

# The long term future of UHF spectrum

### A response by Vodafone to the Ofcom discussion paper "Developing a framework for the long term future of UHF spectrum bands IV and V"

15 June 2011 (amended 1 July)<sup>i</sup>

# 1 Introduction

Vodafone welcomes Ofcom starting to consider the long term future of the UHF spectrum in Bands IV and V (470-790MHz). This spectrum falls in the "sweet spot" in the radio spectrum that is suitable for both capacity and coverage. It is therefore attractive for a wide range of applications, and therefore has the potential to provide substantial benefits to citizens and consumers, and to the UK economy.

If television was a new application in the twenty first century, it would be impossible to justify devoting nearly an octave of prime UHF spectrum to TV broadcasting, when there are several other platforms for its delivery – satellite (itself using nearly 1GHz of microwave spectrum), cable and broadband. In this sense, UHF TV broadcasting is a legacy user of spectrum.

However, around 40% of households currently use terrestrial broadcasting as their primary platform for television viewing, and a significantly higher proportion use it as secondary platform ("second sets" etc). It is likely that these numbers will reduce over time due to market trends in the broadcast industry:

- demand for multi-channel HDTV, which is better served by satellite and cable.
- growth in video on demand.

Despite this, a substantial proportion of citizens will continue to use terrestrial broadcasting for the foreseeable future, and it will be imperative from Ofcom's perspective that any future rebalancing of UHF spectrum does not significantly disrupt their ability to watch television. This paper suggests some possible ways that the UK might be able to release UHF spectrum for other uses that provide substantial benefits for UK citizens and consumers and the UK economy, while maintaining this imperative. To deliver this, Ofcom will need to start the preliminary planning many years in advance.

# 2 Recommendations

While any further release of UHF spectrum will not take place for a number of years, it is important that Ofcom starts now to consider the long term implications. This will enable the long term planning to take place that will be needed to minimise disruption to viewers, and will help Ofcom to avoid taking near-term decisions that preclude options for long-term realignment of the spectrum:

1) The lower digital dividend (channels 31-37) is a very important factor in any future adjustment in the use of UHF spectrum, both to relocate any multiplex channels moved

from higher frequencies and for transitional arrangements. Ofcom should not initiate an award process for this spectrum until it has studied the long term future of UHF spectrum bands IV and V in more depth.

2) Ofcom should promote the development and use of adequate standards for RF performance and immunity of TV receivers.

3) Of com should investigate how the TV aerial industry can be encouraged (or required) to install only wideband antennas throughout the UK.

4) Of com should study the possibility for UHF terrestrial broadcasting to migrate to full or partial SFNs, to reduce the spectrum needed.

5) Ofcom should consider carefully whether it is an efficient use of spectrum for new TV services that require viewers to purchase new reception equipment to be broadcast on the terrestrial UHF as well as the cable and satellite platforms.

# 3 The future UK landscape for television broadcasting

The landscape of broadcasting in the UK is changing rapidly, as demand for HDTV and video-on-demand both increase (with the possibility of 3D-TV in the future). Both of these services can be delivered more effectively using platforms other than terrestrial UHF broadcasting (satellite or cable for HDTV, and cable or IPTV for video-on-demand). These trends are likely to reduce the use of terrestrial UHF for TV services.

It is likely that a considerable number of citizens will continue to use terrestrial reception for a long time, but this will increasingly be for 'second sets'. As a result, demand on the terrestrial platform for HDTV and minority channels is likely to drop. This is likely to be accompanied by a move to DVB-T2, and perhaps single frequency networks (SFNs).

These trends are likely to make a second 'digital dividend' possible, perhaps in the latter part of this decade.

### 3.1 Experience from the digital switchover and clearance of channels 61 and 62

The UK was the only European country to include a digital dividend within its proposals for the plan for digital television broadcasting that was agreed at the ITU GE-06 conference. This digital dividend comprised TV channels 31-40 and 63-68. While the parameters for these channels allow a range of alternative uses, there was little consideration of how the spectrum might actually be used. As a consequence, the digital channels were chosen to minimise the impact on broadcasting, rather than to maximise the net benefit from the potential alternative uses.

One important constraint for the UK is the 'grouping' of domestic TV reception antennas (see section 5.2), which in Europe is almost unique to UK. This is why the digital dividend is in two blocks, to avoid moving TV channels between groups, which would require the replacement of some of these antennas. When other European countries started to consider their own digital dividends, they decided on a single frequency range at the top of Band V, to simplify cross-border coordination and minimise the number of frequency boundaries with broadcast spectrum. The value of spectrum is greatly increased by international harmonisation, so Ofcom has decided to align the UK digital

dividend, which will involve the migration of TV broadcasting in channels 61 and 62 down to channels 39 and 40. This will involve two "switchovers" for some viewers, because the decision to migrate channels 61 and 62 was taken too late

This experience provides some lessons for any future adjustment of the use of UHF bands IV and V:

- The value to citizens, consumers and industry of harmonisation with Europe will almost always outweigh the costs in achieving it.

- It is therefore important to consider the likely use for any spectrum released.

- It is important to plan a long way ahead, to minimise the number of transitions that viewers experience.

### 3.2 The European dimension

The penetration of terrestrial broadcasting as a primary platform for TV varies widely between European countries, from around 2% (Hungary and Romania) to more than 60% (Spain, Cyprus and Czech Republic)<sup>1</sup>. The UK falls slightly above the median.

It is likely that countries with a low penetration of terrestrial broadcast reception and/or a low number of operational terrestrial multiplexes will wish to start considering a second digital dividend quite soon, in order that they can fulfil their national policy objectives to make efficient use of spectrum. This is likely to gain momentum after the ITU World Radiocommunication Conference in 2016 (WRC-16), which is likely to set the framework for any future European harmonised changes to the use of spectrum below 790MHz.

It is important to Ofcom to make the preparations necessary to participate fully in the European discussions, even if this timeframe is considered to be earlier than optimal from a UK perspective.

# 4 Demand and Supply for UHF spectrum

UHF Bands IV and V (470-790MHz) fall in the "sweet spot" in the radio spectrum, that is suitable for both capacity and coverage. It is therefore attractive for a wide range of applications that have the potential to provide substantial benefits to citizens and consumers, and to the UK economy. This paper concentrates on the most important of these current and potential uses – broadcasting and mobile broadband.

#### 4.1 Future demand for broadcasting

As discussed in the introduction, UHF terrestrial television broadcasting is effectively becoming a legacy service. However, it will persist for the foreseeable future, due to the long lifetime of TV sets and the obstacles and lack of incentives for some citizens and other market actors<sup>2</sup> to migrate to newer TV platforms. It is likely that developments in

<sup>&</sup>lt;sup>1</sup> Report for the European Commission; Exploiting the digital dividend – a European Approach; Final Report, 14 August 2009; Analysys Mason, DotEcon and Hogan & Hartson (figure 6.4, page 116).

<sup>&</sup>lt;sup>2</sup> For example, owners of multiple occupancy properties with TV signal distribution systems.

the TV market will reduce the number of programme channels that need to be broadcasted on the terrestrial platform, and there will not be a strong demand for HDTV.

The number of terrestrial multiplexes needed for terrestrial UHF broadcasting would therefore reduce over time. The introduction of more efficient video coding and transmission techniques (like MPEG4 and DVB-T2) and the more extensive use of SFNs would further reduce the spectrum requirement for terrestrial UHF broadcasting.

### 4.2 Future demand for mobile broadband

Data traffic is increasing exponentially – a wide range of studies have found annual growth of between 50% and 100% per annum. This growth is driven by increasing use of services that require high bit rates. Users increasingly expect these services to be ubiquitous – at work, at home, in urban and rural areas, and while on the move in cars and trains. Delivering these services will require an increasing bandwidth of radio spectrum, and a proportion of this spectrum will need to be at lower frequencies (in practice, below 1GHz) to provide ubiquitous coverage.

### 4.3 White space technologies

Ofcom has published a number of consultations on various aspects of use of TV white spaces. In its consultation of February  $2009^3$  Ofcom provides an estimate of the economic benefit of allowing cognitive access in UHF TV white spaces – a very modest figure of £15 – 270 million net present value (NPV) over 20 years. However, the figures used in this analysis suggest that the NPV of releasing the equivalent amount of spectrum in the future for licensed applications would be around £10 billion<sup>4</sup>. This is around two orders of magnitude higher than Ofcom's estimate of the NPV of cognitive access over the same period.

It is therefore clear that, in order to promote the most efficient use of this spectrum and the benefits that arise from its use in the long term, Ofcom should not authorise any use of TV white spaces in the short term that prevent future readjustments of the use of this spectrum.

### 4.4 Long term future of PMSE

PMSE (radio microphones) has been a major user of 'white spaces' within the UHF band for many years. It is likely that any future changes in use of bands IV and V will reduce the availability of white space spectrum for PMSE. Learning from the experience of Channel 69, it is important that future bands for use by PMSE are identified well ahead of the possible loss of capacity in bands IV and V, so that the PMSE industry can migrate to the new band over the natural replacement cycle for PMSE equipment. Ofcom might consider encouraging this migration through discounted pricing for PMSE licences.

<sup>&</sup>lt;sup>3</sup> Digital dividend: cognitive access; Consultation on licence-exempting cognitive devices using interleaved spectrum; 16 February 2009; The estimate is in the impact assessment, starting in para. A5.9.

<sup>&</sup>lt;sup>4</sup> Vodafone response to Ofcom consultation on the Digital Dividend: cognitive access - licence-exempting cognitive devices using interleaved spectrum (February 2009), pages 8-9.

One possible future band for radio microphones is 2025 – 2090MHz. This band is already used by another type of PMSE –electronic news gathering (ENG) and outside broadcast links – and the sharing criteria with other primary services in the same band will make it difficult to use for high capacity mobile applications for many years. This might partially displace the existing ENG use of this band; however, research is already well underway on improving the spectrum efficiency of ENG links (using techniques like MIMO) and using higher frequency bands.

# 5 Technical issues to be addressed

### 5.1 The likely form of any future release of UHF spectrum

Every digital dividend that is being considered around the world (apart from the UK lower digital dividend) is at the upper end of the UHF broadcast spectrum. There are two fundamental reasons for this:

- 1) Having the mobile allocation at one end of the band results in only one frequency boundary at which interference mitigation needs to be addressed.
- 2) The lower part of the UHF band provides better coverage for UHF broadcasting, and many broadcast networks have been planned on this basis.

For the same reasons, any future digital dividend is likely to be immediately below 790MHz (the lower boundary of the existing one).

A natural lower boundary for a second digital dividend in Europe would be 698MHz, which is the boundary for the first digital dividend in Asia Pacific. This would allow the same bandplan to be used in Europe as is currently being developed by Asian countries, which would result in greater economies of scale for terminals.

Alternatively, the spectrum could be used for extra downlink channels, in conjunction with existing uplink channels in the 800MHz band or any other mobile band. This might provide a better match to future mobile traffic, and could simplify a number of implementation issues for use of this spectrum.

# 5.2 Antenna grouping

It is likely that future adjustment of the use of the UHF spectrum will involve changes of TV channel for some main station transmitters that will cross the boundaries of antenna groups. It is likely that some domestic TV reception antennas in the service area of these transmitters will need to be replaced, which will take some time. Therefore, these switchovers are likely to take some time, with a period of simulcasting on current and new channels. There need to be sufficient free channels available for this purpose.

We would suggest that Ofcom and/or DTG start to consider strategies to identify households that might need new antennas (for example, this could be a combination of automatic retunes, on-screen messages only transmitted on the current channel etc).

### 5.3 The lower digital dividend

As discussed in section 5.1, the most likely location for a future mobile band in the UHF spectrum is adjacent to the existing band, immediately below 790MHz. It is unlikely to overlap with the currently UK lower digital dividend (channels 31-37, or 550–606MHz). However, this spectrum could be extremely valuable in facilitating the clearance of spectrum for a second digital dividend, either for moving multiplexes from higher channels or for transitional arrangements.

The planned award of 800MHz spectrum will provide Ofcom with information on the value of UHF spectrum for mobile broadband, which can inform a decision on the optimal way forward for the lower digital dividend.

### 5.4 RF performance of TV receivers

Many studies of the impact of the first digital dividend have highlighted the wide spread in performance TV receivers and set top boxes currently on the market and in use.

It reasonable to expect that future TV sets should have a performance at least as good as the best ones that are currently on the market. Of com should consider what might be the best approach to achieve this (including a certification scheme like the digital "tick").

#### 5.5 Single frequency networks

In UK, the channel plan is largely based on separate channels for adjacent service areas, though there are a few local single frequency networks (SFNs). However, some countries have planned their terrestrial networks to include much more use of SFNs. The experience of these countries might provide confidence for the UK to increase its use of SFNs in the future.

SFNs cannot be used when service areas transmit different programme content, such as local news or adverts. It is likely that the TV channels with local programme content could be concentrated on a single multiplex. It is unclear how many other channels carry local adverts. Ofcom might wish to consider the economic value of these local adverts compared with the opportunity of cost of the spectrum that is needed as a result (because SFNs could not be used).

One possible migration strategy to reduce the spectrum needed for UHF broadcasting in UK would be to establish four SFNs in the lower digital dividend (channels 31 - 37) and migrate viewers on to these channels where this is possible (i.e. except in service areas where these channels cannot be used due to international coordination).

### 5.6 Connection of "second sets" to cable and satellite receivers

There are a number of obstacles for citizens and consumers to move from terrestrial UHF TV reception to other platforms. For 'second sets', one barrier is the need for internal cabling in the home from the 'point of-entry' of the TV service and 'second sets'. This barrier can be overcome using wireless technology, but this needs a frequency band with sufficient 'reach' to connect different rooms.

Ofcom might consider encouraging innovation in this area because of the wider benefits, including ensuring that suitable spectrum is available for this application. The worst

possible outcome would be for the current UHF TV white spaces to be used for this purpose because of the lack of a suitable alternative.

# 6 Conclusions

The trends in broadcasting and mobile broadband make it likely that a future adjustment in the use of the UHF spectrum will be needed within the next decade, in order to promote the most efficient use of this spectrum and the benefits that arise from its use.

It is important to minimise any disruption that this adjustment might cause to existing users of this spectrum, and in particular terrestrial television reception. This paper identifies a number of issues that will need to be addressed. Some of them need to be planned many years ahead.

It is therefore important for Ofcom to start preliminary thinking about the long term future of the UHF spectrum. It should not hold any spectrum award for the current lower digital dividend until this has been completed.

<sup>&</sup>lt;sup>i</sup> This amended version corrects an error in a frequency in section 4.4.