

REPORT TO THE EUROPEAN COMMISSION

**RESULTS OF THE WORK OF THE HIGH LEVEL GROUP
ON THE FUTURE USE OF THE UHF BAND (470-790 MHz)**

By Pascal Lamy

1. PURPOSE

The High Level Group (HLG) on the future use of the UHF band (470-790 MHz) was convened at the end of 2013 by the Vice President of the European Commission and Commissioner for the Digital Agenda Neelie Kroes. It comprised nineteen executive-level representatives from the mobile and broadcasting sectors, including the PMSE sector, under my Chairmanship. The overarching objective laid down in the mandate of the Group was to deliver strategic advice to the Commission for the development of a European strategy on the future use of the UHF band.

In order to fulfil the objectives of the mandate, my aim was to achieve a consensus within the High Level Group and deliver a report to which all members would sign off. Although the Group could find a lot of common ground, some pertinent differences remained which did not allow such consensus to bear fruit. Therefore, I have prepared this report under my own responsibility.

2. THE EUROPEAN CONTEXT

The trigger of the High Level Group process dates back to 2012, when the International Telecommunication Union World Radiocommunications Conference (WRC-12) allocated the valuable spectrum resource of 694-790 MHz (called the '700 MHz band') to the mobile service alongside the previous exclusive allocation to the terrestrial broadcasting service in ITU Region 1¹ with effect in 2015. In all other world regions the 700 MHz band is already allocated on a co-primary basis to and increasingly used for mobile services. This band represents an opportunity for globally harmonised spectrum for mobile broadband offering economies of scale and roaming with any next generation mobile technology (LTE² and beyond). However, terrestrial broadcasting services are using the 700 MHz band today in the EU. For conventional mobile networks to have access to this band, terrestrial broadcasting networks would have to clear it because both types of networks cannot coexist in the same frequency band with today's technology. The rest of the UHF band (470-694 MHz) continues to be allocated exclusively to the broadcasting service in ITU Region 1.

Both mobile and broadcasting services are valued by European citizens. The devices that give us access to these services are used by nearly every European on a daily basis. Yet there are differences throughout Europe in relation to how and how many TV programs are received. This diversity across Europe leads to a challenge in coordinating the future use of the UHF band.

Neither the mobile nor the terrestrial broadcasting sectors could exist without access to spectrum. The original UHF broadcasting band (470-862 MHz) is a valuable asset for ubiquitous and cost-efficient network deployment, whether for terrestrial broadcasting or mobile. These frequencies have been traditionally used for terrestrial broadcasting for many decades. However, mobile operators also need such lower frequencies, in

¹ ITU Region 1 includes European Union and other European countries, Africa and the Middle East

² Long Term Evolution, what is popularly known as "4G"

particular, for bringing broadband services, such as the Internet, into rural areas, in line with EU policy objectives set out in the Digital Agenda for Europe, but also for optimal in-building service in densely built urban areas.

It should be clear from the start that the debate on the future of the UHF band is not about sacrificing culture for the sake of the digital economy. The European audiovisual model has provided citizens with a broad range of quality programming, free at the point of access (so-called free-to-air) and fulfils major public policy objectives such as cultural diversity and media pluralism. This is particularly important for the most vulnerable in society and must be maintained. In most EU Member States digital terrestrial television (DTT) represents the backbone of this model. Due to its characteristics of delivering high-quality TV programmes (so-called linear TV services) to mass audiences and ensuring universal and free-to-air access for citizens, it will continue to play an essential role as a major distribution platform for the foreseeable future. Europe's DTT platform underpinned by DVB³ technology is a global leader in its domain. Its sustainable development is dependent on spectrum in the UHF band, which gives it capacity to further innovate and develop and thus to remain viable and competitive. This being said, due to the diversity across Europe in terms of the actual penetration of digital terrestrial broadcasting (in comparison with other platforms such as satellite broadcasting or cable TV), the impact of change in UHF spectrum use would be very different from country to country.

The aim of achieving a win-win situation for both the mobile sector and the broadcasting sector was at the centre of the work which the Group has undertaken. By better understanding the likely trends in demand and supply as well as the specific needs of the parties involved this report aims at identifying a European roadmap that could lead to a win-win situation for the two sectors involved i.e. to the benefit of European citizens and consumers, while recognising that specific companies or countries may be affected to a greater or less extent depending on their specific situations today.

3. LIKELY TRENDS IN DEMAND AND SUPPLY

The High Level Group has conducted an analysis and developed – and reached consensus on – three fact sheets on consumer demand, network supply and Member State diversity (Annex 1). These proved helpful for drawing the overall picture as to where we stand today and what the drivers and enablers of change are. Drawing on this consensual factual basis, I would outline my main conclusions as follows.

Firstly, on the demand side, linear TV viewing will remain dominant for the foreseeable future. As a complement, non-linear TV (e.g. video on demand or catch-up TV such as the BBC iPlayer) is increasing although it remains at a much lower level (today at 10% of overall TV viewing). There is growing uptake of audiovisual content other than television delivered over the Internet (such as Youtube or Netflix). It is important to note that a limited number of TV channels dominate viewership on the DTT platform while other TV channels have a low percentage of viewership compared to the most popular ones. However, availability of a range of channels going beyond the mass-market ones is essential to cover specific cultural and demographic segments and ensure content plurality – though the necessary extent of this is a matter for discussion in the light of finite spectrum resources and the capacity of alternative platforms. Many broadcasters

³ Digital Video Broadcasting, the family of digital TV technologies developed in Europe

use already the Internet to deliver content on fixed or mobile networks. Linear TV is delivered today to a very small extent also over mobile networks but the trend is increasing.

"Free-to-air" is a crucial factor in the European audiovisual model. DTT is free at the point of access in all Member States, which is particularly important for the citizens' access to public TV channels. Furthermore, the DTT ecosystem offers broadcasters a transparent and controllable interface to consumers.

The primary consumer device today is the home big-screen TV. Secondary devices, today mainly second TV sets, will be increasingly nomadic or mobile as well as data-enabled such as tablets, smartphones or laptops. Mobile devices are also increasingly used to consume audiovisual content. The proportion of video in mobile data traffic is already more than 50%, however the proportion of mobile linear TV alone is still relatively low and cost-sensitive for the consumer. Mobile traffic grows rapidly at about 50% annually (compound annual growth rate) due to the proliferation of smart mobile devices and the deployment of 4G networks. Rapidly rising penetration of smartphones and tablets is driving higher mobile data usage.

Secondly, on the supply side, terrestrial broadcasting and mobile broadband platforms are likely to co-exist for a long time, in order to ensure that supply meets demand. DTT will retain its essential role as a competitive platform for the delivery of linear audiovisual services to mass audiences with nearly nation-wide coverage. I conclude that convergence of both platforms is not on the practical policy agenda yet.

Next-generation terrestrial broadcasting technology (DVB-T2 and HEVC⁴) offers large capacity gains for DTT which can offset increasing spectrum demand due to new video formats like HD and Ultra HD. Changes to network topology and configuration such as single frequency networks or denser-located lower-power lower-tower transmitting stations would also bring additional space to accommodate more services. However, a loss of the 700 MHz band would be likely to impose additional limitations on the scope of programme offer in a number of Member States. It should also be taken into account that spectrum availability for wireless microphones (PMSE) will shrink if DTT uses spectrum more efficiently. The PMSE community is interested in using higher frequencies below 2 GHz as an alternative for wireless microphones – however, predictability for such use is absolutely necessary.

Mobile broadband offers a wide range of popular services, yet mobile standards are not currently capable of supporting broadcasting to mass audiences on big screens. Efficiency gains for mobile networks through use of the latest 4G technology are highly significant and are not yet in place for all mobile spectrum below 1 GHz (e.g. in the 900 MHz band, still largely used for 2G GSM services). Mobile networks also benefit from the capability of devices to use alternative Wi-Fi technology in dedicated unlicensed spectrum, which offloads highly significant amounts of mobile traffic via alternative access networks but is dependent on the presence of a broadband fixed-line connection and the availability of a Wi-Fi connection.

⁴ High Efficiency Video Compression, a compression technology more efficient than AVC used today in high definition broadcasting.

The process of migration to a new DTT technology is complex and costly, and requires careful planning in terms of frequency coordination and implementation (such as simulcast requirements). It also necessitates addressing the need and scope of compensation for the broadcasting sector in order to avoid putting it at a disadvantage. Raising awareness of equipment manufacturers and consumers at an early stage would be essential in order to stimulate investment. Early device availability accommodating next-generation standards would be a key driver for consumer migration, which nonetheless must benefit from a migration period and/or from migration-support measures that respect consumer interests.

Thirdly, on the diversity side, DTT has quite different market shares across the Member States due to competing wired and satellite platforms. Differences in DTT market shares range from 4 % (e.g. Belgium) up to almost 80% (e.g. Italy). This affects the level of utilisation of spectrum for terrestrial broadcasting in the UHF band. Such variety imposes a major challenge on a coordinated policy approach to releasing the 700 MHz band but also to ensuring efficient spectrum use in the 470-694 MHz band. In any case, diversity in national situations has to be part of a spectrum strategy at EU level – one which does not freeze spectrum in one Member State for the sake of another and allows for economies of scale and easy cross-border coordination in the single market.

The rapid take-up of 4G-based mobile broadband services is expected to increase the overall demand for data capacity to serve ubiquitous broadband connectivity and seamless user experience. This will require also further capacity at lower frequencies such as the 700 MHz band in the mid-term. At the same time spectrum above 1 GHz is currently not always in high demand according to information collected by the Commission from the Member States (see footnote 25). Noting the recent assignments in the 800 MHz band, the 700 MHz band is not immediately needed for mobile services. This is an opportunity for a planned transition path (detailed in Annex 2) that would benefit from a coordinated approach at the European level (in order to manage the cross-border implications of radio interference caused by high-power transmitters) and from a common European deadline (in order to give a signal to industry to undertake appropriate and timely adaptations on the equipment side to ease financial impacts on operators and citizens alike). I consider this transition roadmap as a major achievement of the work of the HLG.

Further details are contained in the fact sheets in Annex 3. These fact sheets are based on a broad consensus in the High Level Group.

4. PRIORITIES FOR EU ECONOMY AND CITIZENS

The conclusions drawn within the Group on the basis of the fact sheets cast light on distinct policy priorities which, in my view, should be safeguarded by a forward-looking approach to the future use of the UHF band.

What are the **EU policy priorities** at stake?

1. To ensure the sustainable development of the digital economy and the specific European audiovisual model collectively as two pillars of the European vision, and avoid advancing one of these priorities at the cost of the other; in this regard, to assess over time how demand for different audiovisual platforms is developing including DTT and wireless broadband.

2. Taking into account Member State diversity in the role of the terrestrial broadcasting platform – to establish a Europe-wide frame for specific national solutions regarding use of the UHF band while fostering the single market and cross-border frequency coordination.
3. To promote a coherent and leading EU position in the international scene and make the Union a benchmark for the future worldwide use of UHF spectrum in a way which is consistent with the European vision and offers an attractive proposition for other regions, economic actors and technology ecosystems to follow.

These priorities should come high on the political agenda to promote our European content and culture while aspiring at a leading role for the Union in broadband and wireless.

5. THE COMPROMISE ON THE TABLE

I have aimed at reaching a consensus as a package – one which embodies a win-win solution and covers the whole UHF band, thus giving the certainty they are requesting from public authorities to all stakeholders. The Group progressed well on working out such agreement, yet some issues remained which prevented the emergence of a final consensus. Annex 2 contains the proposal I put forward as a compromise. Points 1 to 5 in that annex contain a lot of common ground that could be achieved in the Group. The main reason that my proposal could not be agreed in the end was the dissent of the mobile and broadcasting sectors on point 6 ("The international aspect: coordinated approach to ITU World Radiocommunication Conference 2015").

In particular, as already noted, the transition path included in the annex to my proposal was broadly agreed and thus represents a major outcome of the Group's work. It outlines the main elements of and the process of transition to new DTT technologies in the context of Member States deciding to release the 700 MHz band, without prejudice to any future national decisions or EU-level political agreement.

Members of the High Level Group agreed that the principal future scenario is based on platform co-existence, not convergence. As mobile traffic grows some Member States are considering repurposing the 700 MHz band, which follows up to developments outside Europe. In this band, co-primary allocations (mobile and broadcasting service) after WRC-15 will be a fact for the EU. On the other hand, the 700 MHz band is not immediately needed for the mobile sector – this represents an opportunity for a win-win solution as it may offer buffer time facilitating a less costly transition. At the same time, the terrestrial broadcasting sector needs reassurance that they will have continued access to spectrum below the 700 MHz band, to the extent that national conditions dictate, so that they will be able to develop and compete. A related aspect is the cost compensation for the broadcasting sector upon any vacating the 700 MHz band as it would carry the burden of ensuring continuation of its services through costly network re-configuration within a certain deadline and within a reduced amount of spectrum. The cost impact on consumers also needs careful planning and mitigation.

Therefore, my proposal focused on a compromise which foresees coordinated repurposing of the 700 MHz band to mobile services while linking it to reassurances for the sustainable development of terrestrial broadcasting in spectrum below the 700 MHz band. In addition, it included stock taking of market and technology developments at a later point of time in order to cater for any adaptation of the policy approach.

While the High Level Group could identify a lot of common views, some pertinent differences in the positions of the mobile and broadcasting communities remained. Both sectors expressed disagreement with certain aspects of the compromise, which fall back to two issues:

- *The deadline* for releasing the 700 MHz band – while my proposal was to aim at 2020 (with a flexibility of +/- 2 years), the broadcasting community expressed concerns and advocated a longer time span.
- *The approach to formulating safeguards for broadcasting* to use spectrum below the 700 MHz band. In this regard, the mobile sector backed a co-primary allocation of the 470-694 MHz band already at WRC-15, which the broadcasting sector considers a threat for the predictability and thus the sustainability of their business conditions. The broadcasting sector insisted that ITU-level guarantees be extended until 2030, meaning no co-primary allocation in the ITU Radio Regulations until 2030.

Both sectors agreed in principle to the need for a stock-taking exercise at a later point in time to assess the demands and prospects of terrestrial broadcasting and mobile broadband. My proposal is to have this no later than 2025. Agreement was also in place that terrestrial broadcasting will continue to be an important platform until 2030.

The device and equipment manufacturers' sector broadly supported my compromise proposal while reinforcing their view on the importance of allowing supplemental downlink in the 470-694 MHz range provided that such use would continue to accommodate terrestrial broadcasting according to the needs of Member States.

6. RECOMMENDATIONS TO THE EUROPEAN COMMISSION

Given the two remaining differences noted above, the High Level Group could not agree on a compromise document. However, the scope of consensus reached on a number of aspects as well as the identified obstacles has given me the basis for conclusions and recommendation under my sole responsibility.

Given that some Member States have already launched plans to release the 700 MHz band, an EU-level strategy for the UHF band is needed in advance of WRC-15, not least because the question of allocation spectrum below 700 MHz to the mobile service is likely to be raised by other parties at WRC-15.

What are the **actionable items** I could identify?

1. Repurposing in the future the 700 MHz band for mobile services throughout the EU is desirable as the way forward to ensure capacity for mobile broadband services in the light of steadily rising demand while serving Europe's broadband coverage targets and benefiting from global economies of scale; it requires a well-devised schedule and a transition roadmap with a common deadline.
2. Sustaining the European audiovisual model is dependent on the availability of a core spectrum band, subject to national differences and regular stock-taking; this is the 470-694 MHz band and assurances are needed that broadcasters will retain access to this spectrum – these may include but are not limited solely to ITU-level measures.

3. A consistent EU approach to future WRCs, which safeguards European values while fostering the digital society – the possible need and point in time for a co-primary allocation of the core audiovisual band to mobile services is central in this regard.

What is my **recommended approach** to address these?

The release of the 700 MHz band should facilitate the least costly and disruptive transition in terms of cross-border coordination and equipment upgrade for operators and consumers, which means sufficient lead time. In order not to handicap fast moving Member States and also not to generate too much pressure on ones which need more effort due to high DTT penetration, a deadline of **2020** (with flexibilities of +/- 2 years) seems appropriate.

Reassurance should be given to terrestrial broadcasting for a next cycle of investments. This is linked to safeguards for access to spectrum below 700 MHz until **2030**. This should be backed by a consistent EU position at future WRCs (starting from WRC-15) against co-primary allocation of spectrum below the 700 MHz band to the mobile service. Yet such a view cannot be just frozen as of 2015 until 2030 without further scrutiny.

The EU position should follow market realities and national conditions, in particular on the developments regarding competing wired and wireless audiovisual platforms, including mobile. Therefore, a stock-taking should be planned to re-assess UHF spectrum usage, at a fixed late date after repurposing the 700 MHz band. It would be appropriate to conduct such a stock-taking **by 2025** to inform a potential review of the EU position well in advance of the deadline for safeguards of 2030. In my view, it is appropriate to conduct this stock-taking before a future WRC.

I would refer to this as the EU "**20-25-30 model**". This model would rely to a significant extent on safeguards through decisions taken at the international level within the ITU, where Europe represents a voting minority in ITU Region 1. On the other hand, European specificity (e.g. the large differences in the market shares of the DTT platform across Europe) could be tackled through tailored EU-level measures. Therefore, I would also recommend an additional EU "**flexibility option**" (see below) which could be integrated in this model.

I believe there is already one lesson learned on the future use of the 700 MHz band in Europe – this process has been influenced by developments outside Europe, namely the emergence of a globally significant band plan from stakeholders in the Asia-Pacific region as well as a concerted effort of some African and Middle Eastern states at WRC-12 to obtain the co-primary allocation of this band to the mobile service in the whole ITU Region 1. It can hardly be imagined that Europe would agree on an alternative long-term option for the 700 MHz band, which would be more beneficial for its digital economy and society, other than adopting mobile usage in line with the aforementioned band plan.

In view of that, Europe's ambition should be to play a leadership role in shaping the future use of the rest of the valuable UHF spectrum – below the 700 MHz band and also beyond ITU Region 1. This ambition could become more concrete on the basis of the proposal made by the device and equipment manufacturers' community within the High Level Group.

In this regard, my recommendation to the Commission for the "flexibility option" is to study EU-harmonized scenarios allowing co-existence of traditional broadcasting services in the 470-694 MHz band with other downlink-only (i.e. unidirectional)

electronic communications services, in cases where there is no or declining demand for DTT at national level. Such scenarios should guarantee continued access to spectrum for terrestrial broadcasting as the primary user, subject to national demand. This calls for timely study, adoption and dissemination of an EU harmonized approach to supplemental downlink and its co-existence with terrestrial broadcasting services in order to preserve the specificities of the European audiovisual model and at the same time open the door to innovation and new services. A timely consensus on such an approach could allow pursuing a consistent EU position for WRC-15 and beyond on the matter of the utilization of UHF Spectrum below the 700 MHz band. In my view, this option, the possibility of which remains dependant on the availability of “dual use” equipment, would be consistent with the 20-25-30 model while injecting a level of flexibility that can be decided by each Member State on the basis of national specificity and would have several inherent win-win elements:

- It would give reassurance to terrestrial broadcasting and preserve the EU audiovisual model. DTT could further use spectrum in 470-694 MHz as the core audiovisual band and on a primary basis.
- Mobile or any future convergent operators could access this spectrum (e.g. as a supplemental downlink) in order to provide in the first place innovative and competitive linear audiovisual services and, in addition, other unidirectional services, but only if compatible with any broadcasting use in the relevant Member State.
- It would address Member State diversity in using the 470-694 MHz band with any technology (DTT, mobile or another) for terrestrial broadcasting or other compatible use. Thereby, it would facilitate cross-border coordination and ensure efficient use of UHF spectrum depending on national circumstances.
- Citizens would have continued access to linear broadcasting as well as more and better audiovisual services.

It should be ensured that such policy approach, if retained by the European Commission, is future-proof in the context of any future amendment to the ITU Radio Regulations, which may be adopted with the majority of non-EU countries and may be incompatible with the EU model, in particular a potential future co-primary allocation to the mobile and broadcasting service in the 470-694 MHz band at WRC-15. The EU must be prepared with a common forward-looking plan to deal with such a challenge. Therefore, while outcomes at ITU level are of limited EU control (an EU common position may not be sufficient for majority in ITU Region 1 and may necessitate EU exemption through a footnote), timely EU-level measures under Union law on telecommunications and spectrum are needed to safeguard the European model for the whole EU territory without prejudice to EU's obligations at its outer borders under the ITU Radio Regulations. Such measures could be anchored in the next Radio Spectrum Policy Programme and/or adopted under the Radio Spectrum Decision.

In summary, my recommendation to the Commission for the development of a European strategy on the future use of the UHF band is to work with Member States and stakeholders towards adoption of the "20-25-30" model, which provides certainty and predictability for sustainable co-existence with available spectrum resources, subject to stock-taking, and also to consider a "flexibility option", which addresses EU-level

diversity and offers the potential for EU leadership in spectrum management of sub-700 MHz spectrum.

I consider it indispensable to also include in my recommendation the transition roadmap, which the Group agreed – it should serve as high-level guidance to national and EU-level policy. A crucial element thereof is cross-border frequency coordination, which has to start early, ensuring sufficient lead time (at least 3 years as concluded by the RSPG⁵), before any transition takes place. Another important element is the scope of cost compensation for broadcasters, which is a national decision. However, EU guidance should be considered to address from the outset any concerns regarding compatibility with state aid rules.

I am fully aware of the high political sensitivity of my recommendations and the fact that these are not fully backed by an explicit agreement within the High Level Group. However, we should be aware about the pace of changes we face and what is at stake if we just wait and may believe that staying in our comfort zone could last for ever. As a whole-hearted European, I firmly believe that a European strategy is primarily about moving together at the forefront of developments which will have major impact on European citizens and consumers as well as for the future competitiveness of the European economy.

⁵ Radio Spectrum Policy Group. Report on proposed spectrum coordination approach for broadcasting in the case of a reallocation of the 700 MHz band (document RSPG13-524rev1).

ANNEX 1

Compromise proposal by the Chairman on the future use of the UHF band (470-790 MHz)

Chapeau

Linear services will remain a dominant mode of audiovisual consumption in the foreseeable future while non-linear services, in particular delivered over the internet and broadband connections, are continually growing from currently a low level⁶.

Content production for all platforms must be protected through the future use of spectrum in the UHF band, including for PMSE. Alternative spectrum should become available in the future for PMSE in other frequency bands.

Point 1 – political reassurance for the future role of terrestrial broadcasting

The core principles of pluralism and cultural diversity underpinning the European audiovisual model are fully recognized and must be maintained.

Due to its characteristics of delivering high-quality linear services to mass audiences and ensuring universal and free-to-air access for citizens, digital terrestrial broadcasting will continue to play an essential role as a major distribution platform for the foreseeable future⁷. The sustainable development of terrestrial broadcasting networks in the context of continued innovation, platform competition and Member State diversity depends on spectrum availability in the UHF band. DTT is the main linear service distribution platform in the EU which is very efficient and cost-effective⁸ for content distribution to mass audiences on a one-to-many basis, while recognising the diversity in its penetration across the Member States and in the existence of alternative one to many delivery platforms⁹. DTT fulfils important policy objectives and delivers economic, social and cultural benefits. In order to remain viable and competitive it must retain a capacity to further innovate and develop.

⁶ Estimated consumption share at approximately 9.9% in 2014 (from the fact sheet on demand of annex 3)

⁷ The UK regulator Ofcom has recently noted the importance of DTT at least until 2030.

⁸ [reference provided by EBU, inserted by the Chairman] Network cost is typically between € 0.2-1.5 per household per month for up to 60 channels distributed 24/7. Per channel distribution cost can be as low as € 1c per household per month (sources: 'BNE presents key data at the European Spectrum Conference' at <http://www.broadcast-networks.eu/newsroom/> and contribution by Mediaset to the High Level Group)

⁹ Such as cable, satellite or IPTV

Point 2 – certainty regarding spectrum allocation below 700 MHz

The UHF band is a key asset for the production and ubiquitous delivery of audiovisual content through linear and non-linear¹⁰ broadcast services to meet evolving consumer demand. It is the core band for DTT and PMSE today, which is globally harmonised and heavily used for the delivery of audiovisual services, including the 700 MHz band.

If the decision is taken by a Member state or at Union level to repurpose the 700 MHz band for wireless broadband at a certain deadline, investments into terrestrial broadcasting and PMSE will be required to enable such a change by clearing this band, which should be backed by sufficient certainty for terrestrial broadcasting and PMSE to use spectrum below the 700 MHz band as of this deadline.

Spectrum below the 700 MHz band – namely the range 470-694 MHz – should continue to be used for DTT distribution to mass audiences (and hence be considered the 'core audiovisual band') without preference to any technology and fostering a co-existence model with DTT based on protection from harmful interference. PMSE equipment should continue to have spectrum opportunities in this band in due consideration of its spectrum requirements.

The core audiovisual band (470-694 MHz) should continue to enable the delivery of a broad and diverse range of broadcast audiovisual content. The characteristics of the existing service should be ensured, i.e. high quality content, delivered in a resilient manner on a free and universal basis to citizens in a manner that sustains and supports European cultural diversity. Furthermore, they should seek to fulfil public policy objectives.

Point 3 – transition path including (technology) standards availability

Any changes in spectrum use would need to safeguard the important benefits that DTT and PMSE services deliver to citizens and consumers. Specifically, Member States should ensure that broadcasters and PMSE users are left no worse or no better off than they would have been without any clearance of the 700 MHz band. Clearing the 700 MHz band would be likely to involve significant disruption and cost to the broadcast industry, PMSE and citizens.

Several issues need consideration at EU level. It is likely that there would be large differences between Members States in terms of time and effort to complete the transition, including any release of the 700 MHz band. An efficient frequency coordination process is needed so as to optimize the remaining capacity for DTT through regional discussions based on best practices and not limited to border per border discussions. In this regard, a European vision with clear direction to industry, device manufacturers, PMSE and citizens is necessary as a pre-requisite to an effective outcome, and to enable informed and early uptake of consumer equipment in the event that an upgrade is needed (e.g. DVB-T2). A realistic time frame needs to be foreseen in order to minimise any negative impact on the viewers, while at the same time ensuring minimum necessary duration of the simulcast period and the overall transition. The timely identification and harmonisation of additional spectrum (tuning ranges) for PMSE is required as a substitute capacity.

¹⁰ Such as HbbTV, which relies on terrestrial broadcasting.

A transition roadmap is presented in annex 2, including measures for cost compensation.

Point 4 – financial implications upon migration and compensation issues

A decision by a Member State or at Union level to repurpose the 700 MHz band would create costs for reconfiguring broadcasting networks and distribution models as well as upgrading PMSE and consumer equipment, but also probably generate auction proceeds. The broadcasting and PMSE sectors should not be disadvantaged by such a transition and cost compensation should be duly addressed.

In cooperation with the Member States the Commission could facilitate such a transition by providing guidance to Member States clarifying how national measures with the aim of supporting transition would be compatible with state aid rules. There are five major areas which should be considered as part of transition measures: consumer equipment (devices, aerials and communal systems), broadcast networks, simulcast period, broadcasters and PMSE. Further details and areas are contained in the transition roadmap (see Annex 2).

The timing of potential repurposing of the 700 MHz band (694-790 MHz) for wireless broadband will impact the cost of transition to new network technology and user equipment. An appropriate, possibly common, deadline should take into account Member States diversity and provide sufficient lead time to ensure certainty for market players and consumers as well as mitigate cost. Governmental policies should ensure transparency and encourage timely transition for both equipment suppliers and citizens alike.

Point 5 – cross border coordination issues

Cross border coordination is critical as it needs to be completed before any actual transition out of the 700 MHz band can begin. To this end, an efficient frequency coordination process and sufficient negotiation time are needed so as to optimize the frequency plan and spectrum capacity for DTT, through regional discussions based on existing best practice arrangements and not limited to border per border discussions.

Cross-border coordination imposes a challenge in cases where continued DTT use in one Member State may limit the timely repurposing of spectrum in the UHF band in another adjacent Member State(s) or vice versa.

The Radio Spectrum Policy Group (RSPG) has estimated that coordination required in the case of clearing the 700 MHz band would take about 3 years. The RSPG is currently addressing the issue of frequency coordination in light of its work on the future of the UHF band. The Commission has proposed to strengthen the role of the RSPG's good offices to assist Member States in cross-border coordination. Early certainty on the results of cross border coordination is crucial for an effective transition roadmap as described in the annex.

Furthermore, sufficient time must be foreseen to complete the cross-border coordination before the changes are implemented in the networks.

Point 6 – the international aspect: coordinated approach to ITU World Radiocommunication Conference (WRC) 2015

Use of the core audiovisual band (470-694 MHz) by terrestrial broadcasting on a primary basis until 2030 should be secured by coherent EU level measures in the context of World Radiocommunication Conferences (WRCs) and the EU single market. Such measures should allow for flexibility for Member States to deal with diverse national situations¹¹ and be subject to EU level review of the demands and prospects of both the terrestrial broadcasting and mobile sectors by 2025 at the latest. No co-primary allocation of the core audiovisual band (470-694 MHz) should take place before the aforementioned review.

In this regard, the EU should adopt a common position against the co-primary allocation of the core audiovisual band (470-694 MHz) to the mobile service at WRC-15.

In line with the policy outlined in this document, the 700 MHz band should be repurposed to wireless broadband in the EU with the target date 2020, allowing for earlier release of the band in certain Member States. An earlier release from 2018 or a later release up until 2022 may be permitted in justified national cases. The benefits of a coordinated EU level approach to releasing the 700 MHz band should be assessed by the Commission in support of the transition roadmap (annex 2). The terrestrial broadcasting and PMSE sectors should facilitate such a transition in line with the principles agreed above.

¹¹ An example would be downlink-only use of the core audiovisual band in countries where terrestrial television plays a minimal role. Such use would need to accommodate broadcasting locally and in adjacent Member States.

ANNEX 2

Agreed transition roadmap

Introduction

This annex outlines the process of transition to new DTT technologies if it is decided to release the 700 MHz band .

Several principles that should be taken into account. Any changes would need to safeguard the important benefits that DTT and PMSE services deliver to citizens and consumers. Specifically, Member States should ensure that broadcasters and PMSE users are left no worse or no better off than they would have been without any clearance of 700MHz. Clearing 700MHz would be likely to involve significant disruption and cost to the broadcast industry, PMSE and consumers.

It sets out the range of measures Member States should consider to ensuring that in their national circumstances disruption upon transition is mitigated. It assumes the gradual adoption of more efficient technologies but recognises their adoption depends upon consumer uptake according to the circumstances of each Member State.

A coordinated transition of the DTT platform to new technologies such as DVB-T2 and eventually out of the 700 MHz band would comprise the following main areas:

- Planning and preparations
- International frequency coordination (including broadcast transmissions, PMSE, local and community services, etc.)
- Management and coordination
- Communications
- Technical activities
- Support to the trade stakeholders
- User support

EU-Level Issues:

- It is likely that there would be large differences between Members States in terms of time and effort to complete the transition, including any release of the 700 MHz band.
- An efficient frequency coordination process is needed so as to optimize the remaining capacity for DTT through regional discussions based on best practices and not limited to border per border discussions.
- A European vision with clear direction to industry, device manufacturers, PMSE and consumers as a pre-requisite to an effective outcome, in the event that an upgrade to consumer equipment is needed (e.g. DVB-T2).
- A realistic time frame needs to be foreseen in order to minimise any negative impact on the viewers, while at the same time ensuring minimum necessary duration of the simulcast period and the overall transition.

- Timely, identify and harmonise additional spectrum (tuning ranges) for PMSE as replacement

Planning and preparations

This is an initial phase of the process and involve the following activities:

- Defining key objectives (e.g. facilitating the technology transition and spectrum efficiency, while protecting the long term interest of viewers and the content industry, whilst promoting market competition). It should be ensured that the current TV services remain on air and have the option to migrate to higher resolution formats over time.
 - Set a completion date across Europe for the transition that does not disadvantage broadcasters, PMSE or citizens.
- Impact assessment, including a cost/benefit analysis including all sectors of the broadcasting and PMSE industry, to determine the scope of the intended change and provide support for an executive decision
- Review and put in place any necessary legislation and regulation, including legal framework:
 - Such potential legal framework must be synchronized with service launches and be adaptable to technology choices of a given country on a country by country basis.
 - Such potential legal framework would ensure that consumer equipment available on the market is future proof from a given point in time and that legacy equipment cannot be sold
 - Such measures are best decided on a consensus basis within a platform gathering relevant stakeholders including the consumer electronics industry.
- Estimate the overall costs and appropriate budget for financial resources and identify and action funding interventions
- A comprehensive transition plan, including a detailed time plan, as a pre-requisite for a successful transition, including:
 - A plan, including time table, for frequency planning and coordination, licensing, and transition, including PMSE
 - If decided to clear the 700 MHz band, develop a road map with a detailed time plan for the release.
 - Simulcast (parallel transmission on the currently used and the new DTT standard for a period of time) to stimulate the citizen adoption of the new technology standards while assessing the impact of simulcast on PMSE.
 - Detailed communication plan
- Definition of appropriate technical parameters and coverage requirements for the DTT platform, where applicable.
- Identifying all relevant stakeholders (government, regulators, public service broadcasters, commercial broadcasters, community broadcasters, broadcast network operators, platform operators, equipment manufacturers, retailers, installers, landlords and housing companies, consumer associations, communities) and ensuring their commitment.
- Detailed plan for user support and support to relevant ‘trade stakeholders’, including equipment manufacturers, retailers, and receiver antenna installers.

International frequency coordination

This stage is critical as it needs to be completed before any actual transition can begin.

To this end, an efficient frequency coordination process and sufficient negotiation time are needed so as to optimize the frequency plan for DTT, and hence maximise the multiplex capacity of DTT, through regional discussions based on existing best practice arrangements and not limited to border per border discussions.

The Radio Spectrum Policy Group (RSPG) has estimated that coordination required in the case of clearing the 700 MHz band would take about 3 years. The RSPG is currently addressing the issue of frequency coordination in light of its work on the future of the UHF band. The Commission has proposed to strengthen the role of the RSPG's good offices to assist Member States in cross-border coordination. Early certainty on the results of cross border coordination is crucial for an effective transition roadmap and the steps described below.

Furthermore, sufficient time must be foreseen to complete the cross-border coordination before the changes are implemented in the networks.

Management and coordination

This is a key function and the principal responsibility rests with the highest authority involved in the process, typically the government. At the executive level it involves:

- Implementation of the detailed transition plan
- Coordination of the parties involved in the planning and implementation of the transition.
- Control and monitoring of the progress
- Budget and resource management
- Risk and issue management
- Reviews and adjustments to the transition plan

Communications

Communication efforts are directed towards two large groups:

- The users, including landlords and housing companies, consumer groups, communities, and individuals
- The 'trade stakeholders', including equipment manufacturers, retailers, and antenna installers

The main objective is to ensure that the trade stakeholders and the viewers are timely prepared for the transition and well informed about the available support.

A communication plan may include any form of advertising (TV, radio, press, on-screen messages) as well as web sites, direct mail, educational programmes, roadshows and

community events. Branding (e.g. a dedicated logo) is an essential element of the campaign.

Communication is required throughout the transition process, which may last for a very long time (e.g. in Finland the full transition to DVB-T2 is anticipated to run until 2026), and may need to be segmented into different phases, such as:

- Initial ‘visionary’ campaign
- Transition awareness campaign
- User support and help scheme campaign
- Switch-over warning

Technical activities

Significant technical work will be required before and during the transition. It can be broadly divided into three categories:

- Frequency planning, including a detailed plan of all frequency changes on DTT transmitters.
- Changes to the DTT transmission networks required to implement the new frequency plan. This may include the introduction of new transmission technologies (e.g. DVB-T2) and changes to the network configuration. Detailed planning of these changes is needed in order to minimise disruption and possible loss of service, both within a country and between countries.
- Changes to the receiving equipment (including communal systems). These may include re-directing the roof antennas, in some cases replacing the antennas and amplifiers, implementing interference mitigation countermeasures with respect to the mobile services operating in the adjacent band when required, and re-tuning the receivers. Regulators may need to define and publish the technical requirements for the receiving systems well in advance of the changes in the transmission networks.
- Identify replacement spectrum for PMSE, engage with manufacturers to ensure timely availability of new equipment, engage with users to ensure minimum disruption of AV content production and to provide long-term planning security for the industry.

In addition, there will be a need to define technical and regulatory conditions for co-existence between DTT and mobile communications operating in the adjacent frequency bands, as well as the appropriate approach to interference mitigation necessary to protect the DTT consumer.

Support to trade stakeholders

It is essential that equipment manufacturers, retailers, and installers are actively involved in the transition process. TV manufacturers and more specifically retailers are critical to ensuring that future proof receivers are supplied to citizens. The larger retailers are

particularly important in this regard, as they have substantial negotiating power with the manufacturers.

Timely guidance should be provided to manufacturers regarding technical requirements and expected demand volumes in order to ensure timely availability on the market of the future proof consumer equipment and ensure a move away from the manufacture and supply of receivers based on legacy technology.

Retailers and installers may be supported by information and promotional material (e.g. leaflets), staff training, technical briefings, and guidance on likely stock requirements.

Information actions during sales seasons should promote equipment with new standards.

An on-line tool may be established to search for retailers and installers.

User support

Most of European DTT viewers would be affected, depending on the selected scenario, in two different ways:

- The need to obtain new equipment because of the transition to DVB-T2
- The need to change the receiving installation in the event of the release of the 700 MHz band

It is essential to ensure that all viewers are prepared in time for the transition and well informed about the available support.

Involvement on landlords and housing associations is important in particular in buildings where changes to communal reception systems are required.

A help scheme for socially disadvantaged groups needs to be put in place. Help lines and practical assistance should be provided upon request.

Timely information about planned works, scheduled changes, installations, required re-tuning, or troubleshooting should be provided. Ideally, a central information point (e.g. a web site) would contain all relevant information in one place.

When the transition to new technologies is coupled with the provision of new DTT services it is important to provide adequate information to the viewers about the new services and how to find them.

Enhanced risk of Interference needs to be addressed with a clear framework for interference mitigation defined and implemented.

In order to deal with impacts on PMSE users, information and advice to their whole range of users, from the private (including disabled) to the commercial, needs to be put in place.

Timescales

The overall timescales for these activities would depend on a number of factors, in particular:

- the size and penetration of the DTT platform
- the extent to which households are already equipped with reception equipment incorporating new technology
- the duration of the simulcast period
- the need and time required for international frequency coordination
- and to what extent different activities could be carried out in parallel.

The timescales would also depend on other factors, such as the adoption rate for new technology and the active engagement of all parties in the process. Furthermore, the time required for re-engineering the DTT network will not be known until detailed planning has been carried out and the frequency plan confirmed.

However, a realistic time frame needs to be foreseen in order to minimise any negative impact on the viewers, while at the same time ensuring minimum necessary duration of the simulcast period and the overall transition.

It is likely that there would be large differences between Members States in terms of time and effort to complete the transition, including any release of the 700 MHz band.

Funding

It is essential that timely and sufficient funding is provided, in particular for the costs of:

- communication activities
- changes to DTT networks and early economic depreciation of assets
- simulcast
- support to the trade stakeholders
- user support and help schemes
- mitigation of interference to DTT reception after the transition
- upgrading or purchase of new PMSE systems and equipment
- access to radio spectrum at affordable costs for licensed PMSE use wherever the case

Compensation of the costs incurred in the transition should not be subject to the application of state aid rules.

The role of the government and the authorities

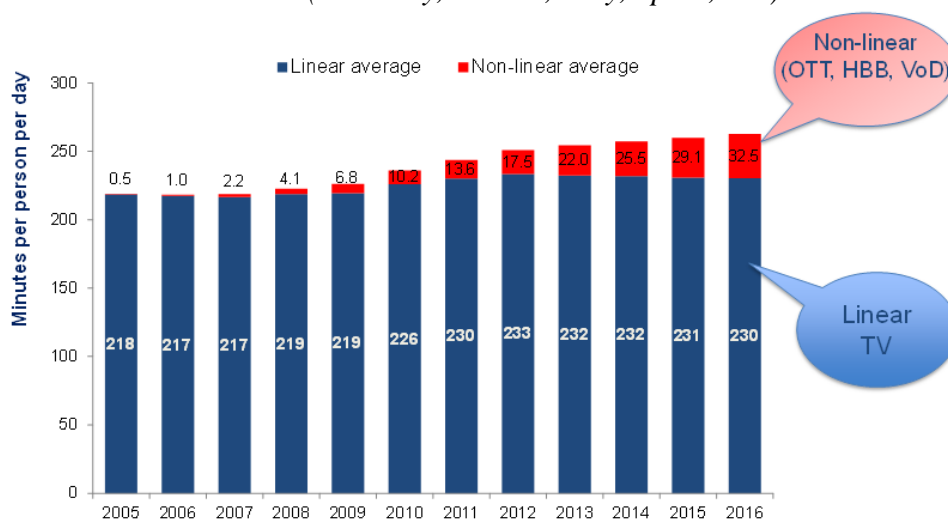
The government and the relevant authorities, including the spectrum, content, and competition regulators, have the leading role and the overall responsibility for the transition process. In particular, they need to define key objectives, ensure sufficient funding and drive the transition.

ANNEX 3: FACT SHEETS

FACT SHEET on Demand

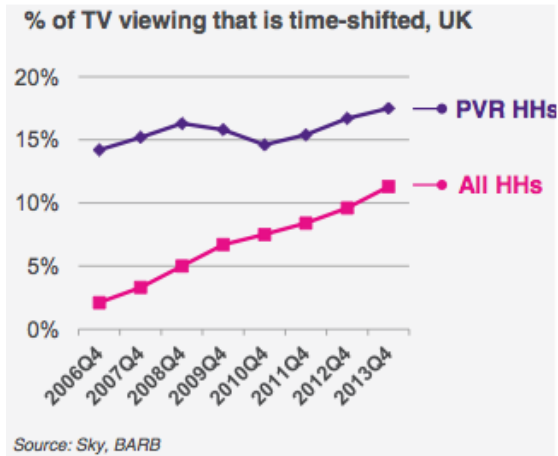
- Broadcasters have a vital role in **content creation**, including that created using PMSE¹². For a number of channels, due to the obligations in licenses, broadcasters play a specific key role in the funding of content creation and culture industry on a country-by-country basis. PMSE plays an important part in almost every aspect of content creation, from broadcast through theatre, film and web.
- **Linear TV** viewing over different delivery platforms (mix is country specific), on large TV screens, will remain at the present high level in the foreseeable future (today around 4 h/day and person, 87 % of population every day).
- As a complement, **non-linear TV**, including recorded (PVR) and on-demand TV viewing (including time shifted) is increasing fast but is still much smaller (today about 10% of viewing on large TV set screens). It is important to note that user demand for non-linear television is often triggered by linear TV.

Evolution of linear and nonlinear viewing on the large TV screen in major EU markets (Germany, France, Italy, Spain, UK)

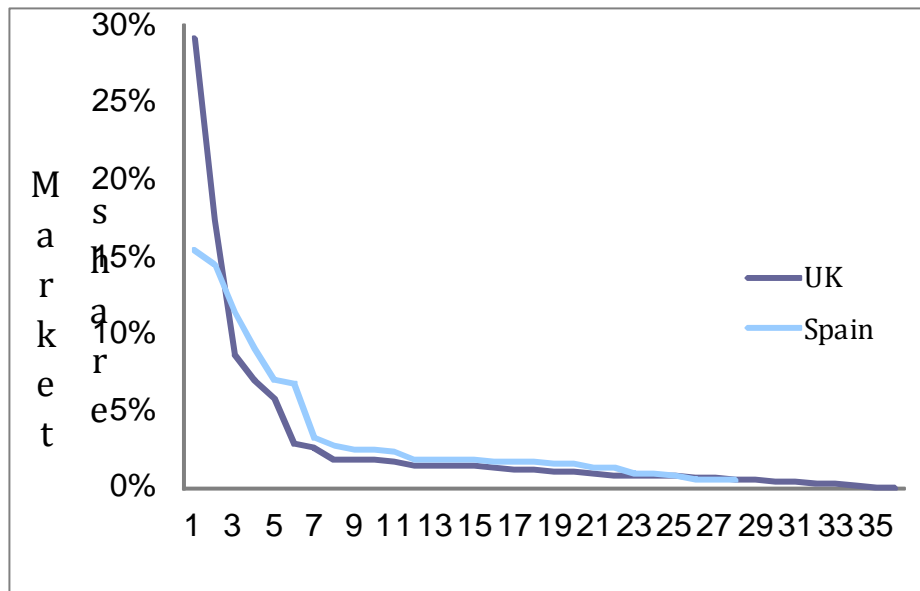


Source: IHS – ScreenDigest: Cross-platform Television Viewing Time FY 2012

¹² Programme Making and Special Events

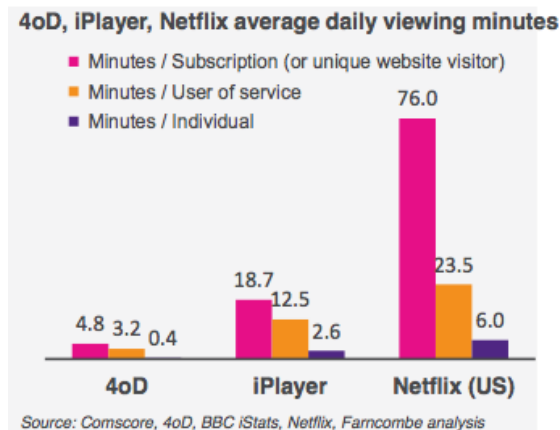


- Linear TV via other networks** (such as WiFi at home/public and including **mobile**) are increasing (distributed as 80% home WiFi, 10% outside home WiFi, 10% mobile (source: Digital Europe)). The role of mobile networks is cost sensitive, but pricing similar to fixed data may provide impetus to wider use on the move. Time-shifted viewing through downloaded portable content is also important but not captured here.
- "Free at the point of access"** is an important factor in the European audiovisual model. A limited number of TV channels dominate viewership on each DTT platform, while other channels represent a long tail. In particular, **Public Service Broadcasting remits** and Community Broadcasting can also encompass channels targeting specific cultural or demographic segments (minority languages etc.). It will be important to retain this breadth also in the future. DTT is free at the point of access in all Member States. Some Member States also provide availability on other platforms.



Market share (y-axis) vs. number of channels (x-axis) [Source: BARB for the UK and audience research for Spain by Barlovento comunicación]

- There is growing uptake of **audiovisual content other than television** (Youtube, Netflix, etc. delivered over the Internet (OTT). In terms of viewing time Internet video is small relative of the total TV viewing. When averaged for the whole population it represents under 2% of the total viewing time. Uptake depending on the device is under further study (e.g. by Médiamétrie company). More detailed figures regarding uptake, dependent on the type of screen (large TV screen, computers, smartphones and tablets) will not be available before 2015.¹³



- **In addition to large TV sets, mobile devices** are also **increasingly used to consume audio-visual content**. The resulting mobile data traffic is already more than 50% video. Many broadcasters use the Internet to deliver content through mobile apps in response to consumer choice of either fixed or mobile networks. Ericsson's 2013 *TV and Media* study highlights that 72% of people surveyed use mobile devices at least weekly to view videos and 42% do this outside the home.
- **Big screens** will be at a fixed location. **Secondary screens**, today mainly second TV sets, will be increasingly nomadic/mobile and data-enabled, and therefore likely to be tablets/ smartphones/ laptops. Secondary TVs typically occupy a separate room, while secondary internet enabled devices may be viewed separately or in parallel with a TV. These devices are increasingly equipped with HD capable displays and therefore are best served with HD content. UHD quality important for home screen, not for mobile use
- **Mobile data traffic is growing fast as LTE¹⁴ adoption increases and can exceed forecasts**. Research from Ericsson predicts a 45% annual growth rate (CAGR) in global mobile data from 2013-2019 which amounts to a tenfold increase.¹⁵ This trend has been confirmed by the ACM (consumer and market authority in the Netherlands). In a recently published report, the ACM notes an annual progression of the mobile data use of about 50% per year over the last 2

¹³ Figures for the US were presented by Farncombe at the convergence workshop on 27 March. Figures for France were submitted by the French regulator ANFR to the ECC TG6 (document TG6(14)39).

¹⁴ Long Term Evolution, popularly known as "4G"

¹⁵ Ericsson mobility report 2013

years. NB: this is exclusively for data over cellular networks – so it does not include Wifi traffic.

Reporting date (ACM)	Amount of Mobile Data (*1.000 Mb)
30-9-2011	3.871.527
30-9-2012	5.932.102
30-9-2013	8.727.345

- **Rapidly rising penetration of smartphones and tablets is driving higher mobile data usage:** In Western Europe smart devices currently represent 45% of all the devices on mobile networks. This is expected to rise to 83% by 2018. For comparison, the typical smartphone generates 48 times more mobile data traffic (529 MB per month) than a basic feature phone (which generates only 11 MB per month).¹⁶

¹⁶ Cisco VNI Mobile, 2014

FACT SHEET on SUPPLY

1. General

Common views:

- Terrestrial broadcasting and mobile broadband platforms are likely to co-exist¹⁷ for a long time, in order to ensure that supply meets demand. DTT will retain its essential role as a competitive platform for the delivery of linear audiovisual services to mass audiences with nearly nation-wide coverage.
- Mobile broadband offers a wide range of services (such as voice or the Internet of Things) with video being the key driver for traffic growth. Video services prevail for download, however they grow in importance also for upload (e.g. with 4G cameras).
- Free at the point of access (FTA) and universality is a consumer benefit to be preserved with terrestrial wireless audiovisual services distribution
- Timing the move to a new broadcasting technology such as DVB-T2 and HEVC¹⁸ for compression is country-dependent due to broadcasting requirements imposed by local authorities. An installed base of DVB-T2 enabled consumer equipment is a key prerequisite for a switch-over from DVB-T to DVB-T2.
- The process of migration to a new DTT technology is complex and requires careful planning in terms of frequency coordination and implementation (such as simulcast requirements); raising awareness of equipment manufacturers and consumers (selling proposition) at an early stage is essential in order to stimulate investment.
- Wi-Fi is a complementary access used for offloading mobile broadband traffic¹⁹, but dependent on the availability of a fixed-BB connection and cannot be considered as a substitute for mobile broadband.
- Spectrum tuning range for PMSE have already been reduced by 72 MHz in the 800 MHz band and would be reduced by further 96 MHz, in case of reallocation of the 700 MHz band, and could shrink further if national SFN^{20*} are more widely

¹⁷ 'Co-existence' is used solely in the sense of simultaneous deployments of both platforms

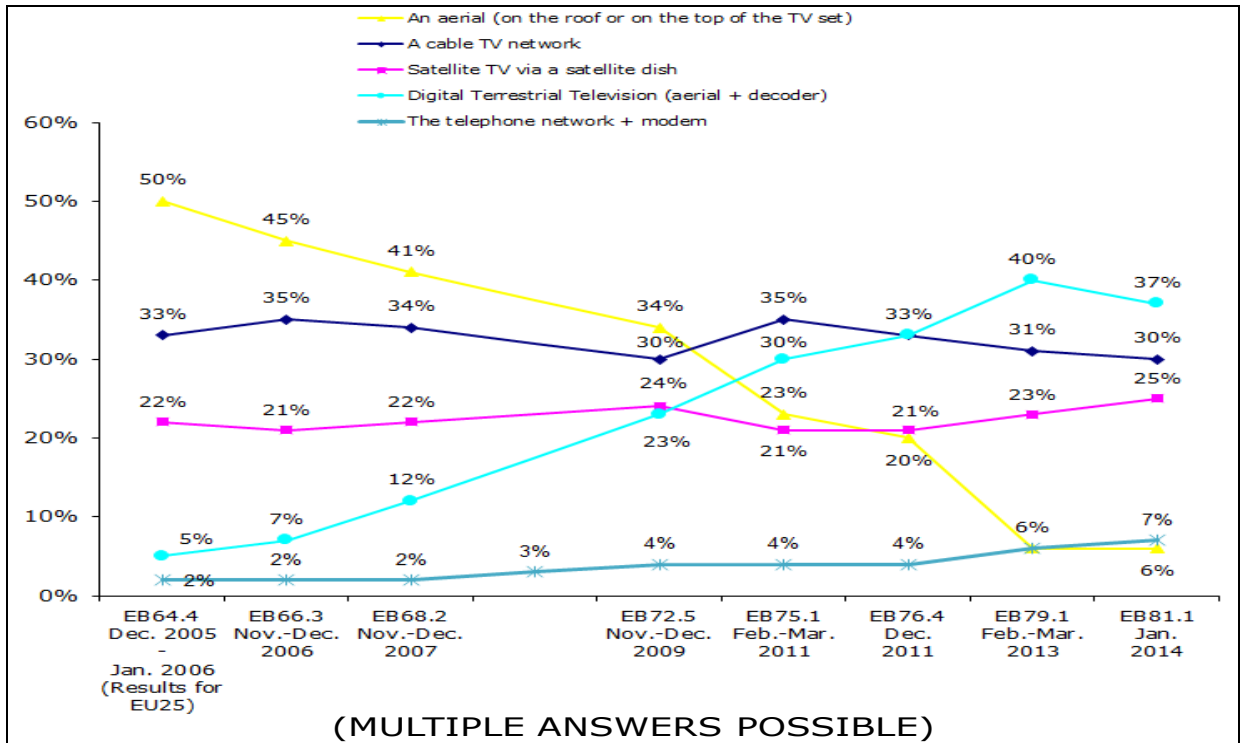
¹⁸ High Efficiency Video Coding, a compression technology more efficient than AVC used in high definition broadcasting today

¹⁹ According to the Commission Study on "Impact of traffic offloading and related technological trends on the demand for wireless broadband spectrum" (SMART 2012/0015, p. 2-3) the volume of traffic that is already being off-loaded, chiefly to Wi-Fi in the home, already exceeds that of the mobile network, and can be expected to grow even faster as well. In 2014, the amount of mobile data off-load is estimated to be about 3.2 times bigger than cellular traffic (Figure 2).

²⁰ Single Frequency Networks, when the same spectrum is reused by many transmitters to distribute one or more TV channels.

used. This will also impact on the introduction of White Space Devices. Higher-frequencies (sub-2GHz) for PMSE are an alternative but must be seriously addressed.

- The EU households receive linear TV services via terrestrial broadcast networks (43%), cable TV networks (30%), satellite (25%), IPTV²¹ (7%) or via the Internet (4%)²².



- Local broadcasting providers, including community media, could be affected by wider use of SFN. To accommodate their need for small scale coverage, next to SFN extra digital terrestrial frequencies are necessary.
- Early device availability accommodating next generation standards will be a key driver for consumer migration to new technologies – such as HEVC, which would be available as of 2015 and provides efficiency gains for both broadcasting and mobile networks.
- Mobile terminals and TV sets operating in the 700 MHz band are available today.

²¹ Internet Protocol TV, a TV signal packages in an internet stream

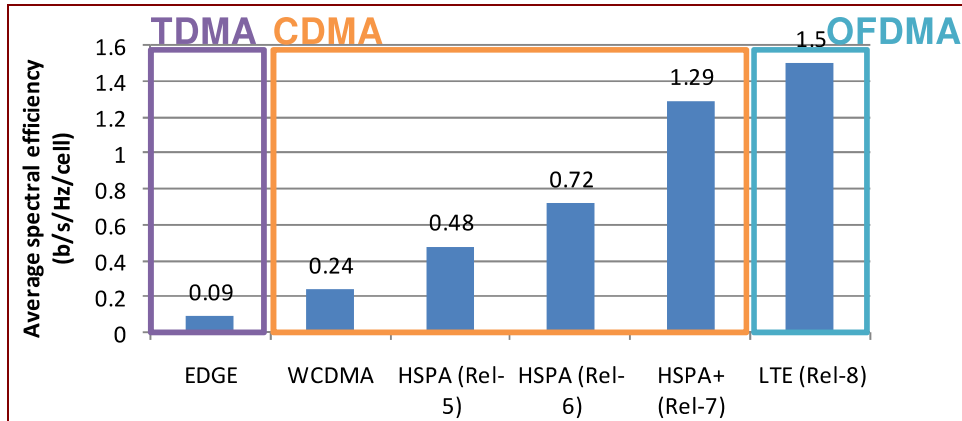
²² e-Communications Household Survey and Telecom Single Market Survey Roaming Results (Special Eurobarometer 414), March 2014

Differences:

- The use of the 700 MHz band for mobile broadband services
- Way of considering additional frequency or technology resources available (wireless broadband bands, VHF band III, WiFi access)

2. Efficiency gains and timelines

Factors	Average gain	Timing	Remarks
Compression - HEVC	40% over MPEG-4	by 2020	Applies to both DTT and MBB; starting technology point matters: availability of MPEG-2 or MPEG-4. Chip set sampling available – e.g. Broadcom.
DTT transmission: DVB- T2	40-60% over DVB-T	available today	The commission study by Analysis Mason on spectrum demand provides estimates
MBB transmission: LTE(-A)	LTE: 3 times over basic HSPA (Rel-5)	available today: 73 EU operators	LTE is commercially available in the EU. LTE-A has been deployed outside the EU.
SFN (DTT)		Available today (IT, BE, HU, NL, PL, ...)	Difficult to quantify. Impacts white space availability for PMSE. Linked to regional content and cross border coordination.
Network topology - small cells in urban areas (MBB)	Significant gain	Public access small cells are not currently widely deployed	Difficult to quantify. In high-frequency wireless and Wi-Fi bands.
Refarming (e.g. 900/1800 MHz)	HSPA (3G, Rel-7): about 13 times over GSM; LTE (4G): 15 times over GSM	Since 2010	Starting point: GSM (2G) transmission. Latest technology deployment assumed for both 3G and 4G.



Source: Contribution by the GSMA and mobile operators to the Sherpa Group

Related observations:

- Efficiency improvements are possible through multiple antenna technology
- According to the RSPG (RSPG Report RSPG13-524 rev1) cross-border coordination due to the potential repurposing of the 700 MHz band for mobile broadband in order to reconstitute equitable broadcasting rights below the 700 MHz band in compliance with GE06 would take at least 3 years

3. What is the capacity requirement (*bit rate*) of a TV channel:

- depending on the video resolution format and video compression,
- for a stationary TV receiver (1st device) and a nomadic TV receiver which may be broadband-enabled (2nd device?)²³,

In 2020	SD	HD	UHD
Stationary [Mb/s]	2	6-9	11-20
Nomadic [Mb/s]	2	6-9	n.a.

Assumptions²⁴:

- Stationary TV receiver: MPEG-4 compression for SD with 576i/25 as well as HD with 1080i/25; a gain factor of 2.5 of MPEG-4 over MPEG-2 for SD; HEVC compression for UHD with 4k/50 (a resolution of 3840/2160); UHD adoption expected around 2020, at least for big screens;
- Nomadic TV receiver: same assumptions serving as an upper limit; no UHD foreseen.

According to the Commission study by Analysis Mason on spectrum demand the *maximum* capacity of a DVB-T multiplex with 64-QAM is at 27 Mb/s whereas for a DVB-T2 with 256-QAM is at 45 Mb/s for roof-top reception. Capacity, quality of service

²³ Resolution of iPad Air: 2048 x 1536, Resolution of a standard 60 inch stationary TV set: 1920x1080

²⁴ Sources: (i) Commission study by Analysis Mason on spectrum demand (ii) Commission study by Plum/Farncombe on platform convergence (ongoing); (iii) RSPG Report on spectrum for broadcasting and WBB (RSPG13-522)

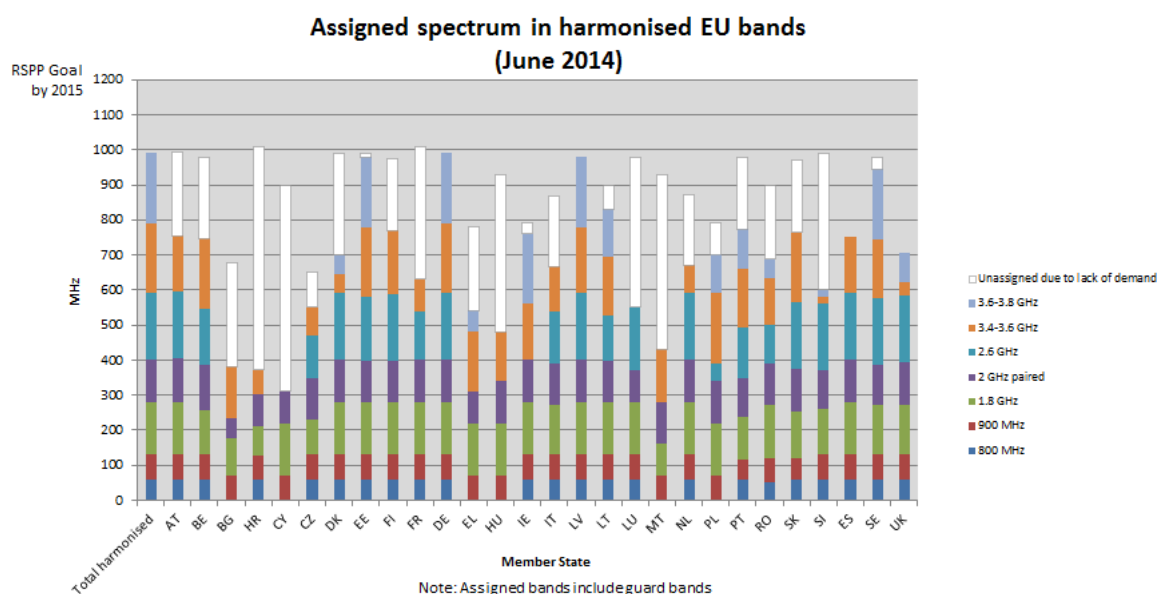
as well as coverage are interdependent requirements. Typically a multiplex could accommodate up to 3 UHD TV programmes.

The numbers in the above table should be understood as average pointers serving to provide guidance to the High Level Group. The required bit rate is a function of picture parameters (e.g. resolution, frame rate, bit depth, colour gamut), compression technology and content type. All types of video consumer devices are increasingly equipped with HD capable displays and therefore are best served with HD content. A roadmap for the introduction of certain new technologies such as UHDTV as well as industry figures for the bit rate requirements have not been yet agreed until 2030.

FACT SHEET on Diversity

Spectrum use

- Both mobile and broadcast network operators have access to several frequency bands although there are variations at national level regarding the actual assignment of spectrum. While a broader understanding of the spectrum used by broadcasting and mobile operators is relevant, the focus of the HLG work is of course on the UHF band.
- PMSE has traditionally used the VHF and UHF TV spectrum allocations for content production. Spectrum tuning range for PMSE have already been reduced by 72 MHz in the 800 MHz band and would be reduced by further 96 MHz (if any reallocation of the 700 MHz band. Equivalent replacement spectrum has yet to be identified.
- The table below gives an overview of the frequency bands that have been harmonised at European level for the use by mobile network operators (around 1000 MHz of spectrum in total). In addition, it shows the amount of spectrum that has been actually assigned to operators at national level. It should be noted that where the bars do not reach the 1000 MHz mark the spectrum has not been released to mobile services by the Member States. For some countries there is lack of demand²⁵ but this is related to higher frequency bands (primarily 2.6 GHz and 3.4-3.8 GHz). There is no lack of demand below 1 GHz, but in some cases Member States have not assigned spectrum in the 800 MHz band due to difficulties in cross-border coordination and in one case due to its use by military services.



Source: European Commission (based on RSCOM13-72, updated June 2014)

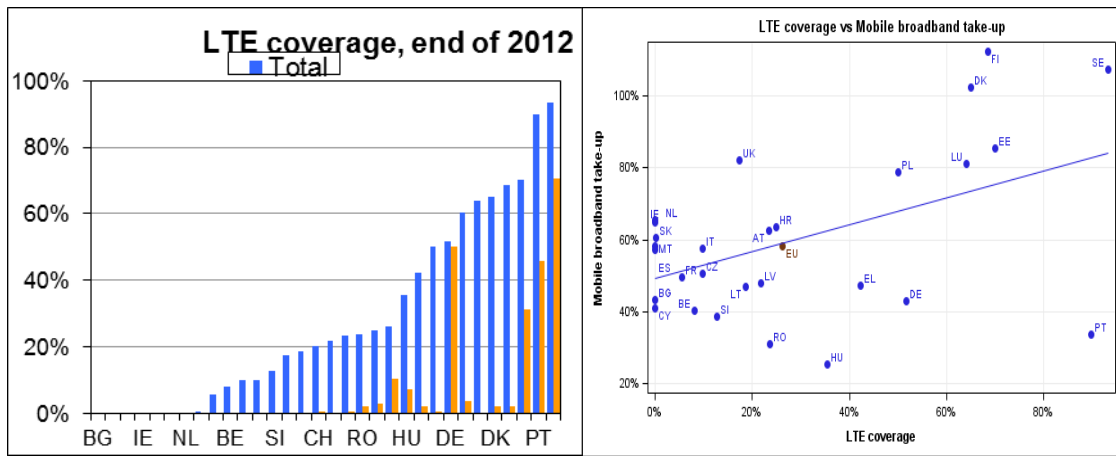
²⁵ Lack of demand has been confirmed by Member States to the Commission within a mutual (pilot) procedure on the enforcement of Article 6, RSPP. It includes the following cases: (i) a licence has been returned to the spectrum regulator, (ii) spectrum on offer has remained unsold during an auction, (iii) there has been no interest shown during a public consultation.

- Complementary wireless broadband bands used with non-3GPP (non-cellular) technology comprise up to 538.5 MHz (RLAN at 2.4 GHz and 5 GHz) and 173 MHz (satellite broadband in various bands below 6 GHz)²⁶.
- Broadcast network operators use spectrum for radio (FM, Digital Terrestrial Radio) and television (terrestrial and satellite). In some countries (e.g. France) satellite is also used to complement DTT coverage. The table below gives an overview of the spectrum used for terrestrial broadcast services.

Frequency band	Spectrum Amount	Type of service	Remarks
Band II: 87.5-108 MHz	20.5 MHz	FM radio	FM is used
VHF band III 174-230 MHz	56 MHz	T-DAB, DTT	T-DAB is available in many EU countries (see http://www.worlddab.org/country-information) PMSE audio operation. In some countries this frequency band (or a portion thereof) is used for DTT services (e.g. Italy, Sweden, Finland), while in some countries this band is not available for DTT (e.g. UK).
UHF band: 470-790 MHz	320 MHz	DTT	This is the core band for DTT and PMSE audio operation. The 700 MHz band is used intensely (more than 3 MUX) in a number of countries, including France, Spain, Italy, Poland, Croatia, Portugal, UK.
L band: 1452-1492 MHz	40 MHz	T-DAB, S-DAB	The band is allocated to digital audio broadcasting but there are no commercial deployments. The band has been harmonised for mobile SDL in CEPT countries (ECC/DEC/(13)03) and it is subject to an EC mandate.

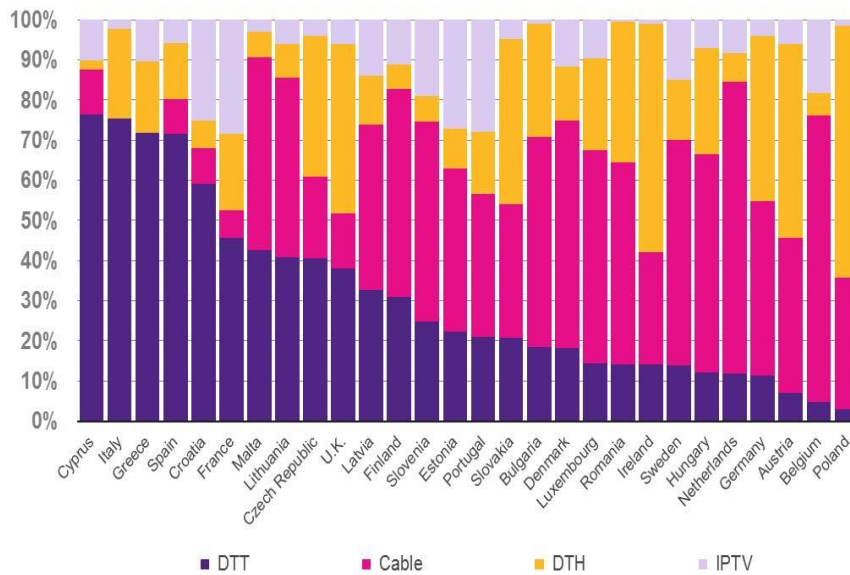
²⁶ RSPG opinion on spectrum for wireless broadband (RSPG13-521 rev1)

LTE²⁷ penetration in the EU



Source: Digital Agenda Scoreboard 2012

Market shares of television platforms across Europe



Source: EAVO (2012), e-Communications Household Survey (2013), Farncombe analysis & research (market shares refer to primary TV-set, however for DTT there is, in addition, an appreciable number of households where a second TV set plays an important role). For some countries the figures may not be up-to-date (e.g. Poland).

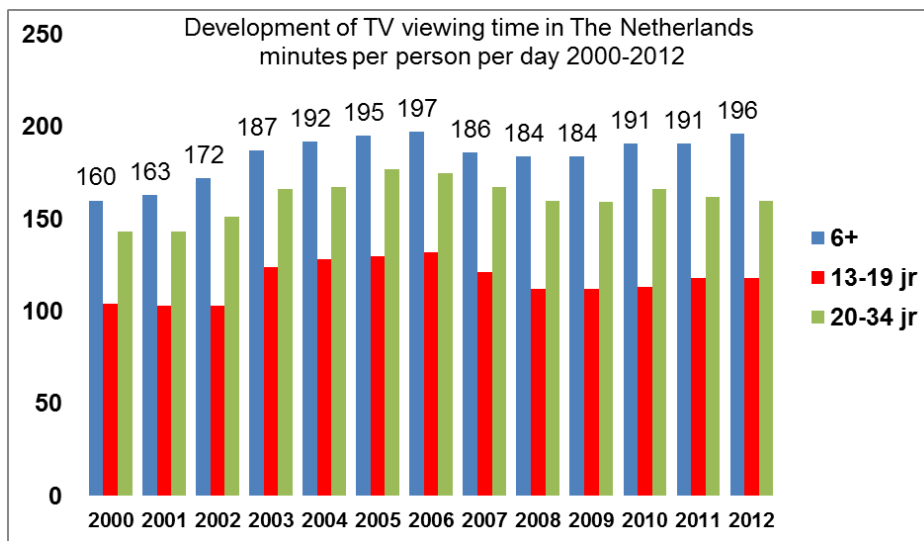
²⁷ Long Term Evolution, popularly known as "4G"

Expiry dates of existing broadcasting licenses in the UHF band

Expiry	Number of countries	Percentage of countries
Expire 2013-2015	5	15.2%
Expire 2016-2019	8	24.2%
Expire 2020-2023	16	48.5%
Expire 2024-2027	9	27.3%
Expire at some point after 2027	3	9.1%
No answer given	2	6.1%
Expire 2016-2026	24	72.8%
Licence renewed annually	1	3%
Expires 2032	1	3%
No licence expiration, Government Policy decides	6	18.2%

Number/percentage of respondent countries (33 in total, 26 Member States) [Source: *RSPG Report on wireless broadband spectrum (RSPG13-522)*]

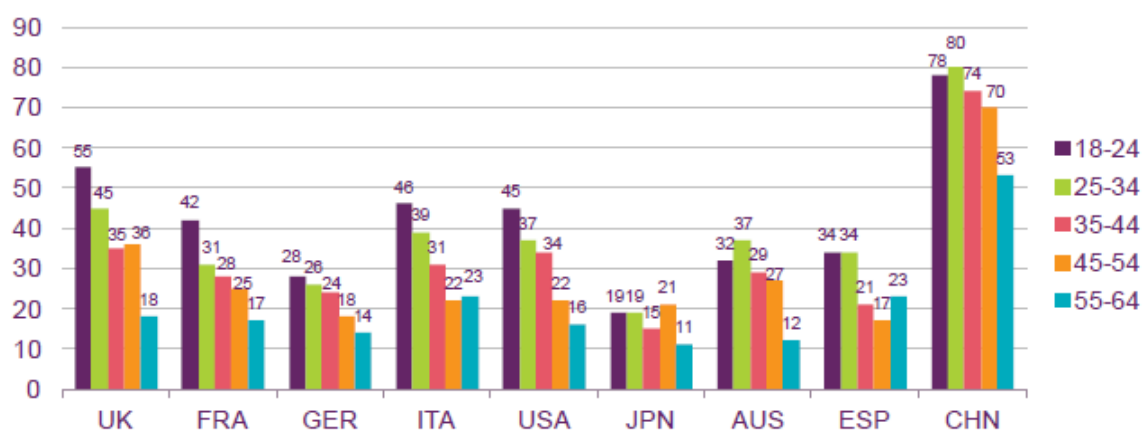
TV consumption (platform or device) by age (other demographics)



Source: *KijkOnderzoek (SKO) / CKO (NPO KLO)*

In the UK, internet users aged 18-24 are the most likely to access TV content online, with 55% claiming to do so, while 55-64 year olds are the least likely, with only 18% claiming to do so. As set out in the following figure, this pattern is generally consistent across the countries surveyed, although in some countries, such as Australia and China, 25-34 year olds have a higher propensity to watch TV over the internet, and in Japan, it is the 45-54 year olds who are the most likely.

All respondents



Weekly viewing of TV content over the internet, by age (Source: Ofcom, 2013)

Mobile technology use across frequency bands

Band	Total FDD	GSM	UMTS	LTE
800 MHz	2 x 30 MHz			✓
900 MHz	2 x 35 MHz	✓	✗	✗
1800 MHz	2 x 75 MHz	✓		✗
2100 MHz	2 x 60 MHz		✓	
2600 MHz	2 x 70 MHz			✓

✓: Original use ✗: Refarming

Source: GSMA.