Your response

Question	Your response
Question 1: Do you agree with the prioritisation of the agenda items, as shown in Annex 5, and if not why?	NOTE – RESPONSE TO Q32 ONLY Confidential? – Y / N
Question 2: Ofcom is supporting the following three priority bands for IMT identification in the RRs: **24.25 – 27.5 GHz** **40.5-43.5 GHz (as part of a wider global 37-43.5 GHz tuning range)** **66 – 71 GHz** **If you don't agree with any of these bands, or think we should be promoting other bands, please provide justification for your views.**	Confidential? – Y / N
Question 3: What are your views on the suitability of the currently identified bands for HAPs and do you think there is a requirement for additional spectrum? Recognising that we support 26 GHz as a global band for IMT under agenda item 1.13, what are your views on the bands currently under study for HAPs, both globally and in ITU-R Regions?	Confidential? – Y / N
Question 4: What are your views on the bands within scope of Agenda Item 1.16 and their suitability for Wi-Fi and Wi-Fi like services? Do you agree that Ofcom should support the CEPT position of No Change? If not, please provide evidence to support your view.	Confidential? – Y / N

Question 5: Do you agree that UK support the inclusion of the updated Recommendation M.1849-1 ("Technical and operational aspects of ground-based meteorological radars") in footnote No.5450A? What are your views on the requirement to include a reference to ITU-R Recommendation ITU R M.1638 1 in footnotes No.5447A and 5.450A and the potential impact upon Wi-Fi (and similar technologies)?	Confidential? – Y / N
Question 6: Do you agree that UK support a position of not making changes to the Radio Regulations to reference specific bands for M2M/IoT usage?	Confidential? – Y / N
Question 7: What are your views on the potential removal of the limitations listed above?	Confidential? – Y / N
Question 8: What are your views on the approach we are proposing to take in respect of ESIMs and are there any additional factors that you think we should take into account?	Confidential? – Y / N
Question 9: What are your views on the establishment of regulatory provisions, in Article 22, that cover non-GSO operation between 37.5 and 51.4 GHz?	Confidential? – Y / N

Question 10: What are your views on the various issues under consideration under Agenda Item 7, particularly in respect of the bringing into use of non-geostationary satellite networks (i.e. Issue A)?	Confidential? – Y / N
Question 11: What are your views on Agenda Item 9.1.1?	Confidential? – Y / N
Question 12: What are your views on the potential establishment of satellite pfd limits, in the 1 452 – 1 492 MHz band, to protect terrestrial use?	Confidential? – Y / N
Question 13: Do you have any views on the bands being studied and are there any other considerations which you think should be taken into account? What are your views on the appropriateness of the current emission limits in the band 3 700 – 4 200 MHz?	Confidential? – Y / N
Question 14: Do you agree that no changes to the RRs are required, under Agenda Item 9.1.7, and that managing the unauthorised operation of earth station terminals (deployed within its territory) should be addressed by the national administration concerned?	Confidential? – Y / N

Question 15: What are your views on the need for additional fixed satellite service allocations in the band 51.4 – 52.4 GHz?	Confidential? – Y / N
Question 16: What are your views on Agenda Item 1.8, particularly the need to enhance maritime safety, set against the need to respect the international spectrum allocations and the protection of passive services in adjacent bands?	Confidential? – Y / N
Question 17: What are your views on Agenda Item 1.9.1, particularly the need to respect the current integrity of the AIS?	Confidential? – Y / N
Question 18: What are your views on Agenda Item 1.9.2, particularly the need to take into account current national users in the bands defined by RR Appendix 18?	Confidential? – Y / N
Question 19: What are your views on Agenda Item 1.10 and do you think that any changes to the Radio Regulations may be necessary?	Confidential? – Y / N

Question 20: What are you views on Agenda Item 1.11, and do you agree that no specific identification for rail communications is required in the Radio Regulations?	Confidential? – Y / N
Question 21: What are you views on Agenda Item 1.12 and do you agree that there is no requirement for specific identification to ITS in the Radio Regulations?	Confidential? – Y / N
Question 22: What are you views on Agenda Item 9.1.4 concerning radiocommunications for sub-orbital vehicles?	Confidential? – Y / N
Question 23: What are your views on Agenda Item 1.1, recognising that licensed amateur operators in the UK already have access to parts of the 50 – 54 MHz band?	Confidential? – Y / N
Question 24: What are your views on Agenda Item 1.2 concerning power limits for MetSat, Mobile Satellite and EESS, and the linkage to agenda item 1.7?	Confidential? – Y / N

Question 25: What are your views on Agenda Item 1.3, particularly on any limits required to protect terrestrial use?	Confidential? – Y / N
Question 26: What are your views on Agenda Item 1.7 considering spectrum needs for short duration satellites, noting also the potential linkages to Agenda Item 1.2?	Confidential? – Y / N
Question 27: What are your views on Agenda Item 1.15, particularly on the protection needs of passive services?	Confidential? – Y / N
Question 28: What are your views on Agenda Item 9.1.6, particularly on the categorisation of WPT and whether WRC action is required?	Confidential? – Y / N
Question 29: Do you have any comments concerning the Standing Agenda Items, where not covered elsewhere in this document?	Confidential? – Y / N

Question 30: Are you aware of any specific issues, not covered elsewhere in this document, which are likely to be raised in this part of the Director's Report and of which you think Ofcom should be aware?	Confidential? – Y / N
Question 31: Do you have any comments on Agenda Item 9.3 considering Resolution 80?	Confidential? – Y / N
Question 32: What changes to the Radio Regulations have you identified that would benefit from action at a WRC and why? Do you have any proposals regarding UK positions for future WRC agenda items or suggestions for other agenda items, needing changes to the Radio Regulations, that you would wish to see addressed by a future WRC?	Confidential? – N

DigitalUK

Response to Ofcom consultation: Preparations for WRC-19

13 September 2018

About Digital UK

Digital UK leads the development of Freeview, the nation's most widely used television platform. Our goal is to create the best free TV service, both live and on-demand.

We work with world-leading companies to deliver television which informs, educates and entertains, ensuring every home in the UK can access high-quality television without the need for a monthly subscription.

Our latest innovation is Freeview Play which brings terrestrial TV, catch-up and on-demand together in a new generation of televisions and set-top boxes, making it easier than ever for viewers to watch what they want, when they want.

Partnerships are crucial to what we do. We collaborate with a broad range of organisations in pursuit of our goals and are owned by Arqiva, the BBC, Channel 4 and ITV.

1. Introduction

Digital UK welcomes this consultation and the opportunity to share our views on preparations for the World Radiocommunication Conference in 2019 (WRC-19). Our particular area of interest is the conference's role in developing the agenda for the following WRC in 2023 when discussion of UHF spectrum, which remains critical to DTT, is scheduled to form a significant part of the agenda.

Our response therefore primarily focuses on Agenda Item 10 and the UK position on topics for discussion in 2023. In doing so we consider it important to highlight changes in the wider landscape affecting both television and mobile – the main users of UHF spectrum. Some of these changes, such as the current growth in UK homes watching via DTT or the diminishing demand for UHF spectrum for mobile, are at odds with the assumed direction of travel in policy thinking just a few years ago.

We cite these significant developments to encourage Ofcom and the UK government to ensure that WRC preparations do not make assumptions based on past policy approaches. The television sector is changing fast and DTT-based services, of which Freeview is the most important, are playing a critical role in much of this change. In doing so we are expanding consumer choice.

Our response therefore makes two key points:

I. **That Ofcom must take a firm position on behalf of the UK in opposing any attempt to bring forward the debate on UHF scheduled for 2023 to WRC-19.** This would run contrary to the consensus on DTT's importance to 2030 and lack the crucial evidence necessary for an informed debate.

II. **Ofcom should support a broad-based agenda item on UHF at WRC-23.** This agenda item should not become a debate solely about the future of DTT or how to take the next slice of spectrum but rather an exercise in fresh thinking, not least about how mobile operators could make better use of their existing UHF capacity.

2. The changing context for UHF spectrum policy

Before offering views on the substance of this consultation, we wish to highlight the changing context for spectrum policy decisions and in particular those relating to the main users of the UHF bands – broadcasting and mobile. Ofcom has already noted some of these changes in recent publications and we would urge it to ensure their significance is properly reflected in discussions at WRC-19 and in shaping the agenda for WRC-23.

I. DTT in the UK is growing and supports 'hybrid' viewing behaviour

As Ofcom will be aware, the rise of on-demand viewing and OTT providers in recent years has prompted some to assume that DTT must be in terminal decline. The reality is somewhat different with DTT now the only major broadcast platform in the UK to be experiencing growth. Nearly a million additional homes now watch DTT on their primary TV set compared to two years ago[1].

As Ofcom noted recently[2], this growth is at least partly attributable to the trend among viewers of moving away from traditional pay TV platforms in favour of Freeview, to which they add flexible SVoD services such as Netflix, Amazon Prime Video and NowTV. Freeview therefore is becoming the entry point to foundational, free-to-view television for more and more UK viewers. With further significant growth of SVoD likely, there is every reason to believe that Freeview will continue to benefit from this trend in viewing behaviour.

Freeview is further embracing these changes by evolving into a fully hybrid platform with the development of Freeview Play – the new standard for TVs and boxes which brings together terrestrial broadcast and broadband delivery. The interface design makes moving between watching live and on-demand virtually seamless while also keeping high-quality UK content prominent and easy to access. Elsewhere in Europe, DTT operators in Germany, Italy and elsewhere[3] are making similar moves to meet changing audience expectations.

The success of Freeview Play promises to not only help boost ownership of connected TVs, currently in around 40 per cent of UK households, but also has the potential to widen access to connected viewing, especially among those demographic groups at risk of being left behind in the next phase of television developments[4]. Just as Freeview's launch in 2002 was critical to making multi-channel TV available to everyone, Freeview Play has the potential to widen

[1] DTT primary set homes grew by 800,000 between Q1 2016 and Q1 2018 - BARB

[2] Ofcom Media Nations Report, July 2018

[3] For example, Germany's Freenet TV Connect and Tivu On in Italy

[4] As shown in data from Ofcom's 2018 Media Nations interactive report, on demand TV viewing skews heavily towards younger demographics – 64% of 16-24-year-olds watch some on-demand TV compared to 39% aged 55+. (see table 4 at this link: https://www.ofcom.org.uk/research-and-data/tv-radio-and-on-demand/media-nations/interactive-report)

access to connected viewing while continuing to ensure the universal availability of high-quality free to view TV, both linear and on-demand.

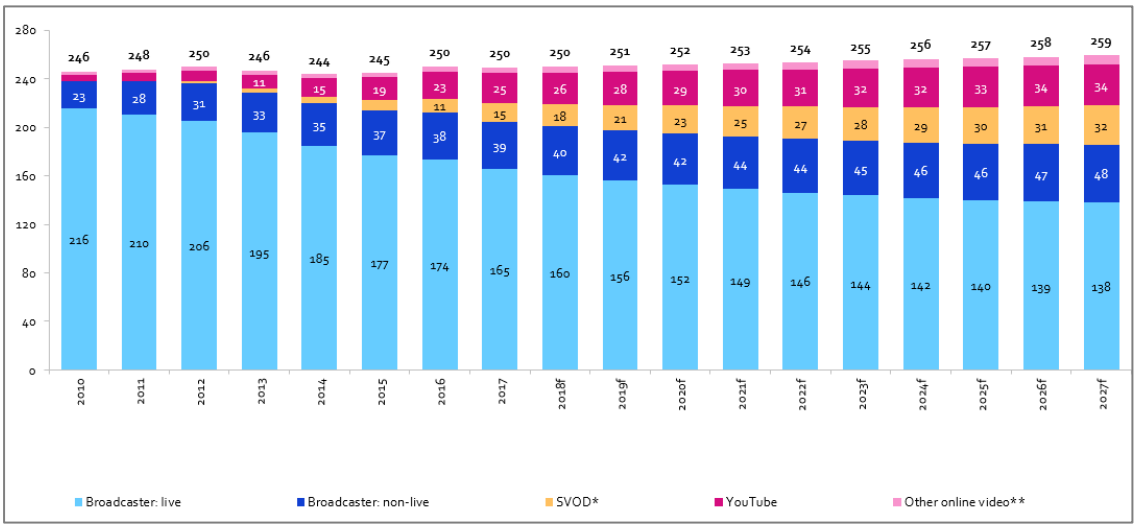
II. Live, linear viewing is proving remaining remarkably resilient

Subscription to SVoD services such as Netflix has seen rapid growth in recent years and an accompanying decline in viewing to live TV. Ofcom recently reported that the overall number of such subscriptions had hit 15.4m and overtaken those for traditional pay TV contracts[5].

The presentation of such facts and subsequent media reporting can sometimes lead to muddled thinking or confusion about the relative *value* of SVoD and pay TV subscriptions or the *amount* of viewing accounted for by these and other catch-up or on-demand services. In fact, SVoD services account for around five per cent of UK television revenues and a similar proportion of viewing[6].

So while watching TV via an internet connection is growing, it remains a largely complementary activity to live viewing, up to half of which is typically via DTT. The rate of change – for the moment at least – also appears relatively gradual. As Ofcom's latest research shows, people on average still watch more than 200 minutes of TV per day[7]. While forecasting in this area is difficult, most sector analysts broadly agree[8] that live TV is set to continue to account for a significant proportion of viewing throughout much of the 2020s – see Figure 2.

Figure 2 – Forecast TV/video viewing, all individuals (minutes per day) - Enders Analysis, 2017



[5] Media Nations, Ofcom 2018
[6] Ibid
[7] Communications Market Report 2018
[8] Similar forecasts have been produced by Mediatique and 3Reasons

III. A safe and secure source of news for UK audiences

DTT also plays an important role in providing a safe and secure means of providing news and information to UK citizens, both day-to-day and at times of national crisis or civil emergency. In a media landscape increasingly subject to global players and content created for international audiences, Freeview remains the only major television platform, which is owned and operated by UK companies solely for the benefit of UK viewers.

DTT also guarantees free and universal access to independent, trusted news sources. As Ofcom reported earlier this year, while television news remains the most popular with viewers (watched by 79 per cent of adults), two-fifths also use social media. Facebook is by far the most widely used social media news source, used by 76 per cent of this group, more than double the figure for second-placed source, Twitter. The fake news crisis which has engulfed Facebook in recent months is indicative of the lack of safeguards on online news sources. In the first three months of 2018, Facebook is reported to have moderated the content of 1.5 billion posts or accounts and to shut down 538 million fake accounts[9]. These inherent problems with unregulated online news provision, particularly in the social media space, are in stark contrast to that provided by UK television news providers, such as the BBC, ITV and Sky, who are under a statutory obligation to be accurate and impartial and are available on a free-to-view basis via DTT to virtually every UK household.

IV. We're a long way from consideration of a full switch to internet television

The same people who mistakenly suggest DTT is in decline are often strong advocates of switching to internet delivery of all TV as soon as the 2020s. While patterns of TV watching are changing, Ofcom has been clear that the UK will not be able to offer every household a reliable TV service via broadband within the next decade[10].

We've seen no compelling evidence to contradict Ofcom's previously stated view that a switch to broadband delivery could not happen until the 2030s at the earliest. In the meantime, DTT-based services, notably Freeview, remain a critical element of the UK television ecology, ensuring universal access to high quality free-to-view TV which celebrates, reflects and sustains UK culture, in contrast with the content available from SVoD services, much of which is US-made and produced for a global audience.

The huge audiences for the 2018 FIFA World Cup[11] were also a timely reminder of consumers' love of the live TV experience. They also served to highlight the

[9] Guardian report 15 May 2018 https://www.theguardian.com/technology/2018/may/15/facebook-closed-583m-fake-accounts-in-first-three-months-of-2018

[10] 'We do not currently expect a full switch-off of DTT until post 2030' – Ofcom, Future of free-to-view TV, 2014

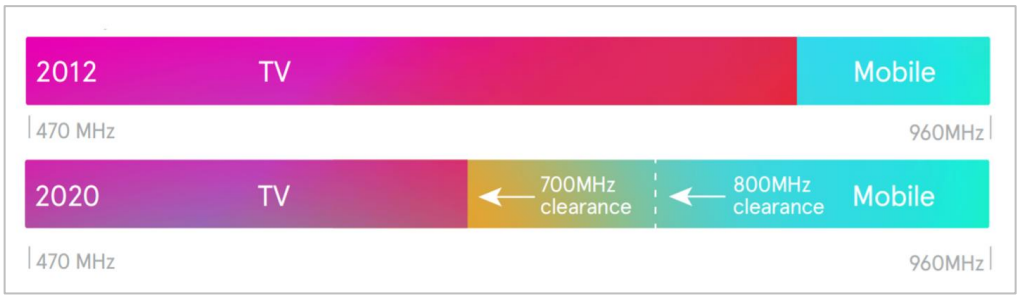
[11] Average TV audience for England v Croatia was 24m

challenges which internet service providers continue to experience in meeting the demands of mass audience events[12].

V. Demand for spectrum for mobile broadband has substantially diminished

The last decade has seen continuing demand for UHF spectrum from mobile operators to meet growing consumer demand for data via 3G and 4G services - see Figure 1 below. The release of the 700MHz band is the latest example of this trend and of the continuing increase in spectrum efficiency by broadcasters. Today, DTT occupies around 40 per cent of the spectrum required for analogue television while providing more than 10-times the number of channels.

Figure 1 – The transfer of UHF spectrum from broadcasting to mobile 2012-2020



UHF spectrum remains critical to the delivery of Freeview. It also underpins a growing number of TV service providers including BT TV, YouView, Now TV and EETV. As with DTT viewing, demand for UHF spectrum for broadcasting therefore remains strong.

This is in stark contrast to the mobile sector's changing needs. As Ofcom recently noted:

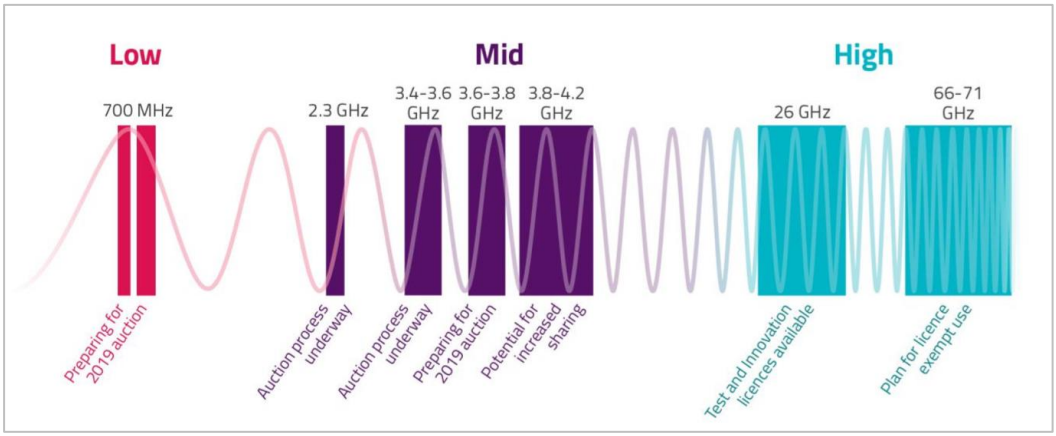
> **'Our earlier work had suggested that there would be strong competition from mobile companies for the valuable airwaves, or spectrum, that underpin DTT. But mobile demand has substantially diminished as investments in 5G require spectrum at higher frequencies'**
>
> *Public service broadcasting in the digital age, Ofcom, March 2018*

But the demands of 5G are quite different. These new services require larger contiguous blocks of spectrum at higher frequencies to accommodate higher volumes of data.

[12] UK viewers watching streamed coverage of the World Cup complained about time lag compared to live broadcast. Australia's OPTUS service crashed due to high demand and was forced to hand back coverage rights to broadcaster SBS. Amazon's streamed coverage of the 2018 US Open tennis tournament was widely criticised for picture and sound issues.

As Figure 3 shows, while some UHF spectrum (the 700MHz band) is being released for future mobile, the primary focus is now on mid- and high-frequency bands such as 26GHz, 37-43.5GHz and 66-71GHz. We welcome Ofcom's noting of this significant change and adjustment of its view on demand for UHF for mobile in its recent publication on the future of PSB. On this basis, we see no justification for raising the prospect as soon as 2019 of further UHF allocations for mobile.

Figure 3 – The spectrum pipeline for next generation mobile broadband



VI. New ideas on defragmenting the upper UHF band

In contrast with DTT's increasing efficiency, there are valid questions to be asked about whether mobile operators are making the best possible use of their existing UHF bands. This is particularly pertinent to any debate about further mobile allocations of existing DTT spectrum which, following the squeeze on capacity imposed by 700MHz clearance, would risk reducing the number of services available.

Ofcom will be aware of the recent debate in the UK and internationally concerning the inefficient and fragmented use of the upper UHF bands by mobile – an issue which will only be further exacerbated by the addition of the 700MHz band. Indeed, Ofcom was probably the first regulator to publicly raise this issue[13] and invite industry to suggest how more efficient use of the upper UHF bands could be achieved. We provide more detail on this topic in Section 3.2 below.

Set against this changing market context, we hope Ofcom will continue to demonstrate leadership in the forthcoming WRC process in both 2019 and in 2023 when future use of UHF spectrum is scheduled for discussion. Formulaic approaches are no longer appropriate to the changes we are seeing and should give way to fresh thinking which reflects the real-world needs of both the broadcasting and mobile sectors.

[13] Long-term planning for UHF spectrum - Ofcom presentation to the EU Spectrum Conference 2017

3. Response to consultation questions

While the 2019 conference is not scheduled to address future uses of the 470-960MHz bands, it will set the agenda for WRC-23 when this topic is scheduled to form a significant area of discussion. Our response therefore focuses on Question 32 and based on the evidence presented above strongly endorse Ofcom's view that any change to the Radio Regulations must be 'appropriately justified and demonstrated to be necessary'[14].

Question 32: What changes to the Radio Regulations have you identified that would benefit from action at a WRC and why? Do you have any proposals regarding UK positions for future WRC agenda items or suggestions for other agenda items, needing changes to the Radio Regulations, that you would wish to see addressed by a future WRC?

3.1. The UK position should oppose any attempt to bring forward the WRC-23 agenda time on UHF to the conference in 2019

Despite the Resolution 810 of WRC-15 proposing that a review of the bands 470-960MHz take place at WRC-23, there is some evidence that a handful of organisations and countries may push for aspects of this debate be brought forward to 2019. The GSMA – a trade organisation representing the mobile industry – has actively campaigned that the Radio Regulations be changed to harmonise the 600MHz band for mobile use as soon as possible[15].

Any attempt to bring forward the debate on UHF to 2019 would be premature in the extreme. It would conflict with Ofcom's stated view that DTT will remain important until at least 2030[16] - a view shared by Pascal Lamy's report[17] on the spectrum needs of mobile and broadcasting and by the European Commission in its 2017 Decision on the future of UHF[18].

The draft agenda item on UHF for WRC-23 also notes that terrestrial broadcasting networks have a long development cycle and require regulatory certainty to secure investment[19]. A change to the Radio Regulations governing all or part of the 470-694MHz bands – even if only as a so-called 'enabling measure' – would undermine commercial and consumer confidence in the platform at a critical stage in its evolution and long before the UK is able to provide an internet television service comparable to DTT in terms of reach and resilience.

Considerable time will also be required to explore in more detail some of the trends outlined above in preparation for WRC-23. Observers of spectrum policy will be familiar

[14] Consultation on preparations for WRC-19, Ofcom, para 8.13

[15] 'Any action at WRC-19 and WRC-23 that can improve harmonisation of the 600MHz band for mobile broadband should be considered' GSMA factsheet – '600MHz for mobile broadband – momentum is growing', April 2017

[16] The future of free-to-view TV, Ofcom, 2014

[17] Pascal Lamy report to the European Commission, 2014

[18] EU Decision on use of 470-790MHz, April 2017

[19] Resolution 235, WRC-15

with the complexity of past debates governing use of UHF spectrum and the significant implications of any changes – clearance of DTT from the 700MHz band at a cost of £600m[20] and impacting some 20 million television viewers, being a case in point. The period following WRC-19 will provide a necessary window for CEPT and other bodies to carry out in-depth studies and explore options. To attempt to make decisions of this nature 'on the hoof' in 2019 without such studies and evidence to call on would risk unanticipated and negative outcomes.

3.2. The UK should support a broad-based agenda item and fresh thinking on UHF at WRC-23

As noted above, spectrum decisions of the last decade have seen a pattern of UHF spectrum used for broadcasting reallocated to mobile. Primary examples of this are the digital switchover process completed in 2012 and more recently with the clearance of the 700MHz band which have together enabled the launch and roll out of 3G and 4G mobile services.

With the focus now heavily on the launch of 5G services in higher bands and broadcasting rapidly adapting hybrid models to encompass internet delivery, this 'salami slicing' approach looks increasingly outdated.

The UK should therefore support the current draft agenda item's broad scope, examining spectrum use by broadcasters and mobile operators equally in the full range 470-960MHz. This offers an opportunity for fresh thinking and to break with moribund approaches of the past.

Significantly, Ofcom itself has raised important questions about spectrum efficiency in the upper parts of the UHF band, primarily used for mobile[21]. For broadcasters who have undertaken extensive spectrum re-planning and increased use of spectrum efficient standards such as DVB-T2, this is a refreshing change and indicative of the innovative approaches required. Digital UK went on to commission high-level research in this area which indicated that defragmenting the upper UHF bands using either FDD or TDD technologies could offer spectrum efficiencies of between 20 and 70 per cent[22].

This initial work has prompted interest in this topic both in the UK and internationally. The UK Spectrum Policy Forum commissioned a follow-up report highlighting the challenges of defragmentation but also signalled its belief that the study provided a basis for further thinking in this area[23]. As noted earlier, the Australian Communications and Media Authority (ACMA) has also publicly expressed interest in the idea of consolidating capacity above 700MHz, citing the Digital UK report and stating that spectrum allocations should not be 'set and forget' (see Appendix 1).

The DTT platform meanwhile has been steadily increasing its spectrum efficiency. The clearance of the 700MHz band and re-planning of remaining DTT bands, which will see

[20] Ofcom cost benefit analysis, 2014
[21] Ofcom presentation to the EU Spectrum Conference 2017
[22] The Defragmentation Dividend, Aetha Consulting, November 2017
[23] Study on UHF Band 694-960MHz - LS Telcom report for UK Spectrum Policy Forum, July 2017

the platform give up a third of its spectrum while retaining existing services, is just the latest example. Greater use of single frequency networks coupled with investment in improved compression technologies, has seen DTT achieve a five-fold increase in spectrum efficiency (see Appendix 2). It is also worth noting that since the 1990s the Freeview trademark licence now mandates that all products are based on the more efficient DVB-T2 standard.

In this era of change, DTT in the UK is not standing still and continues to evolve to meet viewers' growing expectations in terms of TV choice. The new Freeview Play service which combines DTT with internet delivery through an integrated interface is rapidly becoming the new standard for UK televisions and boxes adopted by nearly all major brands.

As noted above, this development promises to not only help boost ownership of connected TVs, currently in around 40 per cent of UK households, but also has the potential to widen access to connected viewing, especially among those demographic groups at risk of being left behind in the next phase of television developments.

These benefits can only be realised while Freeview and other DTT services continue to have secure access to the UHF spectrum which underpins the live viewing experience that accounts for the vast majority of TV consumption.

In conclusion therefore, we urge Ofcom to not only recognise but act on the changes in UHF spectrum demand we are seeing. The UK position for WRC-19 should therefore be firm in opposing any attempts to trigger a premature and poorly informed debate about UHF spectrum at WRC-19. Equally we hope to see the UK playing a leading role in championing fresh thinking which reflects the growing importance of DTT and diminishing demand for UHF spectrum from mobile during the preparation phase for WRC-23. In doing so, Ofcom can ensure the interests of UK citizens and consumers are fully and properly taken into account.

Appendix 1 – Communications Day report of ACMA comments on UHF defragmentation

COMMUNICATIONS DAY

27 July 2018 All you need to know in telecooms ISSUE 8677

ACMA floats idea for massive sub-1GHz band

The Australian Communications and Media Authority is considering a radical plan to combine various spectrum bands at 700MHz, 850MHz and 900MHz into one giant sub -1GHz band suited to the voracious future demands of 5G networks.

Speaking at the Unwired Revolution event in Sydney this week, ACMA member James Cameron said "sub-1GHz planning arrangements are not 'set and forget,' and we need to be considering putting in place the building blocks for optimisation of the band for 5G."

Unlike the demands of 2G through to 4G generation technology which have generally worked well with 20MHz and 40MHz allocations, 5G will be better served by allocations as large as 80-100MHz to provide for its higher throughput.

Cameron said that the ACMA had been looking at optimisation of the 900MHz 'GSM' band along with the reallocation of 850MHz. But he also asked "are there ways, in the long-term, we could make even better use of our precious sub-1 GHz wireless broadband allocations? Is there some way we could consolidate the bands themselves, potentially offering a defragmentation dividend?"

Cameron said some thinkers were imagining a world where the distinct sub-1GHz bands such as 700, 850 and 900MHz were restructured into essentially a single band, with the corresponding possibility of efficiency gains by removing guard bands and adopting a time division duplex structure as opposed to the traditional frequency division approach now used.

"It's a big idea which raises many hard, practical questions, not least of which is how would it be done," he added.

But in a sign that the ACMA is serious about the idea, it is flying out Marc Eschenburg from Aetha Consulting to its Radcomms conference in October. Cameron credited Eschenberg's paper 'The defragmentation dividend: a more efficient use of the UHF band' as the source of the idea. His paper was prepared for Digital UK and published last November: it proposed a defragmentation of 694-960MHz with claimed capacity benefits of up to 70% greater efficiency.

Cameron also flagged a number of other hotspots in spectrum management thinking, including:

- monitoring of 600MHz as a potential re-farming candidate for wireless broadband,
- additional class licensed spectrum will be made available to support low duty cycle, low power, devices optimised for wide-area Internet of Things networks. This new band, adjacent to the existing 900 MHz class licensed band, will facilitate greater access for bespoke Internet of Things applications such as LORAWAN and Sigfox
- in the mid-band, the ACMA is looking at the "priority" of the 1.5GHz band
- in the 26 GHz band, the regulator is looking at the possible suite of licensing options that can be used to support not only a range of different 5G use cases, but also provide flexible solutions for many different types of businesses that are wanting to access spectrum suitable for 5G.

Grahame Lynch

Appendix 2 - DTT increase in spectrum efficiency 2002 – 2020

Dates	Number of muxes	Number of services	DTT spectrum utilised (MHz)	Spectrum deployed (MHz)	Number MHZ per service	Efficiency increase from 1998
1996	Analogue	**5**	470 – 854	**368**	73.6	-
1998	6	**24**	470 - 854	**368**	15.3	X 1.0
2002	6	**32**	470 – 854	**368**	10.5	X 1.4
2012	6	**48**	470 - 790	**312**	6.5	X 2.4
2017	9	**89**	470 - 790	**312**	3.5	X 4.4
2020	7/9?*	**83**	470 - 694	**224**	2.7	X 5.7

*Two interim multiplexes licensed to 2020