terms of provision of mobile broadband services:

- improvements in the quality of mobile broadband services, for example higher data rate services, with good coverage inside buildings, particularly in main population areas;
- extension of such services into rural areas.

However, the suitability of UHF spectrum for additional mobile communication capacity is substantially dependent on the cost of making handsets that can operate at UHF frequencies, as well as at the frequencies already used. Unless there is a market expectation that the available UHF frequencies will be used for mobile communication services across a sufficiently large market, the benefits resulting from harmonised equipment are reduced. In particular, industry has responded to a consultation organized by a CEPT administration that sufficient economies of scale would require a total addressable market of at least 100 million mobile subscribers. However, this minimum addressable market of 100 million would only cover basic development and engineering costs of a new spectrum band variant and the benefits of lower equipment costs gained from economies of scale will materialize when the addressable market is much more than 100 million.

# 2 SPECTRUM ISSUES IN RELATION TO THE IMPLEMENTATION OF FIXED/MOBILE APPLICATIONS IN THE BAND 470 - 862 MHz

## 2.1 Overview of current usage of the band 470 - 862 MHz

The UHF band is allocated in Europe for broadcasting as well as for other terrestrial services on a primary basis. In the last 40 years, it has been mainly and is still widely used for analogue television. In most countries, there are 3 to 4 nationwide programs on-air, often complemented by some local or regional programs.

DVB-T is currently introduced in many European countries, and other countries are planning to launch DVB-T within 2007/2008. It can be expected that there will be far more than many tens of millions of DVB-T receivers on the European market by mid 2007. In some countries, DVB-T networks of 6 multiplexes or more have been operating now for some years, and licences were granted for more than 20 years. In the Netherlands, analogue TV already has been switched off completely by the end of 2006. A number of countries, where DVB-T is yet to start, are considering or have already decided to use MPEG-4 with DVB-T. However countries that have already introduced DVB-T may need temporarily to use additional layers for introducing MPEG-4 as well as to facilitate an associated transition period. DVB-H services were launched in some countries in 2006 or planned to be launched in 2007/2008.

Under the GE06 Agreement, the UHF broadcast band in Europe is planned for DVB-T using 8 MHz channel spacing. Each country has been allocated a total of 7 to 8 full-coverage layers in the GE06 digital Plan (see also Report A [3]). Most countries have planned for protection of portable outdoor reception and some largely for fixed reception. It should be noted that the GE06 allocations are scattered on a non-contiguous basis across the whole band 470 - 862 MHz. The Plan entries of GE06 will only become fully available after analogue switch-off. The European Union proposes to switch off analogue TV before 2012. According to the GE06 Agreement [1], analogue TV will have no right of protection after 17 June 2015.

Many European countries use the band 470 - 862 MHz or parts of it for primary terrestrial services other than broadcasting. The 645 - 862 MHz band is allocated in a number of CEPT countries to aeronautical radio navigation services (ARNS) on a primary basis, in accordance with No. 5.312 of the Radio Regulations (RR) and the band 790 - 862 MHz is allocated in a number of CEPT countries to mobile service on a primary basis, in accordance with No. 5.316 of RR. Assignments to these services have been taken into account at the RRC-06 when requested by the Administrations concerned. In some countries, it is planned to move some of these other primary terrestrial services into other bands. Protection of other primary services may cause restrictions on the implementation of fixed/mobile applications in some CEPT countries.

In addition, there are services in Bands IV/V with secondary status in the RR. On a national basis, these services could be of great importance, for instance the Radio Astronomy Service in channel 38, defence and Services Ancillary to Broadcasting and Programme making (SAB/SAP). An increase in the number of broadcast programmes and of non-broadcast applications, e.g. sporting events and multimedia programme productions, leads also to an increase in the demand for SAB/SAP services (e.g. Professional Wireless Microphone Systems, or PWMS; see also Report A). Many of these services may be affected or constrained by any development of the band.

## 2.2 Technologies and spectrum requirements for fixed/mobile applications

Depending of the technology used, mobile communications generally require spectrum that is either “paired” (frequency division duplex (FDD)) or “unpaired” (time division duplex (TDD)). FDD system assignments are made using paired channels (of a size varying with the technology used), which are not adjacent to one another, but are sufficiently separated (duplex gap) in the spectrum to avoid interference between them. For TDD systems, a single frequency channel is used to transmit signals in both the downlink and uplink directions. If TDD systems are not synchronised there is a need for a guard band between adjacent channels. Inherently, FDD is more suitable for coverage provision in mobile communication applications.

Today in CEPT, IMT-2000 band plans are made using 5 MHz channel spacing, which is consistent with current IMT-2000 technology characteristics. However, channel spacing other than 5 MHz might offer some benefits in coordinating with other services (e.g. 8 MHz spacing consistent with DTT planning). It is also noted that future evolution of IMT technologies is expected to introduce wider and narrower channel widths and

configurations than 5 MHz (e.g. 3G LTE considering 10 MHz and 20 MHz channels as well as smaller spacing down to 1.4 MHz).A working FDD system consists of an uplink plus a downlink with a duplex separation between them and a duplex gap. In a practical implementation several uplinks and downlinks are grouped together either side of the duplex gap. Depending on the system characteristics the actual spectrum requirements might vary significantly.

The European Commission has conducted a study on "Future Mobile Communications Services and Markets" (FMS)[1] addressing the expected market development of mobile communication in the European Union for the 2010-2020 timeframe. The results of these studies have been used for developing ITU-R Report M.2078 on "Spectrum requirements for the future development of IMT-2000 and IMT-Advanced" to describe the European situation.

ITU-R Report M.2078 estimates a range of spectrum requirements for the future development of IMT-2000 and IMT-Advanced depending on the user density and number of operators of the relevant market. A detailed analysis of the results of ITU-R Report M.2078 [4] considered in ECC PT1 indicates an additional spectrum requirement of 95 MHz (raw spectrum without guard bands) for wide area deployment of IMT-2000 including rural and sparsely populated areas for the timeframe until 2020.

Several studies have been conducted showing the benefits that could be obtained by an additional 80 MHz, plus 10 MHz of a duplex gap, a total 90 MHz of harmonised spectrum in the UHF band for mobile communications. This amount of spectrum would provide more than the capacity of the existing GSM900 band. The benefits would be particularly important to improve mobile communications in rural areas.

As an example, on a national scale with 2x10 MHz per operator this would provide spectrum for 4 operators in 90 MHz including the duplex gap. The number of operators and bandwidth per operator can be varied according to local and national needs.

### 2.3 Potential economic value of identifying a harmonised sub-band

There is a need for manufacturers and operators to be able to address a large market in order to achieve the necessary economies of scale for equipment manufacture, particularly user terminals. This would require a common approach across multiple countries, but may not necessarily require frequency harmonisation across the whole of the EU.

Industry stakeholders have shown significant interest in the available UHF spectrum for mobile communication services, but this interest is dependent on a number of factors, including the harmonisation of this spectrum for mobile communication use in Europe and the related issue of economies of scale in handsets.

In the UK stakeholder meetings have broadly confirmed these positions, but have further emphasised the importance of harmonisation and of maintaining flexibility in the specific band plans. These discussions in the UK have also suggested that sufficient economies of scale would require a total addressable market of at least 100 million mobile subscribers, implying harmonisation amongst the UK plus at least one country with a population in excess of 40 million, or several (four or more) countries of lower population. However, this minimum addressable market of 100 million would only cover basic development and engineering costs of a new spectrum band variant and the benefits of lower equipment costs gained from economies of scale will materialize when the addressable market is much more than 100 million.

Harmonisation of spectrum has an impact on the cost and availability of terminals. The development of multi-band terminals, resulting from a lack of harmonisation, has also an impact on the handset performance, such as more insertion loss and lower sensitivity, and on its complexity.

According to a GSM Association study (Annex A3), there are significant costs involved for manufacturers when they consider the need to incorporate extra frequency bands in a mobile handset. The exact amount varies and depends on assumptions made (such as the number of vendors a market needs to support). The study concludes that there are substantial cost benefits to be had from such common frequency bands, at least on a regional basis (i.e. EU or CEPT wide).

The GSMA study concludes that there are significant economies of scale to be had in the production of terminals with internationally identified common frequency bands. Without the identification of common bands, handset costs could be set prohibitively high, and the effect will be a significant reduction in the take-up of any mobile service. This will harm not only consumers and industry directly, but also the benefits that mobile offers to economies as a vital infrastructure. Therefore, adequate consideration should be given to the European and

[1] http://fms.jrc.es/pages/about.htm

worldwide situation with regards to the spectrum used for mobile services in order to ensure that this spectrum is available in the largest possible addressable market which would then drive costs down.

## 2.4 Potential band plan options

This section discusses the generic options for selecting a harmonised band plan. It is not based upon the usage of the UHF spectrum by individual nations, but rather identifies the generic constraints which may impact on the selection of favoured options.

All possible options will require feasibility studies by Administrations into the impacts on their national requirements and plans, both for the GE06 and other services.

### *2.4.1 Choice of segment size*

Section 2.2 discusses the quantity of spectrum which may be required for viable harmonisation of fixed-mobile application. It should not be too large, since this impacts on the efficiency of mobile antennas capable of tuning across the sub-band. It should, however, be large enough to support sufficient capacity and number of operators to generate some value in each nation which implements it. It should also be large enough to provide the potential for a sufficient market size to achieve the benefits of harmonisation (section 2.3), consistent with the need to protect existing services in the band. It should not be so large that it would require substantial modifications to the GE06 Plan.

For the purpose of illustration only and noting that these scenarios are not exhaustive, the band 470 - 862 MHz is divided into four *segments* of at least 2 x 40 MHz, plus guard bands as appropriate. Each segment is considered to include all guard bands required to provide adequate protection, both internally to the fixed-mobile services and externally to protect other services. The segments may potentially support FDD, TDD, or a combination of both.

### *2.4.2 Identify four segments*

The four segments selected for further study are identified in Table 2.1.

| Segment | Lowest Channel | Highest Channel | # channels/bandwidth |
|---|---|---|---|
| Segment A | 21 | 32 | 12 channels/96 MHz |
| Segment B | 31 | 44 | 14 channels/112 MHz |
| Segment C | 45 | 58 | 14 channels/112 MHz |
| Segment D | 58 | 69 | 12 channels/96 MHz |

**Table 2.1: Potential band segments**

For illustrative purposes, one possible band plan is given for each of the four segments in Figure 2.1. These illustrations assume that, in general, no guard band is required to protect other services from mobile downlinks (the protection of Broadcasting services in the adjacent channel and beyond should be ensured by careful fixed/mobile planning and applying the mitigation techniques described in Report A), but that two channels are required to provide protection for and from mobile uplinks.

Segment A: 2x40 MHz within channels 21 to 32 + 2x8 MHz Duplex

| Ch 21 | Ch 22 | Ch 23 | Ch 24 | Ch 25 | Ch 26 | Ch 27 | Ch 28 | Ch 29 | Ch 30 | Ch 31 | Ch 32 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz |
| Uplink | | | | | Duplex | | | | | | |
| | | | | | | | Downlink | | | | |

Segment B: 2x40 MHz within channels 31 to 44 + 2x8 MHz Duplex + 2x8 MHz Guard Band

| Ch 31 | Ch 32 | Ch 33 | Ch 34 | Ch 35 | Ch 36 | Ch 37 | Ch 38 | Ch 39 | Ch 40 | Ch 41 | Ch 42 | Ch 43 | Ch 44 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz |
| Guard band | Uplink | | | | | | Duplex | | | | | | |
| | | | | | | | | | Downlink | | | | |

Segment C: 2x40 MHz within channels 45 to 58 + 2x8 MHz Duplex + 2x8 MHz Guard Band

| Ch 45 | Ch 46 | Ch 47 | Ch 48 | Ch 49 | Ch 50 | Ch 51 | Ch 52 | Ch 53 | Ch 54 | Ch 55 | Ch 56 | Ch 57 | Ch 58 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz |
| Downlink | | | | | Duplex | | | | | | | Guard band | |
| | | | | | | | Uplink | | | | | | |

Segment D: 2x40 MHz within channels 58 to 69 + 2x8 MHz Duplex

| Ch 58 | Ch 59 | Ch 60 | Ch 61 | Ch 62 | Ch 63 | Ch 64 | Ch 65 | Ch 66 | Ch 67 | Ch 68 | Ch 69 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz | 8 MHz |
| Downlink | | | | | Duplex | | | | | | |
| | | | | | | | Uplink | | | | |

**Figure 2.1: Example band plans in FDD configuration for potential frequency segments for fixed/mobile services in the Band 470 - 862 MHz**.

An asymmetric band plan with increased capacity for downlink duplex can also be foreseen. For example, a 32 MHz uplink duplex could be paired with 48 MHz downlink duplex. An asymmetric band plan allows supporting asymmetrical traffic. With the development of data traffic (video streaming, TV, VoD, web surfing, rings tones downloading, games,..), the downloading traffic is increasing more rapidly than the uplink traffic.

Also variants of these segments may be considered, e.g. for Segment C, using channels 49 to 62 would make it possible with channel arrangements similar to what is used in the USA.

### *2.4.3 Potential usage of segments*

Given the four segments previously defined, there are three generic options for utilising the segments to support fixed-mobile services:

1. Single segment including uplink and downlink within one segment. The example band plans illustrated in 2.4.2 are all of this type.
2. Paired segments, potentially widely separated, with uplinks in one segment (e.g. channels 21 - 25 in segment A) and downlinks in the other (e.g. channels 52-56 in segment C). In this case only part of the segments would be needed to provide a like-for-like comparison with the other options..
3. Hybrid use of segments, where links in one direction are provided in 470 - 862 MHz and the links in the other direction are provided in another frequency band (such as 900 MHz, 2.6 GHz etc.)

Note that Option 3 is always an FDD option, while the other options could include, FDD, TDD or a mixture.

Option 1 minimises the tuning range required from handsets and therefore maximises the handset antenna efficiency.

Option 2 increases the tuning range required by mobiles. The very wide duplex spacing may cause difficulties in mobility management because downlink measurements by the mobile will not provide a good representation of the uplink channel conditions.

Option 3 requires that other bands are available for assignment to fixed-mobile services. This may reduce the available harmonisation benefits. The very wide duplex spacing may cause difficulties in mobility management because downlink measurements by the mobile will not provide a good representation of the uplink channel conditions. If the uplink is provided in another frequency band, this option would not require guard bands in the 470 - 862 MHz band; in addition, it would not impose frequency planning constraints to protect uplinks in case the 470 - 862 MHz band is used for digital broadcasting services in neighbouring countries.

### *2.4.4 Considerations for selection of segments*

Segment D has a generic advantage for selecting it over other segments, independent of the particular national constraints. It is close to the widespread use of mobile services at 900 MHz. This may allow some reuse/reengineering of 900 MHz components in handsets and base stations, increasing the potential harmonisation benefits. It may also allow a single mobile antenna to tune across the whole of segment D and 900 MHz. This approach would also be of interest using Option 3, where the fixed/mobile downlink would be situated in the upper part of the 470 - 862 MHz band and the uplink above 900 MHz.

Moreover, most of CEPT countries are of the opinion that a range of a minimum 8 TV channels should be identified, e.g. channel 62 – 69, in order to allow for benefits related to sub-band harmonisation and introduction of mobile communication services.

As highlighted in Annex A4, the variation of the propagation loss across the band is roughly offset by antenna efficiency and other issues, so this does not provide any other significant reason for selection of one segment over another.

### *2.4.5 National Issues regarding selection of sub-band*

National issues and constraints are the critical factor in selecting a particular segment and the way in which the segments are utilised. Annex A1 provides details of the current and future situation regarding the 470 - 862 MHz band in various countries.

The histogram in Figure 2.2 summarises the starting distribution of plan entries across the usage of the UHF band (source: EBU Tech Rev, Oct 2006 [5]).

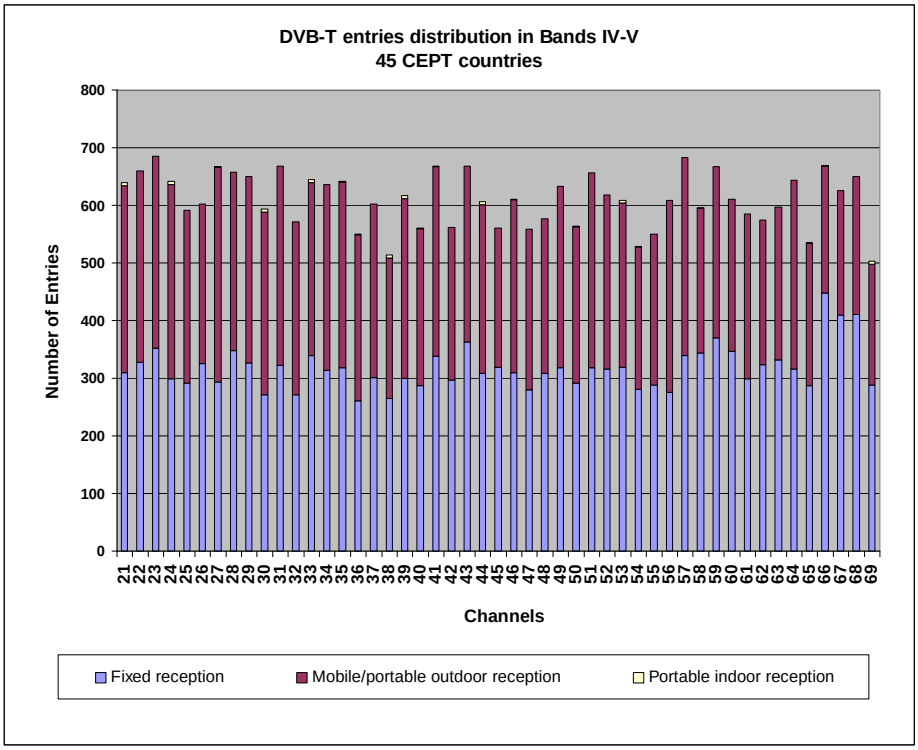



**Figure 2.2: Starting distribution of the GE06 Plan entries in Bands IV/V for DVB-T and for the different reception modes, in the CEPT countries**

## 2.5 Regulatory aspects and issues in relation to the WRC-07 and/or WRC-11

Use of the Band 470 - 862 MHz by fixed/mobile services will have to comply with the international obligations arising from the GE06 Agreement [1] and the ITU Radio Regulations [5]. Radio Regulations are subject to modifications at each ITU WRC.

According to the Table of Frequency Allocations of the Radio Regulations [6] the frequencies in the Band 470 - 862 MHz are currently allocated on a primary basis to the broadcasting and other services in Region 1 noting footnote 5.316. Member states cannot assign a frequency to a station contrary to the allocation for that frequency in the Table, unless the station when using the assignment does not cause harmful interference to, and does not claim protection from harmful interference from, a station operating in another ITU member state in accordance with the relevant allocation in the Table and the other provisions of the Radio Regulations.

Some of the member states took steps to allow additional flexibility in the use of the GE06 frequencies being discussed, via a Declaration under which they formally declared that their GE06 Plan entries might be used for other broadcasting uses or other terrestrial applications besides broadcasting with characteristics that may be different from those appearing in the GE06 Plan, and the signatories undertook that any such use would be protected from harmful interference to the levels defined in the GE06 Plan. This is on condition that any such use must still conform to the 'envelope' of the relevant GE06 Plan entry.

If the spectrum is assigned for fixed/mobile service, then under the Declaration this is permissible so long as the use does not breach the 'envelope' defined in the GE06 Plan. However, it is important to note a potential problem with the uplink path of fixed/mobile services. The downlink path would be protected between RRC member states in so far as it accords with the relevant 'envelope' in the GE06 Plan.

Uplinks are not covered by the GE06 Agreement. Because such use is not in accordance with the allocation for 470 - 862 MHz in the Radio Regulations, and there is no provision for notifying mobile transmitting stations in the GE06 Agreement, it is not possible to obtain protection by registering an assignment for this use in the Register of the ITU. Nevertheless, the receiving station of a mobile uplink would only be protected from interference from other countries to the same extent as a broadcasting receiver at the same location and frequency (protection level defined at a height above ground level of 10m).

In order to protect the uplink path it would be necessary to change the allocation for the Band 470 - 862 MHz at a World Radio Conference in 2007 or 2011 taking into account the protection of services, to which the band is already allocated, from fixed/mobile services. In addition, frequency planning restrictions and coordination rules would have to be imposed on both the mobile and the broadcasting services in order to protect the uplink.

This issue is under discussion within CEPT in the framework of WRC-07 preparation. However, it is noted that RSPG has concluded that the studies required "to consider and possibly identify sub-band(s) with the objective of developing a non-mandatory decision at European level to facilitate the use of fixed/mobile applications (including uplinks), under certain harmonized conditions to be defined and adopted in the 2007-2010 timeframe" should be pursued "without further delay and irrespective of any WRC-07 decisions".

## 3 ASSESSMENT OF THE FEASIBILITY OF SHARING THE BAND 470 - 862 MHz

This section addresses sharing, i.e. the co-existence between DVB-T and Fixed/mobile services. However, it is noted that other services, such as aeronautical radio navigation and radio astronomy, need to be protected against harmful interferences in some countries.

### 3.1 Interference scenarios and planning constrains

Sharing between DVB-T and fixed/mobile services in the Band 470 - 862 MHz implies the consideration of the following interference scenarios:

- Co-channel interference between fixed/mobile and DVB-T networks ;
- Adjacent channel interference between fixed/mobile and DVB-T networks.

Adjacent channel interference should be considered on the first adjacent channels (N±1) and beyond (N±M, M>1).

Figure 3.1 shows schematically interference pathways for the scenarios above.

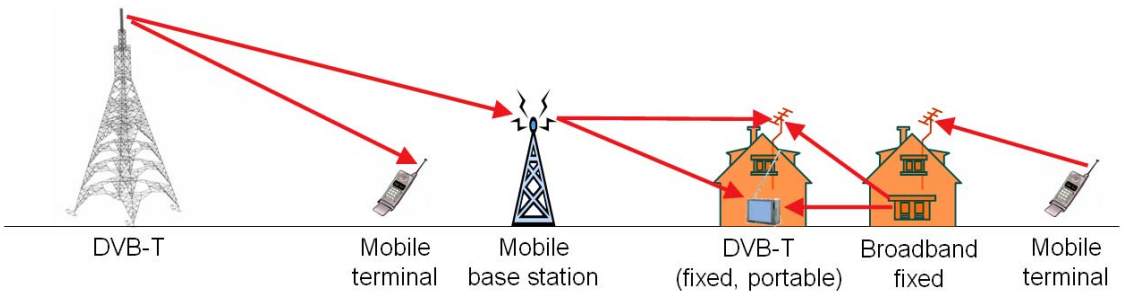



**Figure 3.1: Interference scenarios for sharing between DVB-T and fixed/mobile services**

It is important to point out that in order to satisfy commercial objectives of fixed/mobile applications both the downlink and uplink paths need to be protected to an acceptable level from incoming interference generated by DTT. And it is also important to note that in order to satisfy commercial objectives of broadcast applications, the broadcast transmissions need to be protected to an acceptable level from incoming interference generated by fixed/mobile downlink and uplink paths.

## 3.2 Overview of available sharing studies (to be supplemented)

The preliminary results of ITU-R and national studies are presented below. However, due to the complexity of the issue and because of the still ongoing work these should not be taken as definite conclusions on relevant compatibility aspects.

Some studies on sharing and compatibility between DVB and IMT have been conducted within ITU-R. In particular, Working Party 8F issued a Draft New Report on this subject. However, Working Party 6E has pointed out some limitations of these studies and indicated a number of matters than need to be addressed before concluding on this issue and drawing any recommendations.

ITU-R studies are also complemented by some national investigations. Details of these studies can be found in Annex A2.

Moreover, sharing studies between fixed/mobile services and other services (in particularly, ARNS) are required as well.

### *3.2.1 Co-channel Interference*

With regard to the co-channel interference scenarios it should be noted that a specific situation of re-using GE06 Plan entries for fixed/mobile applications is to be considered here, e.g. these application need to be operated under the constraints of the existing Plan. In fact, the GE06 Agreement has been optimized for digital terrestrial broadcasting by creating a de facto harmonization of DVB-T planning criteria and parameters. In the Band 470 - 862 MHz the Plan includes entries for fixed rooftop reception, portable outdoor/mobile reception and portable indoor reception for DVB-T only. Nevertheless, with the provisions of the GE06 Agreement there is the possibility to deploy terrestrial applications other than broadcasting using a Plan entry provided that no additional interference is caused and no additional protection is required.

Considering co-channel interference within the GE06 frequency arrangements in the band 470 - 862 MHz it has been found that:

- Operation of the IMT downlink in a DVB-T frequency allotment would be uncritical in almost all circumstances because the IMT outgoing interference into co-channel DVB-T service is below the respective DVB-T interference for distances above 15 km for all but one DVB-T RN/RPC combination (RN4/RPC3, GE06 Agreement). Distances below 15 km are rarely relevant because the co-channel reuse between DVB-T and IMT-2000 networks over such short distances is not possible anyway.
- No harmful co-channel interference into fixed reception DVB-T service is expected from the IMT-2000 uplink. In practice, the same channel could not be used in the same area because of the protection requirement of the Base station uplink receiver. This protection requires large separation distances between areas using the same channel for DVB-T and for IMT-2000 uplink.
- The level of impact on an IMT-2000 base station (uplink) from DVB-T interference depends on the RPC that is associated with the allotment where the IMT-2000 is intended to be operated. However, the protection level which is afforded to DVB-T reception in the GE-06 Plan is not sufficient to protect IMT-2000 Base Station reception within the original planned allotment. Therefore, feasibility of sharing between IMT-2000 uplink and DVB-T using GE06 Plan entries is limited.

It has been shown that co-channel interference from DVB-T into IMT-2000 Base Station reception can reduce significantly the cell size of a mobile network. Co-channel interference may require a very large (up to 200 km) separation distance between DTT and IMT-2000. It could be also expected that higher co-channel separation distance would be required in case of sea path.

However, co-channel interference could be mitigated by applying appropriate techniques as discussed in Section 3.3. Using a combination of interference mitigation techniques, such as antenna directivity and/or cross-polarisation discrimination, interference cancellation, DVB-T and UMTS BS antenna vertical radiation patterns, a significant reduction of the required separation distance can be achieved (in some cases down to around 50 km).

### *3.2.2 Adjacent channel Interference*

Adjacent channel interference to DVB-T reception from fixed/mobile service appears if the difference in field strengths between a DVB-T service and an interfering fixed/mobile service is too large. Consequently, it can result in so-called hole punching in DVB-T coverage. Usually, this takes place in the proximity of interfering fixed/mobile transmitter (Base stations or mobile handset). However, it is also important to distinguish between two possible types of interference:

- From a fixed location (either a downlink path from a Base station of the Mobile service or uplink path from a broadband installation in a fixed position of the Fixed service).
- From a mobile handset transmitting an uplink signal.

Compatibility issues between DVB-T networks and down-link services operated on adjacent channels have been described in the Report A to ECC. In particular, it has been concluded that adjacent channel co-existence of "cellular / low-power transmitter" networks for downlink applications and DVB-T networks in the Band 470 - 862 MHz is possible within the GE06 Agreement [1], by applying the available mitigation techniques together with careful network planning.

However, the transient nature of the moving mobile transmitter makes it harder to protect the wanted DVB-T service across its entire coverage area. The problem would be worst at the edge of a DVB-T coverage area (where the received field strength will be lowest). Furthermore, generally the mitigation techniques that are available for protection from fixed downlink paths are not suitable for protection from mobile up-link paths. Nevertheless, simulations suggest that interference into fixed roof-top DVB-T reception from mobile service may be acceptable with the use of a limited guard band.

The case of portable indoor reception may be more difficult with an IMT mobile transmitter situated very close to the portable receiving antenna (e.g. in the same room).

The frequency separation required between a DVB-T channel and a mobile uplink channel to allow them to work in the same location has not yet been precisely determined.

Considering the protection of mobile services operating in a dedicated sub-band it has been found that:

- A sufficient frequency separation between DVB-T and IMT-2000 uplink is needed in order not to exceed the out of band blocking level of an IMT-2000 base station.
- The impact of DVB-T transmission on IMT-2000 downlink capacity in adjacent channel would be negligible where transmitters are co-located, even without a guard band. When transmitters are not co-located the frequency separation required between a DVB-T channel and a mobile downlink channel to minimise the impact of loss of capacity has not yet been precisely determined in all cases.

## 3.3 Possible mitigation techniques

A number of measures can be considered to reduce the impact of interference to and from IMT-2000 systems. Some of these relate to the way that IMT-2000 systems typically work (e.g. power control) and some require specific measures to be implemented at base station sites, such as antenna separation or filtering.

The following are non-exhaustive examples or possible techniques that could be applied to mitigate incoming interference:

- Use of adaptive antennas which can cancel incoming interference contributions;
- Use of polarisation diversity;
- Use of filtering;
- Use of reduced transmission power;
- Use of multiple access interference cancellation techniques;
- Use of techniques such as OFDMA which can vary the interference immunity on individual sub-carriers to assist in providing interference protection when the incoming interference is fading in a frequency selective way or when the mobile channel straddles the boundary between two DTT channels.

A brief discussion of these and other possible interference mitigation techniques is given in Annex A5.

### 3.4 Workable sharing scenarios

First sharing studies demonstrate that there is a certain opportunity to operate fixed/mobile services in frequency channels that are allotted to DVB-T according to the GE06 Plan, e.g. there is an opportunity for a country to use parts of its frequency allotments in the range 470 - 862 MHz for fixed/mobile services. In particular, co-existence of IMT/UMTS downlink with DVB-T fixed reception will require the application of the same available mitigation techniques and careful network planning as in the case of interference from downlink "cellular / low-power transmitter" networks and "larger coverage / high power/tower" type of networks addressed in Report A. In case such mitigation techniques can not be implemented adequate guard bands will be needed on a case by case basis to protect DVB-T reception from IMT/UMTS downlink interference. In addition, two main compatibility issues appear, one on the side of DVB-T performance, another on the side of fixed/mobile service performance:

- adjacent channel interference from fixed/mobile handsets into DVB-T reception;
- co-channel interference from DVB-T transmitters into fixed/mobile base stations.

Concerning the first issue, it is possible that handsets which operate in transmit mode (uplink) may cause some interference to DVB-T receivers which are located relatively close to the mobile handsets. The exact level of interference will be dependent upon a number of factors including:

- the system variant and reception mode of the wanted DVB-T service;
- the level of the wanted signal;
- the distance between the interfering mobile handset and the antenna of the victim receiver.
- the directivity of the antenna of the victim receiver for rooftop fixed reception. For portable reception, antenna directivity can not be taken into account.
- the frequency offset between the wanted and interfering channels;
- the quality of the DVB-T receiver's adjacent channel rejection filters.

The remedial actions that can be taken by downlink broadcast stations to mitigate interference to DVB-T fixed reception (see above) are not applicable for mobile handsets. This is because the transmitter causing the interference will be located within the handset, will therefore be mobile and may be closer to the receiving antenna in some cases, e.g. for portable indoor DVB-T reception.

Another way of avoiding the adjacent channel interference would be to reserve a sufficient guard band between the DVB-T channel and the Mobile Uplink channel.

On the other hand, image channel (N+9) interference from mobile handsets into DVB-T reception should be taken into account when considering the different Segments.

The second issue concerns the co-channel interference from DVB-T transmitters into fixed/mobile base stations. Due to the high sensitivity of the Mobile uplink receiver and to the position of its antenna at several tens of meters above ground level (at the base station location) all the existing studies conclude that the Mobile uplink receiver is likely to be interfered with by distant high power DVB-T co-channel transmitters. Separation distances up to several hundreds of kilometres were quoted in some studies as being required in order to protect the Mobile uplink. However, with different interference mitigation techniques available a significant reduction of the required separation distance can be achieved.

However, further detailed compatibility studies between broadcasting and fixed/mobile services should be undertaken to assess the feasibility of sharing the Band 470 - 862 MHz and to identify technical solutions including a sub-band harmonisation for the problems already identified.

Given the above, adjacent channel interference between fixed/mobile services in the band 470 - 862 MHz and DVB-T can be avoided by placing the mobile services' downlink adjacent to the DVB-T spectrum which will ensure that mobile services uplink is sufficiently separated from DVB-T spectrum.

# 4 POTENTIAL APPROACHES FOR THE IMPLEMENTATION OF FIXED/MOBILE APPLICATIONS (WITH UPLINKS) IN THE BAND 470 - 862 MHz

## 4.1 Using GE06 Plan entries for downlink and uplink

Under this approach, an administration would implement fixed/mobile service only in areas and in channels where it has GE-06 plan entries, taking into account the possibility to apply the procedures for the modifications of the Plan.

This would directly reduce the spectrum available to meet the broadcasting requirement and the number of available layers for broadcasting.

According to the first sharing studies mentioned earlier, a Fixed/Mobile downlink using a GE06 entry in a given country, would have a sufficient level of protection, afforded by the GE06 agreement itself, from co-channel DVB-T transmitters implemented in a neighbouring country.

On the other hand, using a GE06 Plan entry for a Fixed/Mobile uplink will not be practical due to fact that the protection in a given country from co-channel interference caused by DVB-T transmitters implemented in a neighbouring country according to GE06 may not be sufficient. Moreover, the current ITU frequency allocation does not foresee a notification of uplink mobile stations which would be necessary when employing the envelope concept. A suitable mobile allocation, whenever it is decided at WRC-07 or WRC-11, would provide the means to notify the uplink station in accordance with those parts of GE06 covering Other Services. It has to be noted however that under these conditions the mobile uplink notification will not make use of any GE-06 plan entry.

In order to avoid adjacent band interference at the national level, the Administration will also have to ensure that there is a sufficient frequency and/or geographic (including terrain) separation between a Plan entry used for broadcasting and a Plan entry used for mobile uplink.

Another difficulty with this approach would be to define a channelling arrangement for the mobile/fixed systems, in particular for FDD since the available plan entries in a given area may not suit the mobile channelling arrangement (e.g., at worst all plan entries may fall in the uplink band), unless the administration succeeds in modifying the Plan accordingly.

Therefore, as this solution would still require the sub-band allocation for mobile service in order to implement mobile uplink it is recommended not to pursue further with this approach for harmonisation.

## 4.2 Using a dedicated sub-band in 470 - 862 - for downlink and another band outside 470 - 862 MHz for uplink

This approach is based on the conclusion that unconstrained operation of fixed/mobile uplinks would be facilitated by the use of a harmonized sub-band (outside 470 - 862 MHz) in order to avoid interference from Broadcasting stations in neighbouring countries.

As far as the use of the foreseen sub-band of the 470 - 862 MHz is intended to be non-mandatory, the present approach consists in introducing in this sub-band only the downlinks of the fixed/mobile services, and introducing their uplinks in a band, outside the 470 - 862 MHz range.

This approach has advantages and disadvantages:

Advantages

- This approach would remove the corresponding disadvantage related to the limited operation of the uplinks
- The possible interference from mobile handsets into DVB-T in adjacent channels will be avoided (no guard band).
- The need for modifying the GE-06 plan will be limited to the sub-band dedicated to downlink
- Operators may uplink for example in the GSM900 band and downlink in a sub-band of the 470 - 862 MHz if they have a requirement for an overall an highly asymmetrical traffic which would require the use of additional downlink capacity in the band 470 - 862 MHz.

Disadvantages

- Fixed/mobile services may not be able to benefit from an improved antenna gain, which is expected when both downlink and uplink are operated in closely located narrow-bands. .
- There is currently no spectrum available for fixed/mobile uplinks, which is sufficiently close to the 470-862 MHz band.
- The 900 MHz band is extensively used by 2G services and UMTS will soon be introduced. The technologies that are used in the 900 MHz band and will be used for a foreseeable future are symmetrical. Using a part of this band paired with a downlink taken from the GE06 plan would leave the paired spectrum in the 900 MHz band unused.
- Other bands such as 1800 MHz or 2.1 GHz would introduce a significant imbalance in the link budget between the uplink and the downlink.
- This scenario would imply variable duplex spacing that has a cost.

The main difficulty with such an approach remains that there is currently no available spectrum for uplink and that the consideration of bands already used would require thorough regulatory and technical investigation. Therefore, this approach can not be pursued without such information.

This approach does not formally fulfil the question asked by the EC since the uplink path is not within the 470 - 862 MHz band.

### 4.3 Harmonisation of a dedicated sub-band

A dedicated sub-band is to be understood as a set of contiguous channels with a total bandwidth narrower than the band 470 - 862 MHz, with the intent to enable administrations to use it for fixed/mobile services including uplinks if they so wish, or to continue to use it for broadcasting services, if they so wish.

The implementation of an assignment to the fixed/mobile services using a frequency in this sub-band requires the use of the GE06 provisions applicable to other primary services, provided that a primary allocation to the fixed/mobile service in the ITU RR is made in the dedicated sub-band.

Administrations will have to apply the coordination procedure in the GE06 Agreement using the trigger field strength in Annex 4 of the Agreement corresponding to digital land mobile systems (e.g. CDMA).

This approach considers specific channel arrangements to ensure operation of fixed/mobile services in the band 470 - 862 MHz.

The existence of a duplex gap between FDD uplink and downlink and guard bands between broadcasting and fixed/mobile services should not result in an inefficient use of spectrum. Therefore, the use of the duplex gap as well as the guard band by other services/applications (i.e. TDD applications, governmental applications, SAB/SAP, etc.) should be investigated including sharing studies when appropriate (see Report C in response to the EC mandate).

## 5 IMPACT OF THE ADOPTION OF A HARMONISED SUB-BAND ON THE BROADCASTING SERVICE

### 5.1 Impact on the GE06 Plan

Overall, the GE06 Plan has been highly optimised to provide a very intricate balance of allotments/assignments to all countries and to fit together the national requirements of all neighbours. The high level of interlocking dependencies means that any change to the characteristics of an assignment or an allotment (power, frequency, etc) could result in consequential changes being required across several adjacent countries.

In the GE06 Plan, the channels assigned to a given site or to a certain area are scattered all over the spectrum. In addition, the coverage areas of different channels assigned to a given site/area are not always congruent with each other, hence may not be interchangeable between multiplexes in a defined region without additional work to find solutions for emerging “holes” in the areas no longer covered. This means that it may not be possible to re-constitute the given GE-06 allocations only by interchanging assigned channels. Any partial or complete re-

constitution is therefore likely to require national and or bi-lateral activities in order to identify alternative channels/assignments/allotments to satisfy broadcasting requirements.

The selection of a harmonised sub-band has to be done in a way that does not break the balance of equitable access established by the GE06 Agreement. The above process should therefore ensure that equitable access to spectrum is maintained as in the GE-06 plan.

In case of a sub-band harmonisation for fixed/mobile services, the DVB-T networks already implemented according to the GE06 Plan and existing other primary services in the harmonised sub-band will impose constraints on the use of the sub-band by fixed/mobile services and a transition to other frequencies may be necessary. This transition will be a complex and critical process.

As the introduction of multimedia broadcasting services including mobile TV requires spectrum below 750 , a common frequency band for fixed/mobile services chosen within 470 - 750 MHz may create difficulties in planning for multimedia broadcasting services as intended by most EU member states. Administrations wishing to implement fixed/mobile services may therefore consider setting up regulatory mechanisms which would ensure that the costs of the measures necessary to overcome such effects are borne by those who will benefit from those modifications (e.g., fixed/mobile operators). The possible business advantages from using a harmonised sub-band within the 470 - 862 MHz band for the “fixed/mobile” services have to be compared against the cost of re-arranging the broadcasting layers that implies international coordination.

The GE06 Plan entry of an administration, which is not party to the harmonisation process or decided to continue the usage of harmonised sub-band for broadcasting, would need to be protected and interference from its Plan entries would need to be accepted.

CEPT considers that a new planning conference such as the RRC-06 or a European conference at the CEPT level should be avoided, and the issues should be solved on a national or bilateral basis. This report has been developed with this objective.

The feasibility for an administration to adopt a specific sub-band for fixed/mobile applications (including uplinks) may be assessed from the point of view of meeting the following objectives:

- Ensuring that the spectrum requirements of the broadcasting service continue to be satisfied, without undue constraint on the continued use of broadcasting in other countries in conformity with the GE-06 plan,
- Minimizing the potential disruptions to broadcasting services currently in operation or under deployment, through minimum changes to the digital plan adopted by RRC-06, and minimizing the risks that changes to the digital plan might involve on the switch-over process.

In practice, some administrations may have certain flexibility to re-assign channels of all their allotments obtained in GE-06 while satisfying the same broadcasting services requirements provided that coordination with neighbouring countries is successful. At this stage, many CEPT countries have already deployed several Digital Television multiplexes which are coexisting with Analogue TV channels in the same geographical areas during the transition period.

### 5.2 Reconstitution of broadcasting layers

After several years of bi- and multilateral coordination, as well as 5 weeks of concerted planning effort and computer analysis and synthesis during RRC-06, about 7 to 8 layers of coverage in border areas were planned in 49 channels for most European countries. Under the GE06 planning assumption this proved to be the maximum number of layers that could be contained in the available spectrum (i.e. about 7 channels are required to provide a full layer), and in addition required a few million Administrative Declarations to overcome remaining potential incompatibilities, resulting in interference limited Plan in many areas.

The impact that the adoption of a specific sub-band for fixed/mobile services including uplink would have on terrestrial broadcasting has to be assessed individually by each country.

The adoption of such a sub-band and decision to use it for services other than broadcasting would create holes in several of the existing layers in GE-06 Plan. If a sub-band consisting of, say, 8 channels is 'emptied' of broadcast services, for many countries the resulting holes in layers would represent, in terms of spectrum usage, an equivalent of roughly 1 layer which would have to be 'reconstituted' in the remaining 41 channels, in order to maintain the number of broadcast layers without holes. This will be difficult near the borders, but comparatively easier away from them.

In order to facilitate this approach, the following 4 methods, which are not mutually exclusive, may be considered:

A: 'Shrink' existing allotments/assignments

1) Reduction in the size of the impacted allotments/assignments, taking into account possible overlapping between adjacent allotments/assignments,

2) Modification of the other characteristics of certain allotments/assignments, for example by restricting the characteristics of the associated reference network, e.g. modifying the reference location probability.

These two methods would lead to a reduction of the existing capacity/coverage available for broadcasting services, i.e. would only partially fill the holes; this would be considered by broadcasters to be a severe negative impact on the GE-06 Plan.

B: Delete/extend existing allotments/assignments

3) Increase in the size of the allotments/assignments adjacent to the impacted ones, when possible without creating cross-border coordination difficulties or affecting the other layers or the other allotments in the same layer,

Method 3) would, in most instances (even if coordinated), increase the interference to other co-channel allotments/assignments, i.e. a reduction in coverage would result; this would also represent a severe negative impact on the GE-06 plan.

If none of the methods 1), 2) and 3) can be used to 'reconstitute' all 'cleared' allotments/assignments in the sub-band, a loss of broadcast coverage will result; this would also represent a possibly severe negative impact on the GE-06 plan.

In any case, methods 1, 2, and 3 would have only limited applicability for smaller countries, or for larger countries that are, for example, divided into smaller independent districts.

C: Maintain existing allotments/assignments

4) Find new frequencies, amounting to an equivalent 8 channels lost for the layers in the sub-band, outside the sub-band to fill the holes (i.e. to maintain existing coverage); this would amount to finding an equivalent of roughly 1 new layers outside the sub-band.

Method 4), if it could be realised, would restrict the 'future development' possibilities of the GE-06 Plan; this could also be considered a negative impact on the growth potential of the GE-06 Plan.

It has to be stressed that whatever the segment chosen is, although large countries may be able to adjust their requirements, the potential impact can be much more important for small countries and would generally involve multilateral coordination. In most of the cases the GE06 plan entries can not be reconstituted for these small countries.

To reconstitute broadcast allotments/assignments outside the sub-band would mean that the capacity of the Plan achieved during RRC-06, i.e. 7 to 8 layers, would be effectively extended to 8 to 9 (or even 9 to 10) layers. This capacity does not seem to be achievable globally, considering the difficulties encountered at RRC-06 to establish the existing 7 to 8 layers.

## 6 CONCLUSION

Under Report B, the CEPT was requested to address the possibility of harmonising a sub-band for mobile communication applications (i.e. including uplinks), assuming zero or minimum impact on GE-06 and with a view of deployment of such services throughout the EU. As requested by the Commission, the CEPT took the utmost account of Community law applicable and of the principles of technological neutrality, non-discrimination and proportionality insofar as technically possible, as well as the RSPG Opinion on the digital dividend.

ECC/TG4 concluded that the harmonisation of a sub-band of the UHF band for mobile communication applications (i.e. including uplinks) is feasible from a technical, regulatory and administrative point of view, provided that it is not made mandatory and any decision about use of the harmonised sub-band is left to individual Administrations, within the framework of the GE-06 Agreement, and without prejudice to existing national licence obligations.

ECC/TG4 concluded that the preferred sub-band for such harmonisation is the upper part of the UHF band, and should include, as a minimum, the range of channels 62 - 69 (798 - 862 MHz).The use of the harmonised sub-band for mobile communication applications should be subject to harmonised technical arrangements (e.g. band plans, options for the location of any duplex gap and spacing, and any guard bands required, for both FDD and TDD use). Appropriate technical arrangements will be set out in a subsequent Report of ECC/TG4. They should be as flexible as possible, within the limits of what is technically feasible, to facilitate the adoption of the harmonised sub-band by as many Administrations as possible, acknowledging the differing national circumstances that will be faced by individual Administrations.

It should be noted that the level of interference likely to arise from the implementation of GE-06 plan entries makes it virtually impossible for any country to start using a harmonised sub-band for mobile communications applications without the agreement of neighbouring countries, noting that these may not be members of the CEPT or EU/EEC in all cases. Implementation of this harmonised sub-band will therefore require bilateral or multilateral negotiations, under the procedures of the GE-06 Agreement, which have been designed to ensure equitable access to spectrum by all administrations. This process, although time consuming, will be required to maintain equitable access for all administrations, irrespective of the impact of any change of use of the harmonised sub-band on their existing broadcasting layers in the GE-06 Plan, by enabling them to either reconstitute those layers, or balance any loss of spectrum for broadcasting with the gain of spectrum for other services.

Administrations must continue to have the flexibility to implement, within this sub-band, broadcasting services or other services under the umbrella of broadcasting, in accordance with the GE-06 Agreement and Declaration 42.

ECC/TG4 also noted the statement from Lithuania and Turkey (see annex A6).

ECC/TG4 also noted the reservations from Belgium, Portugal, Russian Federation and Spain on the identification of suitable spectrum taking into account their national circumstances (see annex A7).

The proposed liaison statement to the CPG on the findings of this report is given in annex A8.

### 6.1 Issues requiring further studies

The use of the harmonised sub-band for mobile communication applications should be subject to harmonised technical arrangements. Appropriate technical arrangements will be set out in a subsequent Report of ECC/TG4.

The list of essential technical issues needing further studies in order to define the appropriate technical arrangements contains:

- band plans
- options for the size and the location of any duplex gap
- options for the duplex spacing
- guard bands required (for both FDD and TDD use)

Also, sharing studies are needed between mobile/fixed services and other services to which the sub-band is allocated according the RR in order to enable a new primary allocation for fixed/mobile services in this band.

## ANNEX A1: CURRENT AND FUTURE USAGE OF 470 - 862 MHz IN EACH COUNTRY

### FRANCE

***Rationale for selecting a sub-band for fixed/mobile communications***

The lower part of the broadcasting band has been used historically more intensively. This historical heritage has to a large extent been transferred from the ST-61 plan to the GE-06 plan, which would make this part of the band much more difficult to use as a result of the disruptions that would need to be imposed on broadcasting networks currently existing or under development in order to make a sub-band available to other services in that part of the UHF band.

One DVB-H network is expected to be implemented soon using the spectrum under channel 55 in order to ensure compatibility between DVB-H reception and mobile transmission in the 900 MHz band in the same terminals.

Information provided by mobile industry has shown that the upper part of the band would be more suitable for implementing mobile systems, since antenna performance will be similar as in the GSM band and since technology will be available due to the proximity with the GSM-900 band and to the use or planned use of this upper part of the band for mobile communications in other parts of the world (United States, Japan, Korea …).

***Preferred sub-band***

The scenarios based on the use of channels above 60 for a digital dividend targeted towards mobile/fixed applications including uplinks have therefore the advantages of limiting conflicts with broadcasting for both fixed reception (RPC-1) and DVB-H networks and of suiting better the mobile industry requirement.

### GERMANY

**Description of the up-to-date situation**

In Germany, the implementation of digital broadcasting started on October 31st 2002 in Berlin. Since then, the switch-over from analogue TV to DVB-T has brought the reception capability of at least fixed reception to about three quarters of the German population, starting individually from several densely populated “islands”. Up to now, 35 % of the German population is even offered portable indoor reception. The switch-over was done with very short simulcast periods of 0 – 9 months in the regions affected. It is expected that by the end of 2008 the public providers will have completed their roll-out for three nationwide multiplexes. The private providers also use at least three multiplexes in the present coverage areas, in some cities even more. It is not expected that there will be private multiplexes with a full nationwide coverage.

In addition to that, the tender procedure for one DVB-H network has been started. Its implementation is expected soon, using the spectrum under channel 55 in order to ensure compatibility between DVB-H reception and mobile transmission in the 900 MHz band.

The geographical layout of the allotments covering the service areas differ from multiplex to multiplex. All channels between 21 and 69 (with the exception of channels 38, 61 - 63 and 67 - 69, see below) are in use for these areas, spread all over Germany according to the channel re-use conditions associated with RPC2 and RPC3 Plan entries.

For the time being, channels 61 - 63 and 67 - 69 are used by the MoD. In a mid-term timeframe, it is expected that these channels may be used by civilian applications. Therefore, they were already taken into account when drafting the GE-06 plan.

From the formal point of view, the duration of each frequency assignment will terminate by the end of 2025. However, in practice according to the Telecommunications Act no frequency assignment holder may claim to be assigned a certain frequency. Moreover, there is a need to bring about one third of the transmitters in line with the results of GE-06 by switching their frequencies. Therefore, amendments of existing networks are inevitable.

In order to save investments, Germany is interested in keeping the need for changes on a very low level. This approach includes, that any intended different use of any part of the UHF-band (e. g. the harmonization of a sub-band for mobile communication applications) should be taken into account at the earliest convenience possible. This would hold also in the case that such a different use would take place not within Germany but within some neighboring countries.

**Preferred choice for a harmonized sub-band for mobile communication applications including uplink**

The GE06 Plan for Germany foresees a more extensive usage of channels at the lower edge of UHF than in the range above channel 60. As already mentioned, there is no broadcasting downstream use at all in the channels 61 - 63 and 67 - 69. In addition to that, channels above 55 are not appropriate for DVB-H. Therefore, the least impact on the existing und future roll-out of broadcasting downstream services (DVB-T, DVB-H) can be achieved by locating such a harmonized sub-band at the upper edge of the UHF-band. If the sub-band includes channels 64 - 66, then the extension down to channel 61 (incl.) will not cause a change to these views.

**SWITZERLAND**

Historically the lower part of the UHF spectrum has been more intensively used than the upper part. A main reason was the use of military services above channel 60 by neighbouring administrations, what did not allow the implementation of co-block broadcasting services along the border region.

Switzerland's GE06 UHF-allocations are based on 7 national layers using RPC2. All 7 UHF-layers consist of identical allotment shapes. Due to the fact that there are only a few content providers for TV-services in Switzerland, up to 3 layers seem to be sufficient for conventional TV-broadcasting. Analogue TV will cease operation by end 2008. By then the public broadcaster will have implemented its first national DVB-T coverage. The roll-out of the second multiplex is planned before 2010.

Out of the seven layers two are expected to be used by DVB-H networks. The two DVB-H layers use only channels below ch46. The licensing process for the first nationwide DVB-H layer is currently in force.

The introduction of DVB-T and DVB-H services predominantly starts in the lower part of the UHF-spectrum. Licenses are given for 10 years. It is therefore likely that the lower UHF-spectrum will be digitized before the European analogue switch-off in 2012 by 3 to 4 nationwide multiplexes. As the investments of the new digital infrastructure will be protected as far as possible until the end of the license periods, which will last until 2017-2020, it is not likely that the lower UHF-spectrum will be available for before 2020. Consequently, the preferred spectrum range for mobile services would be the upper part of the UHF-spectrum.

**Analysis of the impact of the four sub-band options proposed by ECC/TG4 on existing GE06-allocations**

Switzerland made an assessment on the influence of the four subband options "Segment A" to "Segment D" proposed in Section 2.4.2 on the existing Swiss GE06-allocations. It has been analyzed how far the existing GE06-allotments would be affected by introducing a sub-band at different locations.

For illustrative reasons the Swiss GE06 UHF-allotment plan is shown in Figure A1.1. In Table A1.1 the GE06 UHF-allocations are shown, overlaid with the four subband Segments A to D.

Table A1.2 summarizes the results of the analysis. It is shown that an approximately 100MHz wide subband located below channel 57 would affect the existing Swiss GE06-allocations quite substantially. When applying the subband-options "Segment A", "Segment B" or "Segment C" between 4 and 5 of the available 7 GE06-allocations of an allotment would become unusable for digital broadcasting or multimedia broadcasting services. While a maximum of 2 allocations per allotment are affected when applying "Segment D".

In summary "Segment D" affects with 14 of the available 98 allocations much less allocations than "Segment A", "Segment B" or "Segment C" which are impacting 31, 32 and 32 of the existing GE06-allocations.

**Impact of the proposed subbands on the Swiss GE06 UHF-allocations**

UHF-channels

| Swiss allotments | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | number of allocations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basel | | | | | | | | | | | C | | | A | | | | | | | | B | | | | E | | | D | | | | | | F | | | | | | | G | | | | | | 7 |
| Zuerich | | | A | | | B | | | E | | | C | | | | | | | | | | | D | | | | | | | | | | | | | | | | | | | F | | G | | | | 7 |
| Ostschweiz | | | | | F | | B | | | A | | | | C | | | | | | | | | | | | | | G | D | E | | | | | | | | | | | | | | | | | | | 7 |
| Graubuenden | | | | | | | B | | | | | | | | A | | | | | | | | | | | E | | | | | C | | F | | | G | D | | | | | | | | | 7 |
| Poschiavo | F | | | | | | B | | | | G | E | | | A | | | | | | | D | | | | | | | | | | | | | | | | | | | | C | | | | | | 7 |
| Muenstertal | | | | | | | B | | | | | | | | A | | | | | | | | | | | E | | | | | C | | F | | | G | D | | | | | | | | | 7 |
| Ticino | F | | | A | | | | | B | | G | E | | | | | | | C | | | D | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| Wallis | B | | F | | | G | | | | | | E | | A | | | | | | D | | | | | C | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| Valais | | | | | | | | | | | | | | | | | | | | | | | A | B | | | E | | | | D | | | C | | | F | | | | | | G | | | | | 7 |
| Bassin Lemanique | | | | | | | | | | | B | | | C | | A | | | | | | D | | | | | | | | | | E | | | | | | | | G | | | | | | F | 7 |
| Arc Jurassien | | F | | | B | | | | | A | | | | | G | | | | | | | | | | | | | | | | | | | | C | | | | D | | | E | | | | | 7 |
| Bern | | | | | | | | | | | | | | | | | | | | A | | | B | | | E | | C | | | D | | | | | F | | | | | | G | | | | 7 |
| Zentralschweiz | | | | | | B | | | | | | C | | | | | | | | | | | | D | A | | | | | | | | | F | | | | | | E | | | | | G | 7 |
| Berner Oberland | | | | | | | B | F | | | | | A | | | | E | | | | | | | | | | | C | G | | | D | | | | | | | | | | | | | | | 7 |

"Segment A"-subband | "Segment B"-subband | "Segment C"-subband | "Segment D"-subband

Analgoue switch-off in Switzerland: end 2008

Provisional schedule for implementation of UHF-layers:

Legend:
A-G = seven national Swiss layers
= "Segment A"-subband (ch21-ch32)
= "Segment B"-subband (ch31-ch44 / without ch38)
= "Segment C"-subband (ch45-ch58)
= "Segment D"-subband (ch58-69)

C = DVB-T (before 2007)
A = DVB-H (before 2008)
D = DVB-T (before 2010)
B = DVB-H (after 2010)
E = DVB-T / DVB-H (after 2010)
F = after 2010
G = after 2010

ch38 = reserved for radio astronomy

**Table A1.1**
**Swiss GE06-Plan allocations in UHF with the four overlaid subband-options "Segment A" to Segment D"**


**Figure A1.1: Swiss GE06 allotment plan for UHF**

| | analysis for "Segment A"-subband | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Swiss allotments** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **number of affected layers** | **percentage of affected layers** |
| Basel | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Zuerich | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 4 | 57.1% |
| Ostschweiz | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 42.9% |
| Graubuenden | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Poschiavo | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 4 | 57.1% |
| Muenstertal | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Ticino | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 5 | 71.4% |
| Wallis | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 4 | 57.1% |
| Valais | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Bassin Lemanique | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Arc Jurassien | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 42.9% |
| Bern | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Zentralschweiz | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 28.6% |
| Berner Oberland | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 28.6% |
| **percentage of affected allotments** | 28.6% | 78.6% | 21.4% | 0.0% | 28.6% | 42.9% | 21.4% | 31 | <- affected allocations |

| | analysis for "Segment B"-subband | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Swiss allotments** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **number of affected layers** | **percentage of affected layers** |
| Basel | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 42.9% |
| Zuerich | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 28.6% |
| Ostschweiz | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Graubuenden | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Poschiavo | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 4 | 57.1% |
| Muenstertal | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Ticino | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 4 | 57.1% |
| Wallis | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 42.9% |
| Valais | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28.6% |
| Bassin Lemanique | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 4 | 57.1% |
| Arc Jurassien | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 14.3% |
| Bern | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 28.6% |
| Zentralschweiz | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 28.6% |
| Berner Oberland | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 28.6% |
| **percentage of affected allotments** | 64.3% | 28.6% | 42.9% | 42.9% | 28.6% | 0.0% | 21.4% | 32 | <- affected allocations |

| | analysis for "Segment C"-subband | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Swiss allotments** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **number of affected layers** | **percentage of affected layers** |
| Basel | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 3 | 42.9% |
| Zuerich | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Ostschweiz | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 3 | 42.9% |
| Graubuenden | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 5 | 71.4% |
| Poschiavo | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Muenstertal | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 5 | 71.4% |
| Ticino | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Wallis | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Valais | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 4 | 57.1% |
| Bassin Lemanique | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 14.3% |
| Arc Jurassien | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Bern | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 4 | 57.1% |
| Zentralschweiz | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 28.6% |
| Berner Oberland | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 3 | 42.9% |
| **percentage of affected allotments** | 7.1% | 0.0% | 50.0% | 50.0% | 50.0% | 42.9% | 28.6% | 32 | <- affected allocations |

| | analysis for "Segment D"-subband | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Swiss allotments** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **number of affected layers** | **percentage of affected layers** |
| Basel | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 14.3% |
| Zuerich | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 28.6% |
| Ostschweiz | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Graubuenden | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 14.3% |
| Poschiavo | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 14.3% |
| Muenstertal | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 14.3% |
| Ticino | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Wallis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| Valais | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 14.3% |
| Bassin Lemanique | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 28.6% |
| Arc Jurassien | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 28.6% |
| Bern | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 14.3% |
| Zentralschweiz | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 28.6% |
| Berner Oberland | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0% |
| **percentage of affected allotments** | 0.0% | 0.0% | 7.1% | 21.4% | 14.3% | 14.3% | 42.9% | 14 | <- affected allocations |

**Table A1.2: Impact of the four proposed subband-options (Segment A to D) on the GE06 UHF-allocations in Switzerland**

### Further investigations needed

The studies so far conducted have shown that a subband in the upper part of the UHF-spectrum would be the only valid option for Switzerland. The Swiss administration is of the view that the introduction of a subband for mobile services would not allow to reconstitute the broadcasting allocations that will be affected by such a subband. For the moment it is not clear if the loss of 14 GE06-allocations would be acceptable from a political point of view. ECC/TG4 still has many technical investigations to be conducted in the coming months. The Swiss decision regarding a future implementation of a subband for mobile services will highly depend on the outcome of the results of these studies.

## UNITED KINGDOM

The UK's proposals for the award of digital dividend spectrum were set out in a consultation document on 19th December 2006[2]. The consultation closed on 20th March 2007 and Ofcom is considering the responses[3], with a view to issuing details of the proposed approach to awarding the spectrum later in 2007, with the award process expected to take place within 2008.

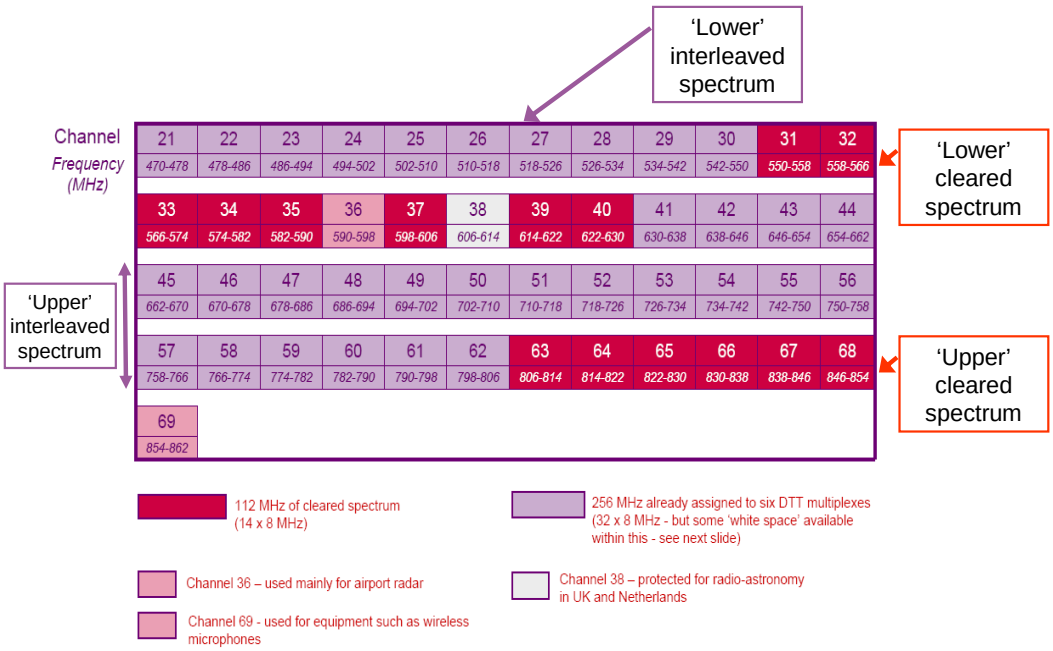
The United Kingdom has been operating a six- multiplex DVB-T network from 80 sites using interleaved spectrum in the UHF bands since 1998. This network mainly provides coverage to the main population centres only and is constrained by the current need to protect existing analogue and interim DTT services both within the UK and our nearest neighbours. The current interim network's overall coverage is to 73% of the population via roof top antenna reception. The main UK transition to an all-digital network roof top reception-based network will be done progressively area by area, starting in 2008 with the borders region between England and Scotland. The finish of the transition will be in 2012 on the UK mainland with the south-east region of England, in Northern Ireland and early in 2013 in the Channel Islands. The final network will provide near-universal coverage for 3 public service broadcast multiplexes and a somewhat lower commercially decided level of coverage for the remaining 3 multiplexes.

Ofcom has set out in a number of public statements on its policy objectives for DTT coverage post switchover. The key objective is that the core coverage of the three DTT multiplexes carrying the public service channels (3PSB) have to match the core coverage of the existing analogue (BBC1, BBC2, ITV & C4/S4C). This has been calculated as meaning that the 3PSB core coverage must reach at least 98.5% of UK households.

[2] http://www.ofcom.org.uk/consult/condocs/ddr/
[3] http://www.ofcom.org.uk/consult/condocs/ddr/responses/

The future all-digital TV network has been planned in channels 21 - 30 and 41 - 62 as a six-multiplex network. Two further multiplexes, bringing the total to 8, were also planned in the remaining channels as part of the GE06 Plan. The Digital Dividend Spectrum for the UK is Channels 31 - 40 and 63 - 68, i.e. *112 MHz of cleared spectrum*. Channel 36 is currently used for airport radars. Channel 38 is reserved for radio astronomy use from UK observatories, and channel 69 is used for radio microphones for programme making PMSE, SAP/SAB. The reuse will be based on the spectrum mask concept developed in GE06. This mask concept means that the GE06 Plan already provides a harmonised spectrum approach while still providing national administrations with the ability to adapt over time to their own requirements. It also allows for the evolutionary introduction of new as yet undefined future systems without the inherent difficulties, lost time and potential opportunities inherent in a replan.

UK has identified its digital dividend to be 64 MHz within the band 550 - 630 MHz (excluding channels 36 and 38) and 48 MHz from 806 MHz to 854 MHz. Subject to appropriate interference protection mechanisms, interleaved spectrum in the remainder of the band will also available, within the frequencies that will be used to carry the six DTT multiplexes.




The DRR consultation outlined how a range of different services could operate within the cleared (and interleaved) spectrum without causing unacceptable levels of interference to these services. The key issue going forward for Ofcom will be to specify how to include licence conditions for new services that will guarantee protection of these DTT service coverage obligations. Any new service will have to operate in such a manner which does not impact on the PSB coverage obligations and with minimal impact on the eventual 6Mux coverage. Ofcom would expect that these would be achieved by careful planning (use of protection ratios, selection of appropriate power levels and channels).

## IRELAND

### Broadcasting Services

Ireland planned for 8 Layers DVB at GE06 (in line with our nearest neighbour).

Legislation has been enacted with a view to up to 6 broadcast multiplexes.

Because of the channel grouping approach used in the development of the Ireland GE06 Plan and requirements for Broadcasting Services as set out in the recently enacted Broadcasting (Amendment) Act 2007, it is

envisaged that Broadcasting Services will require the use of the following channels in any configuration in the UHF Band:

- 24 - 30, 42 - 48 and 56 - 64.

**Terrestrial Mobile Multimedia**

In response to an RSPG questionnaire on the Digital Dividend in 2006, Ireland indicated that the following channels could be made available on a non exclusive basis (interleaved) for Terrestrial Mobile Multimedia (e.g. DVB-H):-

- At the expense of two DVB Layers, channels 31 - 35 and 49 - 55,
- At the expense of one DVB Layers, channels 32 - 34 and 50 - 54.

This broadly suggests that about twelve non-contiguous 8 MHz channels, or 96 MHz, could be made available on a non exclusive basis for Terrestrial Mobile Multimedia (e.g. DVB-H).

**Fixed/Mobile (other) Services**

Ireland indicated in the response to the RSPG questionnaire in 2006 that alternatively, the following channels could be released for Fixed/Mobile (other) Services:

- At the expense of two DVB Layers, channels 21 - 23, 39 - 41 and 65 - 69.

This broadly suggests that about ten non-contiguous 8 MHz channels, or 80 MHz, could be segmented for Fixed/Mobile (other) Services.

There will be implications on the actual spectrum available for Mobile Multimedia (DVB-H) and other services where guard bands are needed in order to avoid interference to Broadcasting Services.

Ireland sought no assignments on Channel 36 at RRC-06. Channel 38 is used for Radio astronomy services in the United Kingdom. Ireland takes note of the relevant footnote in the Radio Regulations. Protection of Radio astronomy Services may constrain use of this spectrum in Ireland.

The Irish Government is keen to increase broadband penetration (see NBS, http://www.dcmnr.gov.ie/Press+Releases/Dempsey+Unveils+New+National+Broadband+Scheme.htm) and considers that the spectrum not required for Broadcasting Services at UHF might be used for this purpose. Ireland considers that a system providing wireless broadband services would be a Fixed Service infrastructure.

**SPAIN**

In Spain, a nation-wide DVB-T network of 7 multiplexes is in operation since 2005, which presently covers approximately 80,45% of the population., User equipment penetration is also increasing progressively, with about 14,4% of the households equipped with DVB-T decoders in January, 2007.

This network coexists with the analogue television, resulting in a high occupancy of the UHF band where no free channel exists at this moment.

After the switchover, planned for April 2010, new multiplexes will be allocated, so the situation is not going to be better regarding the availability of frequencies for new services.

Royal Decree 944/2005, which approves the National Technical Plan for Digital Terrestrial Television, reserves 6 multiplex for nation wide private concessionaries, 2 multiplex for Spanish Public television, 2 nation wide multiplex for regional television in each Autonomous Community, and one more nation wide to be occupied by mobile television, which will be allocated after the switch over. Furthermore Royal Decrees 439/2004, 2268/2004 and 994/2005 related to the National Technical Plan for Local Digital Terrestrial Television establish 291 areas for Local Television.

Consequently 5 layers need to be allocated to DVB-T in the Spanish Digital Dividend considering 7 multiplex already working.

Another important fact to be mentioned is that all existing Digital Terrestrial Television layers are located in the upper part of the spectrum, included 4 nation wide SFN multiplex in the channels 66, 67, 68, 69. As a result any change in channel allocations in this upper part is not feasible.

Due to these constraints, it is quite difficult to identify dedicated sub-bands for new services in the digital dividend even after the switchover. All the efforts are now devoted to make available 2 layers for multimedia broadcasting applications, but it could not be even considered the allocation of any group of channels or sub-bands for fixed/mobile applications in any part of the spectrum.

However, it should be noted that the above described frequency planning will lead to the availability of higher number of programs, increased coverage, local television, high definition television and mobile television, which is fully consistent with the definition and potential uses of the digital dividend.

| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|
| 470-478 | 478-486 | 486-494 | 494-502 | 502-510 | 510-518 | 518-526 | 526-534 | 534-542 | 542-550 |

| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
|---|---|---|---|---|---|---|---|---|---|
| 550-558 | 558-566 | 566-574 | 574-582 | 582-590 | 590-598 | 598-606 | 606-614 | 614-622 | 622-630 |

| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
|---|---|---|---|---|---|---|---|---|---|
| 630-638 | 638-646 | 646-654 | 654-662 | 662-670 | 670-678 | 678-686 | 686-694 | 694-702 | 702-710 |

| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
|---|---|---|---|---|---|---|---|---|---|
| 710-718 | 718-726 | 726-734 | 734-742 | 742-750 | 750-758 | 758-766 | 766-774 | 774-782 | 782-790 |

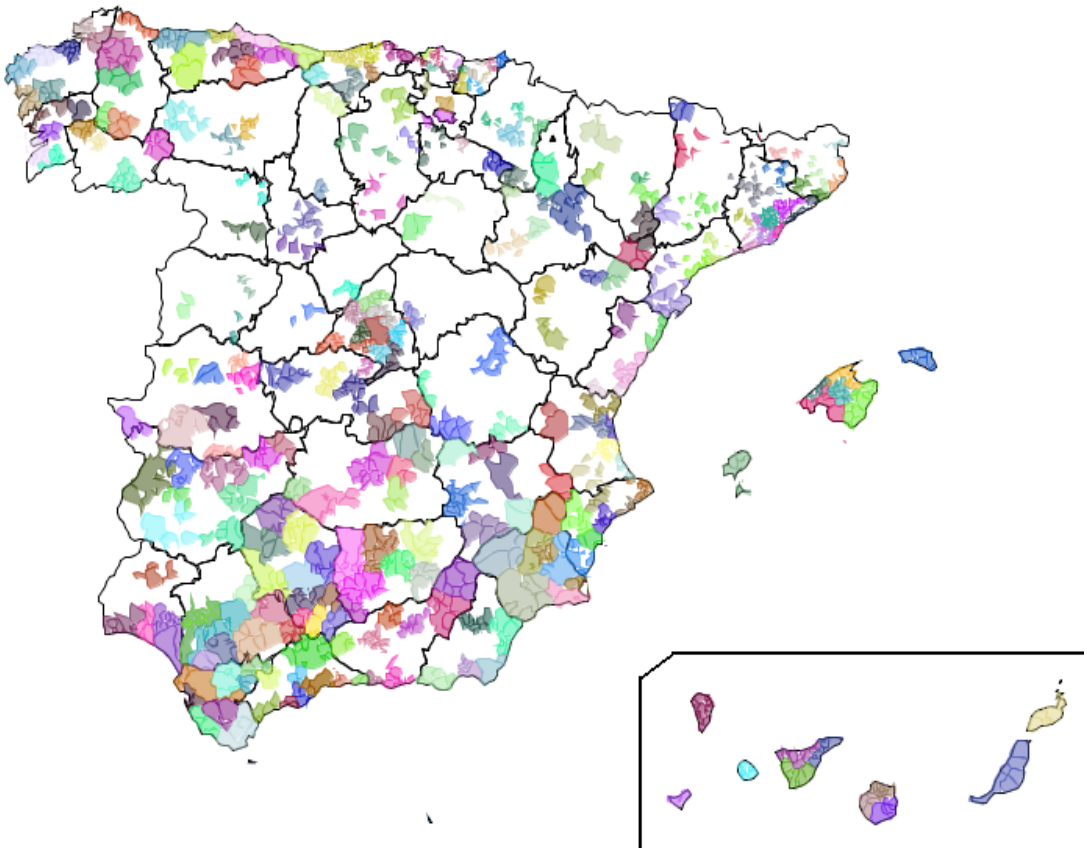
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 |
|---|---|---|---|---|---|---|---|---|
| 790-798 | 798-806 | 806-814 | 814-822 | 822-830 | 830-838 | 838-846 | 846-854 | 854-862 |

4 national SFN networks (operating now)

1 RGE national network and 1 regional network (operating now)

- 291 different areas of local television (planned in the Local Digital Television Technical Plan, operating in some areas), equivalent to a national network (2 in some areas).
- 1 mux for a regional network (planning now).
- 1 mux for mobile TV (planning now).
- 4 mux for national networks (planning now).

**Image of the 291 Different areas of local Television**



**THE NETHERLANDS**

**Broadcasting**

The analogue TV-broadcasting in The Netherlands was switched off on 11 December 2006. Since that date, KPN Broadcast Services facilitates 4 commercial DVB-T layers for Digitenne and 1 public DVB-T layer for the national and regional public broadcasters.

These 5 layers are planned for portable indoor reception in the major urban areas while the public broadcasters layer should also cater for nationwide rooftop reception. This results in rooftop reception for the whole of The Netherlands, portable indoor reception for about 70% of the population and portable outdoor reception for about 80% of the population in the second half of 2007.

The licences for these 5 layers are granted until 31 January 2017. The frequencies used for these layers are scattered throughout the whole of the band IV/V.

The remaining UHF spectrum out of the RRC06 is currently not usable, mainly because of the protection needed by (foreign) analogue TV and military services.

Currently, policy concerning the remaining spectrum is in development.

The use of multimedia broadcasting (DVB-H) is possible under the current licence. The licensee has to take into account the agreed outgoing and incoming interference levels and the GE06 framework when developing or adapting the network for these multimedia broadcasting services. In the middle of 2007 technical user pilots and extensive measurements will start using a test network which comprises more than 20 transmitters.

**Other Services**

Within The Netherlands channel 38 is used for Radio astronomy. Several SAB/SAP services are also using bands IV and V. Wireless microphones are allowed in (parts of) channels 21 - 31, 41 - 60, 63 and 64 - 67. Audio links are allowed in (parts of) channels 31 - 41 and 49.

**Preferred sub-band for fixed/mobile applications (including uplinks)**

The proposed 4 segments in Section 2.4 of the draft report B to ECC for a harmonised band plan for fixed/mobile applications are analysed for the following 4 cases:

1. Impact on the GE06 plan
2. Impact on the licensed situation (without exchanging complete layers)
3. Impact on the licensed situation (exchanging complete layers)
4. Impact on the licensed situation (based on situation 3 and exchanging allotments to optimise)

Cases 3 and 4 can be optimised for a certain segment. In this document, cases 3 and 4 are optimised for segment 4, channels 58 - 69. This seemed to be the option leading to the best result. It might be worth optimising cases 3 and 4 for other segments at a later stage.

All the results are displayed in percentage covered population.

Within The Netherlands, already 5 layers for DVB-T/H are licensed until 31 January 2017. This is a serious constraint for harmonising parts of the band IV/V in a short term and will restrict the possibilities.

Currently, all available frequencies are used in order to allow for 5 layers. The remaining frequencies are not available yet, due to restrictions of still existing (foreign) analogue broadcasting and military use. It is expected that all the remaining frequencies will become available in 2012.

Channel 63 is intensively used by wireless microphones on a non-interference bases. This channel is not planned for DVB-T in The Netherlands during the RRC06. This channel will remain dedicated for wireless microphones.

This study does not take into account the effects of any re-arranging of channels for the current licensees. It is very likely that costs will be involved in this process of re-arranging.

It has to be stressed that this document is a technical study only. Policy concerning the remaining spectrum in band IV/V is currently being developed in The Netherlands.

**Results**

In the following table the impact on RRC06 and the licenses in The Netherlands is shown, when several different sub-bands for fixed/mobile use are harmonised.

| | | Total | Segment 1 (21-32) | Segment 2 (31-44) | Segment 3 (45-58) | Segment 4 (58-69) |
|---|---|---|---|---|---|---|
| Case 1 (GE06) | Coverage | 696% | 203% | 122% | 197% | 210% |
| | Relative loss | | 29% | 18% | 28% | 30% |
| | Damaged layers | | 6 | 6 | 4 | 6 |
| Case 2 (licensed) | Coverage | 497% | 197% | 102% | 119% | 111% |
| | Relative loss | | 40% | 20% | 24% | 22% |
| | Damaged layers | | 5 | 5 | 3 | 4 |
| Case 3 (optimised) | Coverage | 497% | 199% | 114% | 171% | 50% |
| | Relative loss | | 40% | 23% | 34% | 10% |
| | Damaged layers | | 5 | 5 | 3 | 4 |
| Case 4 (optimised) | Coverage | 499% | 199% | 119% | 171% | 48% |
| | Relative loss | | 40% | 23% | 34% | 10% |
| | Damaged layers | | 5 | 5 | 3 | 4 |

In the above table, it is clearly visible that between Case 2 and 3, the loss of RRC06 coverage in segment 4 is minimised. However, it proved very difficult to further reduce the impact on the available spectrum between cases 3 and 4.

To get an impression of the possibilities of harmonising a smaller sub band than the proposed segments, two further segments were defined:

Segment 5: 61 - 69

Segment 6: 64 – 69

In the following table, the impact on RRC06 and the licenses in The Netherlands is shown, when smaller sub bands of segment 4 are chosen.

| | | Total | Segment 5 (61-69) | Segment 6 (64-69) |
|---|---|---|---|---|
| Case 1 (GE06) | Coverage | 696% | 179% | 110% |
| | Relative loss | | 26% | 18% |
| | Damaged layers | | 4 | 4 |
| Case 2 (licensed) | Coverage | 497% | 80% | 80% |
| | Relative loss | | 16% | 16% |
| | Damaged layers | | 3 | 3 |
| Case 3 (optimised) | Coverage | 497% | 20% | 20% |
| | Relative loss | | 4% | 4% |
| | Damaged layers | | 2 | 2 |
| Case 4 (optimised) | Coverage | 499% | 16% | 0% |
| | Relative loss | | 3% | 0% |
| | Damaged layers | | 1 | 0 |

**Conclusion**

Due to the existing licenses and the other constraints in The Netherlands, it will be very difficult to find harmonised spectrum for fixed/mobile applications in the short term.

In the medium term (2012), it should be technically possible to harmonise spectrum without having an impact on the amount of currently licensed layers. However, the amount of spectrum which can be made available will be limited to about 6x8 MHz.

Further studies might be needed to fully exploit the possibilities.

Currently, the policy concerning the remaining band IV/V spectrum is under development, so this study is a pure technical one and does not indicate any preference concerning the placement, amount and/or destination of the remaining band IV/V spectrum.

## LATVIA

**Current use of the UHF spectrum**

Four nation-wide analogue TV networks and a number of regional and local transmitters are currently in use in Latvia. What concerns digital television only test transmissions are on air. The UHF band is widely used as well for SAB/SAP services and the demand for this use is increasing.

It is important to note that no one of the channels currently used for analogue television will become free as a visible dividend for other usage after the analogue transmissions in Latvia will be suspended. All channels for high and medium power stations in the ST61 plan have been incorporated in the GE06 digital plan in the respective allotment areas.

Consequently, any dividend for mobile communications services could be pulled out solely from the GE06 digital plan at the cost of reduction of the broadcasting services – DVB-T, DVB-H or other emerging multimedia services.

**Spectrum demand for broadcasting and other applications.**

Seven (7) nation-wide DVB-T layers are included in the GE06 plan for Latvia. At the time being the spectrum market demand for implementation of digital broadcasting seams to be notably higher than for other applications. The segmentation option to be chosen for harmonization of the sub-band should minimize the impact to the GE06 plan.

Any of the proposed segmentation options causes a reduction of the number of layers for broadcasting and multimedia services, by 2 at average. For all proposed options in one or more allotment areas (table 1) the loss reaches even 3-4. Consequently, with objective to preserve national coverage for all remaining layers certain allotments should be recovered by changing the channel.

Such change could be solved easier inside the country being matter solely of the replanning administration. In border areas, or throughout the territories of small countries, more administrations will be involved in the replanning and the outcome unlikely will be positive. Table below reflects the situation in Latvia for the proposed options.

| Allotment name | Number of affected allotments by sub-band | | | | |
|---|---|---|---|---|---|
| | Segm. A | Segm. B | Segm. C | Segm. D | Segm. D1 |
| Liepaja | 3 | 2 | 0 | 3 | 2 |
| Kuldiga | 3 | 2 | 2 | 0 | 0 |
| Riga | 2 | 2 | 2 | 2 | 1 |
| Valmiera | 1 | 1 | 3 | 2 | 2 |
| Cesvaine | 4 | 1 | 1 | 2 | 1 |
| Rezekne | 1 | 3 | 2 | 1 | 1 |
| Daugavpils | 1 | 2 | 3 | 1 | 1 |
| Viesite | 2 | 1 | 2 | 2 | 1 |
| Total | **17** | **14** | **15** | **13** | **9** |

| | |
|---|---|
| Segm. A | ch. 21 - 32 |
| Segm. B | ch. 31 - 44 |
| Segm. C | ch. 45 - 58 |
| Segm. D | ch. 58 - 69 |
| Segm. D1 | ch. 62 - 69 |

**Selection of the segmentation option.**

Harmonization of the upper part (above 790 MHz) of the UHF broadcasting band could be considered as the most appropriate from the options proposed (A, B, C, D) for the following reasons:

- the use of this part of the UHF band for analogue television currently is minimal. Practically there is no need to protect the analogue plan from mobile services what would be the case for all other options;

- the sub-band bordering with the upper edge of the broadcasting band would not disarrange the continuity of the broadcasting part of the band and, furthermore, if used for downlink only, will not require any guard band between the broadcasting and mobile sections;

- such a location of the sub-band allows to perform replanning for mobile services in a wider spectrum (the upper part of broadcasting band, frequencies above 862 MHz and the 900 MHz band). The harmonized sub-band derived from the TV UHF band could be used for downlink. The mobile uplink, located above 862 MHz, would gain full protection from the TV interference irrespective of the usage of the harmonized sub-band (for TV or mobile) in different countries.

**The harmonized sub-band**

Taking into account that a loss of one TV coverage may be considered as an admissible criterion we suppose a sub-band containing channels from 62 to 69 (64 MHz) could be harmonized for use on non-mandatory bases for mobile service, preferably to used for downlink. In the table 1 (the Latvian situation) the proposed segment is marked D1.The entirety of the other affected layers could be restored with some efforts.

**BELGIUM**

**Introduction**

In Belgium, the three Communities based on the language (i.e. the Flemish, French and German-speaking Communities) are competent for broadcasting[4]. This means that in this specific case of frequency band 470 - 862 MHz the Communities manage this frequency spectrum for broadcasting applications. The Communities have already decided that the spectrum obtained at RRC-06 will exclusively be used for broadcasting applications within the GE06 Agreement. Under broadcasting applications should be understood for example broadcasting a higher number of programmes than the current analogue distributed programmes and this for mobile and/or portable reception, innovative mobile multimedia broadcasting applications, high definition television, etc.

Currently already different channels obtained at RRC 06 are in use for DVB-T and DVB-H.

However Belgium would like to follow and constructively participate in the discussions concerning the implications and feasibility of harmonising a sub-band for fixed/mobile non broadcasting applications including uplinks in the frequency band 470 - 862 MHz.

**Some considerations on potential harmonization approaches**

From the three approaches proposed in the Doc TG4(07) 061, the use of a dedicated sub-band, i.e. 'a dedicated sub-band is to be understood as a set of contiguous channels with a total bandwidth narrower than the band 470 - 862 MHz, with the intent to enable administrations to use it for fixed/mobile services including uplinks if they so wish, or continue to use it for broadcasting services, if they so wish' seems to be the most suitable in order to avoid interference from/to neighbouring countries. Given the existing rights of the GE 06 plan and agreement and the subsidiarity principle it is extremely important that the countries can decide to continue to use the band 470 - 862 MHz for broadcasting.

For small countries like Belgium, the whole country is in border area. In these countries the implementation of the harmonized sub-band for non broadcast fixed/mobile applications would be extremely difficult without the same implementation in the neighbouring countries.

It should also be possible to integrate a DVB-H receiver in the mobile handset functioning in the band 470 - 862 MHz. So the compatibility between the mobile uplink and the DVB-H receiver should also be taken into account.

**Some considerations on the 'sub-band' idea versus the principle of equitable access**

The GE06 plan has been built up in such a way that all the countries should have a similar number of layers. But the distribution of plan entries across the UHF band is not uniform from country to country. In Belgium for example plan entries are distributed all over the frequency band but with more allotments having a frequency channel situated in the upper part of the band. Other countries can have a concentration of plan entries in the lower part of the band.

Therefore, if we consider the idea of a harmonised sub-band at the CEPT scale, this will lead to a breaking of the equitable sharing of layers between countries and even within a given country such as Belgium, as the number of layers of the GE06 plan destroyed will not be the same in each country.

The idea of an introduction of a sub-band and the principle of equitable access and given rights of GE 06 plan are thus not compatible without re-planning. Consequently the introduction of a sub-band at CEPT scale should lead to a complete and time consuming re-planning exercise and this is - given the existing rights of the GE06 plan - not acceptable for the Communities in Belgium.

[4] The federal authority is responsible for the programs of broadcasting which cannot be considered as belonging exclusively to one Community in the Region of Brussels.

**Examination of the four sub-bands identified in the draft report B and examination of other possible sub-bands of 12 channels**

Belgium has studied the impact of the four proposed sub-bands A, B, C and D in the current version of draft report B.

The conclusion of that study is that with the choice of one of these sub-bands for fixed/mobile communication applications (including uplink) the impact on the GE06 plan is significant. Important 'holes' appear in the different layers and the GE06 plan doesn't remain intact. Repairing the 'lost' channels with other new frequencies isn't possible because Belgium is a small country and thus the whole country is in the 'border area' and coordination of new frequency channels - with the same technical characteristics as in the current GE06 plan - under the GE06 Agreement with the neighbouring countries is very difficult and even impossible due to the small reuse distances already used in the current GE06 plan. The repairing of existing layers in the GE 06 plan affected by the introduction of one of the sub-bands A, B, C or D is thus very difficult in Belgium and is impossible without significant re-planning the whole GE 06 plan, not only in Belgium but also in neighbouring countries.

Examination of all possible other sub-bands leads to the same above mentioned conclusions.

Moreover, we studied other hypothetical cases where we should accept some coverage loss. Each time we had to conclude that some regions will be affected much more than others and the principle of equitable access could not be granted.

If we consider for example sub-bands below channel 42, this will prevent the introduction of DVB-H in the whole southern part of Belgium or will result in a non equitable access to the spectrum between Communities. On the other hand, if we consider sub-bands above channel 42, this will result in destroying too much layers.

Finding a 'sub-band' with zero or minimum impact on the GE-06 plan is thus not an easy task and is impossible given the rights resulting from the current Geneva 2006 plan and the current and planned use in Belgium of the obtained GE06 plan.

**Conclusions**

The idea of a harmonised sub-band for fixed/mobile applications (including uplinks) in the frequency band IV/V will hinder the current and planned digital roll-out in Belgium and thus create uncertainty for current and future (foreseen) investments for this digital roll-out. The choice of any sub-band will create different important 'holes' in the layers obtained at RRC 06 and the current GE06 plan will not remain intact.

In addition the idea of a harmonised sub-band at the CEPT scale will lead to a non equitable sharing of 'remaining' GE06 layers between countries and even within a given country such as Belgium and this is completely unacceptable.

Consequently significant re-planning of the GE06 plan will be necessary and this is not an acceptable option for the Communities in Belgium.

**PORTUGAL**

Some years ago, following an International Conference on DVB-T convened in Lisbon, a plan for the introduction of DVB-T in Portugal was prepared by the end of year 2000.

The public tender ran from June to August 2001, and the winner consortium "Plataforma de Televisão Digital Portuguesa" (PTDP) was announced by the Government at the end of August 2001. The operating license was formally granted in October 2001. PTDP was granted a capacity of four nationwide multiplexes, in channels 60 to 69, being foreseen the launching of the DVB-T commercial services during the first half of 2003.

As PTDP did not start with the implementation of the DVB-T network until the first of March 2003, the granted license was revoked by Order of the Minister for the Economy of 25 March 2003.

This situation led to further studies in order to find a new business model more suitable to the Portuguese TV market. These studies are now finished and a new public tender will be launched during the second half of this year.

Rights of use will be granted for three nationwide coverage's and for three regional/coastal area coverage's in Portugal mainland, in a total of six multiplexes. These 6 multiplexes will use the upper part of the UHF band, channels 60 to 69, since the lower part of the band is heavily used by analogue TV.

Under these circumstances, it will be impossible in Portugal to make available the upper part of the UHF band (channels 60 to 69), for fixed services or for two way mobile services.

In Geneva 06 and due to our geographical position we have got 10 DVB-T layers in UHF. The lower part of the UHF band was planned for DVB-H in MFN networks but in SFN small allotments taking into account the 4k mode. The middle part of the band was planned for MFN fixed reception, for local, regional and nationwide coverage's.

Portugal has made an assessment of the influence of the remain three sub-band options proposed in Section 2.4.2, (segment D is impossible to be allocated to fixed/mobile services) on the Portuguese GE06-allotments and the results shows that segment A will affect 81 allotments, segment B will affect 57 allotments and segment C will affect 39 allotments.

This could lead to the conclusion that the preferred sub-band for Portugal is segment C. However, it is not already decided how many and which GE06 layers will be used for Terrestrial Digital Television (TDT) or for other services. Political decisions will likely have to be made on this subject.

In conclusion and for Portugal it is a little early to define the amount and the location of the spectrum for mobile/fixed services in the band 470 - 790 MHz.

**SWEDEN**

Sweden has seven nationwide layers planned for DVB-T in 470 - 862 MHz (GE06). At present, five out of seven nationwide networks are in operation. Each network consists of a number of high power main transmitters (derived from allotments) as well as a number of additional transmitters for improved local coverage. One of the multiplexes needs to cover 99.8% of the population according to Parliament decisions.

The digitalization process is mainly based on conversions of the analogue network. At present it is foreseen that in total more than 1000 transmitters will be used for the delivery of five national multiplexes and a local sixth multiplex. However, the number of digital transmitters that finally will be needed for the necessary coverage can only be known after the switch-off of analogue television is finalised. Analogue television in Sweden is being switched off in steps (region by region) and the process will be ended by November 2007.

In figure 1, an overview of the estimated number of DVB-T transmitters in operation per channel at time of switch-off of analogue television is given.

In this frequency range there are also licenses for secondary services such as wireless microphone equipment. Most such equipment is licensed in the range above 800 MHz (channel 62 and up).

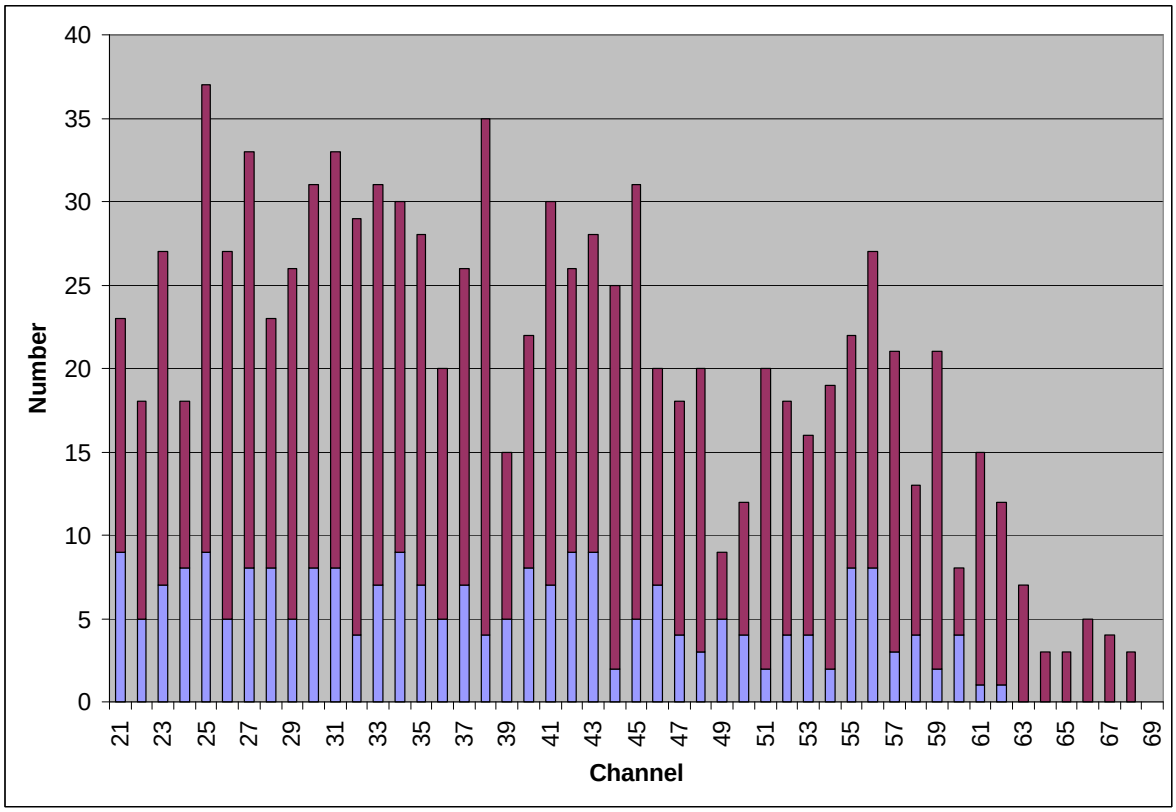



**Figure 1: Approximation of number of DVB-T-transmitters in operation (per frequency channel) at time of switch off of analogue television in Sweden, given the current number of networks (blue – main transmitters, red – additional transmitters)**

**FINLAND**

**Band plan options**

Finland has studied the potential band plan options as described in Table 2.1 and Figure 2.1 of the draft CEPT Report B to ECC and considered from a national frequency management perspective the suitability of these options for a fixed/mobile allocation if so decided.

In this exercise we assumed that 5 nationwide multiplexes ought to be maintained for distribution of digital television and removed the planned broadcasting use in turn from each of the segments described in Table 2.1 of the draft Report. Then the remaining broadcasting recourses were counted, if a given allotment area had still five or more channels available for broadcasting within the remaining band then this allotment area could be covered by fixed/mobile networks using all channels of the segment in question.

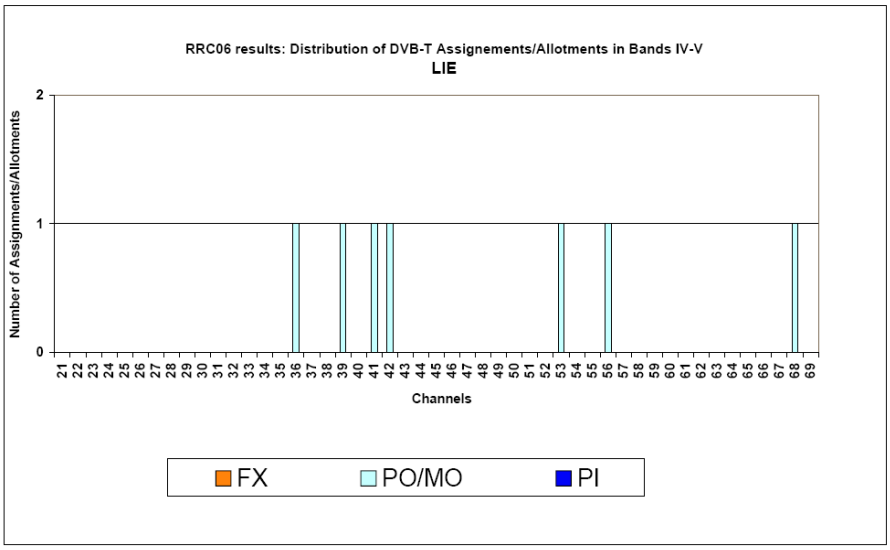
From this exercise it was concluded that allocating segment D (channel 58 - 69) for fixed/mobile services would enable the widest coverage for fixed/mobile networks without the need to modify the GE-06 plan.

This exercise also revealed that in case the lower part of the band i.e. segment A (channel 21 - 32) would be allocated for fixed/mobile service then the coverage of these networks would be somewhat lesser than what would be achieved by using segment D. However, allocating segment A for fixed/mobile service presented clearly the second best option from a national point of view even if it would pose more pressure on the need to modify the GE-06 plan.

This exercise did not take into account GE-06 plan entries of neighbouring countries nor did it take into account the primary allocation according to RR 5.312 posing restrictions to both segments C and D.

**LIECHTENSTEIN**

Many of large CEPT countries have their GE06 Plan entries distributed quite uniformly through the entire Bands IV/V, most small CEPT countries have their plan entries concentrated in a given segment of frequency channels. Therefore, for most small countries there are certain band options which will have a major deleterious impact in their broadcasting layers (in the case of Liechtenstein "Segment B" would affect 57% of the GE06 Plan entries). It should be noted that the smaller countries like Liechtenstein will have the greatest difficulty when reconstituting their broadcast layers.




| **Impact of band plan options for Liechtenstein** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Segment A CH21 to 32** | | **Segment B CH31 to 44** | | **Segment C CH45 to 58** | | **Segment D CH58 to 69** | |
| Number of Assignments/ Allotments | Percentage | Number of Assignments/ Allotments | Percentage | Number of Assignments/ Allotments | Percentage | Number of Assignments/ Allotments | Percentage |
| 0 | 0% | 4 | 57.1% | 2 | 28.6% | 1 | 14.3% |

## ANNEX A2: (TO BE SUPPLEMENTED): SHARING AND COMPATIBILITY STUDY RESULTS BETWEEN DVB AND FIXED/MOBILE SERVICES

The following studies are subject to further work in order to determine precise and general figure results.

**I. Co-channel sharing study, source France**

The feasibility of deploying an IMT-2000/UMTS system in the band IV/V using the GE-06 Plan entries is depending on the coexistence results of the co-channels sharing studies. The aim of this annex is to estimate the conditions for deployment of IMT-2000/UMTS network in a country which has neighbouring countries that are operating broadcasting transmitters in conformity with the GE-06 Plan. The initial simulations have been performed taking into account the terrain data model and the characteristics included in GE-06 Agreement.

Fresnel Deygout and P.1546-2 propagation models are used in the simulations and calculations on co-channel interference from DVB-T to IMT/UMTS.

**Interfering threshold for IMT-2000/UMTS base stations**

The interference protection level for IMT-2000/UMTS base station is considered as acceptable at -109 dBm/3.84 MHz (or I=-106 dBm/8 MHz), which was determined with I/N=-6 dB, where N=-103 dBm/3.84 MHz. In addition, the interference level for the protection of user equipment receivers is at -105 dBm/3.84 MHz with I/N=-6 dB.

Considering a base station maximum antenna gain of 12 dBi and a tilt angle of 5°, the antenna gain in the direction of the broadcasting station is 7.5 dBi according to ITU-R Recommendation F.1336. Then the corresponding interfering threshold is therefore 22 dBμV/m. For the mobile station, the antenna gain is considered to be 0 dBi and the noise level to be -99 dBm/3.84 MHz, the corresponding interfering threshold is therefore 33 dBμV/m. It should be noted that this does not mean that IMT/UMTS station would not be able to operate with interfering levels above this value but only that we can consider that for interfering level below this value, the impact of broadcasting stations interference is negligible. In particular, the interference to the base station is limited to the interfered sector.

The results of this simulations study show that the required protection distance for IMT-2000/UMTS is around 150km for the downlink and up to 250 km for the uplink. Nevertheless, it should be noted that 22 dBμV/m for the uplink and 33 dBμV/m for the downlink are quite pessimistic approaches and mitigations techniques could be implemented to reduce the separation distances to operate co-channel operations for DVB-T and IMT-2000/UMTS.

Moreover, calculations using deterministic or Monte-Carlo approaches seem to confirm simulations; 1 dB BS receiver desensitisation 14% more sites are needed, 48% additional sites will be needed if the BS receiver is desensitised of 3 dB. When the BS receiver is desensitised of 10 dB due to external interference, 270% of additional radio sites will be required. The protection level for UMTS BS/UE should be chosen appropriately. The presence of too strong external co-channel interference will reduce the UMTS coverage quality, and in consequence increase the implementation cost for mobile operators since more additional radio sites are required.

The UMTS network uplink or downlink capacity loss due to co-channel interference from DVB-T have been simulated with Monte-Carlo simulation tool. The impact on co-channel interference from DVB-T on UMTS is either the coverage loss at constant capacity or the capacity loss at constant coverage.

Finally, when DVB-T transmitting power is ERP=100 kW with antenna height at 500 m, the required separation distance is in the order of 200 km but 150km when the antenna height is 100 m

The required separation distances seem quite big without applying any interference mitigation techniques. It should be noted that different techniques (polarisation discrimination, interference canceller, network rearrangement, adaptive antenna…) and combinations of those techniques allow to reduce the required separation distance.

**Example of mitigation techniques**

For example, considering antenna cross-polarisation and interference cancellation, if DVB-T is transmitting at horizontal polarisation and UMTS is using vertical polarized antenna, a cross polarisation factor of 16 dB can be used as an attenuation factor in the calculation of co-channel interference from DVB-T to UMTS UL.

Moreover, by considering that the co-channel interfering signals from DVB-T on UMTS uplink is a well-known waveform, an efficient algorithm of interference cancellation in the UMTS BS enable a significant reduction of interference, especially when the interference signal level is very high; a gain of more than 10 dB interference reduction could be possible.

In conclusion, the UMTS BS receiver desensitisation improvement with combination of two mitigation techniques allows a reduction of the distance separation from 150 to 50 km with the 16 dB depolarisation factor combined with interference cancellation.

**Conclusions**

The co-channel interference from DVB-T to UMTS has been analyzed with deterministic calculations, Monte-Carlo simulations, field strength prediction with data terrain model by using different propagation models. Under the condition that DVB-T is transmitting power higher than 100 kW with antenna heights between 100 and 500 m, the co-channel interference protection separation distance from DVB-T to UMTS is around 150 ~ 200 km for the protection of UMTS network coverage and capacity.

Several interference mitigation techniques and combinations of these mitigation techniques allow to reduce the co-channel interference from DVB-T to UMTS. It is shown as example that the combination of mitigation techniques can reduce significantly the separation distance down to around 50 km.

**II. Adjacent channel sharing study, source France**

**Simulations descriptions**

In the simulations of adjacent channel interference between DVB-T and IMT/UMTS, the UMTS900 system parameters are used as assumptions for IMT/UMTS in UHF frequency band, four co-existence scenarios (coordinated and uncoordinated) in rural and urban areas between IMT/UMTS and DVB-T have been studied with Monte-Carlo simulations with and without the cross-polarisation factor. Both UMTS uplink and downlink capacity losses due to interference from DVB-T have been estimated with Monte-Carlo simulations implemented in SEAMCAT software tool.

In Monte-Carlo simulations, UMTS network is loaded up to 75% cell load at uplink with 6 dB noise rise. At downlink, the network is loaded that all of the transmitting power is used for maintaining the QoS threshold which is fixed as 5% system outage based on the C/I threshold correlated to the Eb/N0. The interference from UMTS UL/DL to DVB-T is simulated based on the C/(N+I)=23 dB, both blocking effects and unwanted emissions are taken into account in the simulations.

The antenna cross-polarisation factor is estimated as 16 dB, for the interference case from UMTS DL to DVB-T and the interference case from DVB-T to UMTS UL. For the interference case from DVB-T to UMTS DL and the interference case from UMTS UL to DVB-T, 10 dB depolarisation factor is used. For each co-existence scenario, the simulation results with and without the depolarisation factor are obtained and given below.

**Interferences analysis**

The simulation results show that:

- The interference from UMTS UL to DVB-T does not appear as a problem for all considered co-existence scenarios, even without any additional guard band. This can be explained that UMTS UE are at the ground level, the efficient WCDMA power control makes the UMTS UE transmit at limited power, in consequence, the interference from UMTS UE to DVB-T receivers becomes very small.
- The interference from UMTS downlink to DVB-T is decreasing with the guard band, the worst case is the urban environment. However when the 16 dB depolarisation factor is used, a guard band of 8 MHz is needed for keeping the interference probability equal or below 2%.
- The consequence of interference impact from DVB-T on UMTS would be the UMTS DL capacity loss, for the case using 10 dB depolarisation factor, the simulated results show that there is no need of an additional guard band. However, a guard band of 3 MHz is needed without using the depolarisation factor between DVB-T and UMTS downlink.
- The main interference problem from DVB-T to UMTS UL is the unwanted emissions of DVB-T transmitter and the blocking effects at UMTS BS receiver. The simulations show that the actual UMTS BS receiver blocking level is not sufficient against the strong signal from DVB-T transmitter. Without considering the UMTS BS receiver blocking effect, a 8 MHz guard band is needed for protecting the UMTS BS receiver against the unwanted emissions from DVB-T transmitter in order to keep the

UMTS uplink capacity loss below 5% when a 16 dB depolarisation factor is taken into account.

The interference due to blocking effects from DVB-T to UMTS BS receiver depends the DVB-T transmitting power, antenna Coupling loss between DVB-T transmitter and UMTS BS receiver, and the UMTS BS receiver out of band blocking level. The UMTS BS receiver out of band blocking level should be refined in the future IMT system specifications in order to define the appropriate out of band blocking level, the IMT UL frequency block must be separated from DVB-T transmitting band by 10 to 20 MHz.

**Conclusion**

For both co-location and uncoordinated cases between UMTS and DVB-T in rural and urban environments, the interference analysis based on Monte-Carlo simulations leads to the following conclusions:

- A sufficient frequency separation between DVB-T and UMTS UL between 10 and 20 MHz would be needed in order to define a sufficient UMTS BS out of band blocking level.
- Co-existence of IMT/UMTS downlink with DVB-T fixed reception will require the application of the same available mitigation techniques and careful network planning as in the case of interference from downlink "cellular / low-power transmitter" networks and "larger coverage / high power/tower" type of networks.
- The implementation of a sub band for IMT would avoid overall less efficient use of the spectrum with band fragmentation due to the multiplication of guard bands, and would ensure the efficient operation of UMTS with better BS and UE antenna gains and a sufficient redefined UMTS BS out of band blocking level.

**III. UMTS uplink interference in marginal coverage areas, source UK**

This section provides an example assessment of interference from IMT2000 mobiles highlighted by UMTS- to-DTT reception in marginal coverage areas.

The scenario modeled (using SEAMCAT) is an urban, UMTS-uplink interference into a DTT domestic receiver. The UMTS handsets (or interferer or UMTS UE) are located outdoors, within a typical UMTS cell and power controlled as part of a UMTS network. The DTT (victim) receiver antenna is located on the roof of a typical domestic building.

A full UMTS network is simulated, including handover and power control aspects. Also the full effect of inter-cell and intra-cell interference is aggregated at the victim DTT receiver.

Two sets of simulations assuming two sets of blocking responses were carried out.

The probability of interference witnessed by the victim DTT receiver as a consequence of a UMTS UE network are shown in Table A2.1.

| **Probability of Interference UMTS UE to DTT** | | |
|---|---|---|
| Radio Planning Design Margins | UMTS to DTT (adapted from DTT to DTT blocking Characteristics) | UMTS to DTT (measured using typical UMTS UE) |
| 3 MHz Guard Band (i.e. 9.5 MHz between DTT and UMTS channel centres) | 0.875% | 0.25% |
| 8 MHz Guard Band (i.e. 14.5 MHz between DTT and UMTS channel centres) | 0.125% | 0% |

**Table A2.1: Probability of Interference from Interfering UMTS UE into Victim DTT Receiver in an Urban Environment**

The probability of interference within the marginal coverage areas was determined to be less than 1% for 9.5 MHz separation between channel centres and less than 0.2% for 14.5 MHz separation. These probabilities would be correspondingly reduced for receivers operating at higher DTT signal levels, thereby further reducing the overall probability of interference to DTT.

Minimum coupling loss calculations were also carried out to determine the minimum isolation distance required between victim and interferer for a given guard band. The assumptions of DTT and UMTS parameters were as with the SEAMCAT simulation and again apply for a DTT receiver with an outdoor antenna located within the marginal DTT coverage area. Distances will be greater for receivers with coverage in excess of the marginal levels assessed.

The MCL using a typical measured DVB-T receiver (see Annex #.#) are reported in Table A2.2.

| Offset | N+1 | N+2 | N+3 |
|---|---|---|---|
| Frequency separation between channel centres (MHz) | 8 | 16 | 24 |
| Path Length in Metres to Achieve MCL | 54.63 | 21.75 | 6.88 |

**Table A2.2: Minimum Isolation Distance required between Interfering UMTS UE and Victim DTT Receiver in an Urban Environment**

Thus, the simulations indicate that, by careful selection of an appropriate limited guard band, the interference between mobile uplinks can be managed to a level which does not significantly impact upon the quality of outdoor DTT reception.

### IV. Measurements on DTT receivers, source UK

This section provides the results of measurements undertaken in the UK to determine protection ratios for 15 DVB-T receivers when subjected to interference from DVB-T. A receiver with a typical operating performance was chosen to test UMTS UE uplink interference in to a DVB-T receiver. Measurements were made specifically incorporating the effects of power control, representative of a UE traveling at 120 km/h and fading to represent interference from UMTS User Equipment (UE).

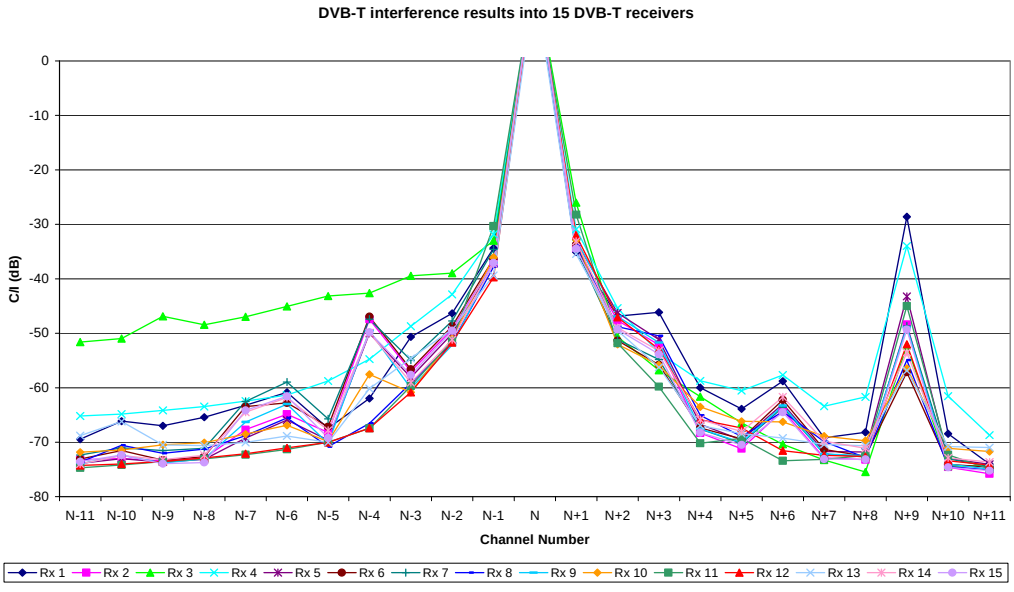



**Figure A2.1: C/I protection ratios for DVB-T interference into 15 DVB-T receivers**

Measurements show that the image channel usually performs similarly to the second adjacent channel. The average C/I protection ratio required from DVB-T interference at N+9 (receiver image) was -49 dB, a difference of 13 to 16 dB when compared to adjacent channel results.

The initial results investigating the interference from the UMTS User equipment show that:

- Adjacent channel UE interference into DVB-T receivers requires a C/I protection ~ -44 dB for non transmit power control and non fading scenarios.
- The results from the UE operating with transmit power control causes more interference compared with no transmit power control applied. One reason for this may be that the mean transmit power of the UE is considered in the transmit power control example, so there are instances of increased by power into the DVB-T receiver. (Independent of the transmit power control the UE transmit power cannot be increased above the maximum power, which is typically 21dBm.)
- UE operating with transmit power control required an adjacent C/I protection ratio of 5 - 8 dB more than the DVB-T result at N-1 and N+1 respectively.
- The difference between the UE operating with transmit power control and a constant power is dependent on the power versis time profile selected.
- Transmit power control plus fading results are similar to the transmit power control only results.

## ANNEX A3: COSTS OF MOBILE HANDSETS

According to a GSM Association study[5], there are significant costs involved for manufacturers when they consider the need to incorporate extra frequency bands in a mobile handset.

RF components, despite halving in value over the past three years, have stayed remarkably constant as a cost component and continue to represent some 7% of the overall cost of a mobile phone. This ratio applies irrespective of whether the device is a low tier or mid tier or high tier handset. The GSMA study identifies that four cost components in a cellular handset incur additional costs as a result of introducing additional frequency bands: RF performance costs and RF component costs (variable costs), non recurring RF associated engineering costs (fixed costs) and opportunity costs. These costs are increasing rather than decreasing over time and are volume dependent. The total costs are also influenced by the number of vendors competing in a particular market, through shared market costs. The study concludes that the impact of introducing a new frequency band on the cost of a mobile terminal varies drastically according to the addressable market, as shown in Table A3.1, due to the need to amortize non recurring engineering cost.

**Table A3.1: The increase in costs on a $30 handset of having to accommodate new frequency bands for varying size markets**

| Market size | 800 million units per year (Global) | 80 million units per year (e.g. China) | 8 million units per year (e.g. Romania, Venezuela) |
|---|---|---|---|
| 300 million dollars of NRE cost amortised over (5 vendors) | | | |
| Implies a per unit recovery of | 37.5 cents | 3.75 dollars | 37.5 dollars |
| Resulting in a 30 dollar handset costing | 30.375 dollars | 33.75 dollars | 67.5 dollars |
| 120 million dollars of NRE cost amortised (2 vendors) | | | |
| Implies a per unit recovery of | 15 cents | 1.5 dollars | 15 dollars |
| Resulting in a 30 dollar handset costing | 30.15 dollars | 31.5 dollars | 45 dollars |

The exact amount varies and depends on assumptions made (such as the number of vendors a market needs to support). The study concludes that there are substantial cost benefits to be had from such common frequency bands, at least on a regional basis (i.e. EU or CEPT wide).

[5] GSMA technical note – "The advantages of common frequency bands for mobile handset production", May 2007, www.gsmworld.com

## ANNEX A4: UHF LINK BUDGET

It is noted that, for a number of parameters within the link budget, there is a possible range of values referenced in different published sources, which will result in different studies providing a range of results unless consensus is reached on key parameters.

A number of the key assumptions are:

- **Base Station transmitted power, antenna gain and feeder losses**: The values proposed are based on UK's planning assumptions, and are similar to those proposed in other sources (e.g. UMTS Forum Report 38). The antenna gain used (15dBi) is lower than might be used in UMTS deployments in higher frequency bands, to reflect the likely achievable performance at UHF.

- **Body loss**: Values for body loss have been derived from ITU-R Recommendation P.1406, Propagation Effects relating to Terrestrial Land Mobile and Broadcasting Services in the VHF and UHF Bands. This gives a range of body loss from 6.9 dB for the lower spectrum (e.g. 550 MHz) to 9.7 dB for the upper spectrum (e.g. 854 MHz).

- **Mobile power and antenna gain**: The link budgets illustrated in Table AX.1 propose a mobile antenna gain of -5dBi. Information from handset vendors suggests that the achievable antenna gain at UHF will be very low, in the order of –5dBi (858 MHz) to –10dBi (474 MHz)[6] for antennas needing to tune over the full UHF frequency range. Assuming a linear relationship of antenna gain versus frequency, this suggests values of -8.8 dBi for 550 MHz and -5.4 dBi for 854 MHz. Studies may therefore need to include a sensitivity analysis around key parameters to illustrate the impact of different values where there is no clear consensus.

- **Building penetration loss**: ITU Recommendation P.1238[7], suggests values of building penetration loss of between 9dB and 24dB for the 900 MHz band. A typical value used for UHF radio planning for indoor coverage is 15dB. Other sources of information on this include Parsons, The Mobile Radio Propagation Channel, which suggests the following range of values at 441 MHz.

| Floors | Mean Penetration Loss on Various Floors |
|---|---|
| Ground | 16.37 dB |
| 1 | 8.11 dB |
| 2 | 12.67 dB |
| 3 | 13.76 dB |
| 4 | 11.09 dB |
| 5 | 5.42 dB |
| 6 | 4.2 dB |

- **Log Fade Margin**: this margin is set at 10.0 dB for lower spectrum and 10.4dB for upper spectrum, including a small frequency variation to the location variability[8] to give a 95% coverage confidence in the predicted coverage.

- **Propagation Model**: For the purposes of interference studies, it is proposed that alternative propagation models might be suited to different interference scenarios being studied. For the assessment of imported and exported interference effects between DTT and mobile systems, based on the GE06 Plan, it is

[6] e.g. Nokia, Handheld Devices and Preferred Spectrum, Multi-radio Multimedia Conference, Berlin January 2005
[7] ITU Recommendation P.1238, Propagation Data and Prediction Methods for the Planning of Indoor Radiocommunications Systems and Radio Local Area Networks in the Frequency Range 900 MHz to 100 GHz
[8] S.R. Saunders, A. Aragon-Zavala, "Antennas and Propagation for Wireless Communication Systems - Second Edition", published by John Wiley, 2007.

suggested that ITU-R P.1546 is used. For mobile network design, however, this prediction method may not be the most appropriate method, since location-specific clutter losses become more relevant. Also, for short-range sharing studies, such as between the mobile uplink and DVB-T receivers, another model such as ITU-R P.1411 may be appropriate.

Link budgets for upper and lower spectrum based on the assumptions documented above show that the upper spectrum is able to tolerate around 3.4 dB extra maximum path loss. This will be offset by the differences in the path losses encountered at a given distance from the propagation model at the different frequencies. These are estimated as around 4.3 dB difference between the bands assuming 26.2 dB variation per decade of frequency, leaving a net advantage for lower spectrum of just 0.9 dB, which is not expected to be significant compared with the differing interference constraints. However, further analysis is required to verify this finding.

## ANNEX A5: MITIGATION TECHNIQUES

A brief discussion of some of possible interference mitigation techniques within an IMT-2000 network is provided below.

**(a) Network planning approaches to add resilience to incoming interference**

Mobile operators typically use various techniques at base station sites to mitigate incoming interference and/or to improve site-sharing possibilities with other networks/operators. Typical techniques include filtering, antenna separation for co-located transmitters (which might add 10-15 dB isolation) and coordination of antenna azimuths. It is noted that these apply primarily to interference to/from base stations only; for mobiles, the most appropriate mitigation factors are power control and frequency planning, discussed in the next section.

Typical approaches for mitigating interference to/from IMT-2000 base stations are briefly discussed below:

- Antenna separation – Coupling between two antennas located in the same site can be reduced by separating the antennas vertically, horizontally or back-to-back by a few metres. For network planning purposes the widely accepted figure of the coupling loss for co-located antennas that are not coordinated is 30 dB. Higher values of coupling loss are achievable where the types of separations described above are available. The improvement is achievable using the antenna patterns only, without the use of any additional screening or absorption material.

- Use of adaptive antennas – Adaptive antennas are used to enhance received signals and may also be used to form beams for transmission. The direct benefit from the use of adaptive antennas on the co-existence with other systems, however, is due to the fact that the RF energy radiated by antenna arrays is lower than that from conventional antennas for the same EIRP and is also focused in limited, specific regions of a cell rather than wide sectors. Consequently, adaptive antennas have negligible impact on 'peak' interference but reduce the probability of interference occurring. They can also substantially reduce the system sensitivity to incoming interference, particularly in the case of the more advanced MIMO systems, which are a core feature of IMT-Advanced, and Mobile WiMAX systems.

- Filtering – for downlink (base station to base station) interference, filtering or power amplifier linearization techniques can be used to reduce the unwanted emissions from a base station, thus reducing the interference at the victim receiver. In a similar manner, receiver filtering may reduce the in-band interference to the victim base station. ITU-R Working Party 8F has previously produced a recommendation on mitigation techniques for IMT-2000 (ITU-R M.2045), which suggests that filtering can add 9-15 dB improvement at 5 MHz offset and significantly better improvement at frequency offsets beyond this.

- Downlink Power Control in TDD Systems – TDD downlink power control is an integral part of the 3GPP TDD standard, and of the Mobile WiMAX standard, and is used primarily to increase system capacity by reducing intra-system interference. In addition, power control also adds immunity to downlink interference as the base station can adapt the power it transmits.

- Antenna polarisation – it is possible to achieve additional isolation between two linearly polarised BS antennas by having them orthogonally polarised to each other. As an example, using vertical polarisation on one antenna and horizontal polarisation on the other can reduce the degree of coupling between the two. The coupling effect is quantified in terms of an antenna characteristic known as cross-polar discrimination (XPD). This can add several decibels of isolation at the base station.

- Use of antenna azimuths – where IMT-2000 macro base stations employ sectored antennas, azimuths could be coordinated to reduce antenna gain in the direction of the interferer.

- Reduced transmission power – It is noted that one means of reducing interference from an IMT-2000 base station is to transmit at lower power. However, to achieve the same coverage with less power, more base stations may be required, although this may not be the case if the system is uplink-limited. Alternatively the base stations may be moved closer to the system users, reducing propagation losses. It is noted that low power systems are increasingly used in-building or within complexes such as airports, train stations, tunnels and stadiums where the high concentration of users may justify a distributed antenna solution that increases base station capacity with minimal EIRP from any single antenna. It is also noted that lower power systems may be able to utilise channels that are unsuitable for full power use (e.g. guard or restricted channels).

- Interference blanker: by considering that the co-channel interfering signals from DVB-T at the UMTS BS receiver has a well-known waveform, the incidence angle from a specific DVB-T transmitter is also well known, an efficient algorithm of interference cancellation in the UMTS BS can allow to reduce significantly the co-channel interference. Under the condition that the interference signal strength and incidence angle is well known, the uplink interference cancellation gain will be more important than downlink. The downlink interference cancellation principle is usually based on G-Rake, the downlink interference cancellation gain depends several parameters, such as the external interference level, intra-network interference level… The uplink interference cancellation works based on the code de-correlation, with the two uplink reception diversity antennae, the interference cancellation gain can be largely improved with the combination of code de-correlation and space de-correlation of the signals. If the interference signal level is at the same level as thermal noise plus the noise rise due to traffic load, the interference cancellation gain should be moderate, when the interference signal level is above the thermal noise plus the noise rise due to traffic load, the interference cancellation gain could be very significant, especially when the interference signal level is very high, a gain of more than 10 dB interference reduction is possible.

**(b) Mobile Power Control**

Power control is an important technique used in mobile radio systems such as IMT-2000 to improve performance (by reducing intra system interference) as well as to lower power consumption for both the Mobile handset battery and the Fixed Base Station. The goal of the power control algorithm is to minimize the interference level by decreasing the unnecessary uplink power transmitted, while maintaining a quality target criterion for each uplink sufficient to maintain the link with the base station. The main implication of power control is that mobile stations close to the base station transmit at lower power, so that they do not use unnecessary resources needed to maintain links with mobile stations further away from the base station.

Additionally, the maximum mobile station power is an operator-settable parameter, and this can be traded-off with the propagation advantage of UHF spectrum in order to provide an adequate level of coverage consistent with protection of DTT services.

As an example of this, calculations by the UK suggest the following variations in power transmitted by mobiles at different locations in a cell, considering a 1km IMT2000 macro cell; this is for information only because the reduction of the cell radius isn't compatible with the objective of large cells for rural area. According to the prediction models described in ITU-R M.1225, for a uniform distribution of mobiles around the cell area, no more than 25% of the users will be transmitting close to full power.

**(c) IMT Carrier Planning**

It is noted that many of the service scenarios proposed for use of the UHF band for mobile services assume that Bands IV and V are being used to provide an additional carrier or carriers, to provide rural coverage in addition to mobile coverage already provided in other frequency bands (e.g. 900 MHz, 1800 MHz, 2100 MHz). The implementation of multi-band networks in itself provides the potential for interference mitigation through frequency planning, since it will be possible for operators to avoid using particular carriers in certain geographic areas affected by interference (or causing interference to other services). Assuming that mobile handsets support multiple frequency bands, then the handset will use the network available in the area it is being used and so will not transmit in the UHF band if this is not supported by the network in that area.

It is noted that the ability of an operator to use carrier planning to mitigate interference, and still achieve a composite coverage over a wide proportion of the country (through availability of alternative IMT frequency bands, or for targeting services which only require regional coverage) might also potentially also enables use of the Band IV/V interleaved spectrum for mobile services on a regional basis.

## ANNEX A6: STATEMENTS

### Statement from Lithuania

Administration of Lithuania has performed analysis which have been presented to ECC TG4 in doc. TG4(07)057 on possible implementation of fixed/mobile service in the band 830 - 862 MHz (channels 66 - 69). This band is used by aeronautical radio navigation systems of the neighbouring countries – the Russian Federation and Belarus. Results of the analysis have shown that only 3 MHz are available throughout the country for implementation of fixed/mobile service. Therefore Lithuania may not be able to implement fixed/mobile service in the whole band channels 62 - 69 mentioned by the Report B.

### Statement from Turkey

Turkey is supporting the course of action chosen by TG4.

Turkey states that no decision regarding the harmonization of a sub-band in the 470 - 862 MHz is being taken yet, considering;

- the existing situation of analog broadcasting and transition scheme of digital TV in Turkey,
- usage of OPS Services in neighboring countries and certain need for a compatibility analysis between fixed/mobile and OPS services.

If decided, preference would be given to the upper band of 470 - 862 MHz.

## ANNEX A7: RESERVATIONS

**Reservation from Belgium**

The choice of any sub-band will create different important holes in the layers obtained at RRC 06 and the current GE06 plan will not remain intact.

In addition the harmonisation of a sub-band will lead to a non-equitable access of remaining GE-06 channels between countries and even within a given country such as Belgium.

Belgium has a very high density of plan entries in the upper part of the band. With the choice this part of the band, Belgium will loose up to four layers in some parts of the country depending of the size of the sub-band.

Bilateral or multilateral discussions will not be sufficient to ensure equitable access to spectrum with our neighbouring countries. Consequently significant re-planning of the GE06 plan will be necessary and this is not an acceptable option for the Communities in Belgium.

**Reservation from Portugal**

Portugal would like to state that it can not agree with part of the conclusions of this report since the upper part of the UHF band is not the preferred band in our country for the purpose mentioned.

In Portugal a public tender will be launched during the second half of this year for the introduction of DVB-T.

Rights of use will be granted for 15 years, for three nationwide coverage's and for three regional/coastal area coverage's in Portugal mainland, in a total of six multiplexes.

These 6 multiplexes will use the upper part of the UHF band, channels 60 to 69, which is the only sub-band available at this moment for the introduction of DVB-T in Portugal, since channels below channel 60 are heavily used by analogue TV all over the country.

Under these circumstances, it will be impossible in Portugal to make available the upper part of the UHF band for fixed/mobile services in the near future.

**Reservation of Russian Federation**

Russian Federation intensively uses the band 470 - 862 MHz for broadcasting service and other primary services.

During transition period simultaneous transmission of analogue and digital television services will require to use the most of available spectrum in band 470 - 862 MHz, taking into account other primary services

The decision on feasibility of designation a part of the band 470 - 862 MHz for mobile/fixed applications could be made only after estimation of spectrum requirement for future development of broadcasting service and after conducting sharing study between fixed/mobile applications and other primary services, operating in the band 470 - 862 MHz in Russian Federation.

**Reservation from Spain**

Spain wants to state in this reservation the impossibility of finding dedicated sub-bands for fixed/mobile applications (including uplinks) in the digital dividend and also notes that the concluded preferred sub-band in the upper part of the UHF band, channels 62 - 69, is the worst case for Spain due to the explanations given below.

In Spain, a nation-wide DVB-T network of 7 mulitiplexes is in operation since 2005, which presently covers approximately 80,45% of the population. This network coexists with the analogue television, resulting in a high occupancy of the UHF band where no free channel exists at this moment.

After the switchover, planned for April 2010, new multiplexes will be allocated, so the situation is not going to be better regarding the availability of frequencies for new services.

Royal Decree 944/2005, which approves the National Technical Plan for Digital Terrestrial Television, reserves 6 multiplex for nation wide private concessionaries, 2 multiplex for Spanish Public television, 2 nation wide

multiplex for regional television in each Autonomous Community, and one more nation wide to be occupied by mobile television, which will be allocated after the switch over. Furthermore Royal Decrees 439/2004, 2268/2004 and 994/2005 related to the National Technical Plan for Local Digital Terrestrial Television establish 291 areas for Local Television.

Consequently 5 layers need to be allocated to DVB-T in the Spanish Digital Dividend considering 7 multiplex already working.

Due to these constraints, it is impossible to identify dedicated sub-bands for fixed/mobile applications (including uplinks) in the digital dividend.

The other important fact to state is that all existing Digital Terrestrial Television layers are located in the upper part of the spectrum, included 4 nation wide SFN multiplex in the channels 66, 67, 68, 69. As a result any change in channel allocations in this upper part is not feasible.

## ANNEX A8: PROPOSED LIAISON STATEMENT TO CPG

ECC/TG4 at its 4th meeting in Antalya 11-14 June concluded that the harmonisation of a sub-band of the UHF band for mobile communication applications (i.e. including uplinks) is feasible from a technical, regulatory and administrative point of view, provided that it is not made mandatory and any decision about use of the harmonised sub-band is left to individual Administrations. The preferred sub-band for such harmonisation is the upper part of the UHF band, and should include, as a minimum, the range of channels 62 - 69 (798 - 862 MHz).

Reservations were made by Belgium, Portugal, Russian Federation and Spain.

Administrations will continue to be able to use this spectrum for Broadcasting services but will also be able to use it for Fixed/Mobile services in a flexible manner depending on national circumstances. ECC/TG4 is continuing technical studies for the sharing between broadcasting and other services. Under footnote 5.316, a sub-band is allocated on a primary basis in a number of Member States.

ECC/TG4 stresses that the studies in ECC TG4 do not address the more complex situations which would arise under Agenda Item 1.4 of WRC 07.

**REFERENCES**

[1] GE06: Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174 - 230 MHz and 470 - 862 MHz (RRC-06)

[2] RSPG Opinion #7 "EU spectrum policy implications of the digital dividend", 2007

[3] Report A: Final Report from CEPT to the European Commission on compatibility issues between "cellular / low power transmitter" networks and "larger coverage / high power / tower" type of networks

[4] ITU-R Report M.2078: Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced

[5] EBU Tech Rev, Oct 2006: Overview of the second session (RRC-06) and the main features for broadcasters, Terry O'Leary, Elena Puigrefagut and Walid Sami *EBU Technical Department*

[6] RR: Radio Regulations

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