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Response to Ofcom Consultation

'TV white spaces: approach to coexistence.'

13 December 2013

This response is submitted by Digital UK on behalf of its Members – the BBC, ITV, Arqiva and Channel 4 - the holders of the terrestrial Broadcasting Act and Wireless Telegraphy Act licences.

1. Introduction

About Digital Terrestrial Television (DTT)

Digital Terrestrial Television (DTT) is the UK's most popular TV platform. At the heart of DTT in the UK is Freeview – a universally available service offering a range of more than a hundred free-to-air TV, radio and text-based services. It is watched in more than 19 million homes, three-quarters of the total. Freeview is the sole television platform in more than 10 million homes (40%)¹

Prior to digital switchover (DSO), more than four million UK households could not access Freeview and elsewhere signal strength was variable. Thanks to industry investment in excess of a billion pounds, switchover made Freeview available to 98.5% of homes.

Viewers are overwhelmingly satisfied with the Freeview service², and post-switchover research demonstrated viewers enjoyed the selection of channels, picture quality and functionality.³

About Digital UK

Digital UK supports the UK's terrestrial TV service and its viewers.

The company is responsible for day-to-day operational management, including the Freeview electronic programme guide, and leads on developing platform strategy, working with its broadcast partners and industry. It also provides viewers with information and advice about terrestrial TV channels, services and reception.

Digital UK is owned by the BBC, ITV, Channel 4 and Arqiva

¹ Source: Ofcom Digital TV Update, Q4 2012

² 84% of Freeview viewers surveyed between April 2012 and March 2013 reported that they were satisfied with the Freeview service. Source: Hall & Partners Freeview brand tracker; sample 5,200 homes.

³ See the Blinc / Digital UK research report 'Viewer Experiences of Switchover', available on the Digital UK Switchover Insights website.

2. Executive Summary

Digital UK welcomes the opportunity to respond to Ofcom's "*TV white spaces: approach to coexistence*" consultation. We recognise the need to ensure that valuable spectrum must be used in the most efficient way possible and are keen to support Ofcom's exploration of ways that may achieve this to the benefit of viewers.

Dynamic spectrum access is one solution that could be fundamental to help in further improving the efficient use of what is clearly now a scarce resource. If deployed effectively, allowing TV white spaces to be used by wireless devices is expected to have significant benefits for consumers, the broadcast industry and wider stakeholders. It has been suggested there are many opportunities to enhance services, reach and offerings through the use of this new technology, and it is likely that there are many more applications that have not yet been recognised.

While supporting the development of this technology with the goal of improving efficiency, it is important that we focus on doing this effectively. While we support the concept of utilising TV white spaces, in this response we also highlight some of the areas where we feel the overall benefits will not be realised due to some concerns we have over the proposed implementation. We believe, based on the technical parameters detailed in the consultation, certain assumptions in the modelling have the potential to significantly affect DTT coverage, which could ultimately disrupt TV viewing to noticeable levels.

On 29 November we sent a letter to Ofcom giving advance notice of some of our concerns on the consultation, and in this submission we expand on those in more detail. At least two errors were identified by the BBC during the review period, and despite Ofcom issuing an Addendum on 24 October explaining one of the errors, the fact that the consultation's conclusion was not altered gives us serious concerns about the adequacy of protection for DTT services from TV white space using the methodology detailed in the consultation.

While we support the exploration of the potential of TV white space as a positive step, we do not believe that this should be to the detriment of existing licensed users. The current coexistence proposals for WSD, even though managed through a database regime, are uncharted territory. We urge Ofcom to act with caution as it assesses the impact TV white spaces may have on the availability and functionality of the terrestrial television platform and its viewers, and continue to support the robust levels of reception that viewers have enjoyed since the very beginning of terrestrial broadcasting, and which form part of the reason why many consumers select DTT as their platform of preference.

We feel it is difficult to comment on issues regarding white space coexistence until we have had the opportunity to consider and be able to respond to the complete end-to-end process for managing TV white space implementation. We would ask Ofcom in the near future to share its view on how the process for identifying and remedying suspected white space interference is managed. We feel this is vital for the industry to understand before being asked to comment on acceptable operating levels.

In particular, in this response we want to take the opportunity to highlight concerns around:

- Proposed levels of DTT coverage

- Proposed levels of DTT reception
- Coexistence parameters; and
- Sustainability

These are detailed below, and our specific answers to the consultation questions follow.

DTT Coverage

- Ofcom is only seeking to protect the headline 98.5% PSB coverage, plus circa 90% commercial multiplex coverage, whereas in reality virtually every household in the UK currently has access to terrestrial television, even if not to the level of reception quality that constitutes an official service; further, the proposal will be removing alternative reception options from those in areas where the prediction model does not accurately reflect viewing choices
- the proposals disregard the fact that coverage (and potential use) of individual multiplexes is much higher than the core coverage where all PSB or COM multiplexes can be received
- the coverage of some transmitters already has a lower than required protection from international interference by way of relaxation, which is not addressed in the model
- the proposal does not allow for the range of DTT transmission modes in use and their differing susceptibility to interference
- some areas of the country fall outside of official 3PSB marginal coverage but Ofcom agreed that a relay would not be provided as part of switchover on the basis that no suitable site was available and households in these areas were already using significantly better than standard receiving installations to receive a service. Ongoing protection of reception in such areas is therefore required but is not addressed in this Consultation

DTT reception

- Ofcom has previously required that changes to the DTT network with the potential to change the pattern of DTT reception across the country be the subject of careful planning and considerable checking to ensure that no adverse consumer impact occurred. For example:
 - 800MHz clearance was designed to minimise the number of households requiring an aerial change, and Ofcom required a comprehensive complaint monitoring and handling process to be put into place to deal with any issues arising
 - Ofcom required a significant amount of analysis and consumer survey work to take place before permitting the commercial multiplex operators to change the FEC mode in use

- the Consultation approach appears to have been influenced by the low level of consumer complaint received so far during the 4G roll-out. However, we are still in the early stages of that roll-out with a sparse 4G network and little or no operation in the most damaging Block A, so full interference numbers are not yet known and parallels should not be drawn. 4G interference to DTT can generally be remedied, the issue being between two licensed and carefully managed and controlled services where mitigation measures can be put in place to protect both. There is no precedent for knowingly permitting interference from a licence-exempt service into a licensed service, which is contrary to the spirit, if not the letter, of the WTAAct. Where interference does occur, it is always on a “polluter pays” basis, which is not presented as the case here
- reception using indoor aerials will not be protected and this is the first use of spectrum that may cause that option to be removed from the significant number of households that have previously used it over many years
- the impact of TV white space on reception for the large number of households using an aerial amplifier, whether individual or communal, has not been considered. This is likely to be an issue given the significant maximum permissible power levels for TV white space
- the list of categories of transmitters that will be subject to consideration in the analysis is incomplete – English regional correction transmitters and alternative transmitters in overlap areas have been omitted
- it is not evident that suitable levels of protection have been identified for the additional HD multiplexes or Local Television
- it is not apparent that account has been taken of the deterioration in DTT reception margins in locations affected by the introduction of 4G networks in the 800MHz band. The impacts of TV white space and 4G interference are cumulative and should not be considered in isolation
- before forming any conclusions, we would ask Ofcom to share its vision of how complaints of interference from TV white space to DTT reception will be collected and managed. A service with the potential to impact on DTT reception should be required to provide adequate levels of consumer support, whether or not it is licence-exempt
- the likely response times to address complaints of loss of DTT reception are unlikely to be sufficiently short to guarantee consumers’ continued enjoyment of a particular programme, which has the potential to cause damage to the reputation of the DTT platform

Coexistence parameters

- we are surprised that the proposed co-existence parameters are significantly different to those discussed at length in the 35 Ofcom Technical Working Group meetings which took place in the 20-month period from September 2011 to April 2013 and that

there is no explanation as to why this is the case. Many of the technical parameters have been changed to the potential detriment of DTT reception and yet this is still represented as a cautious approach

- we do not agree with Ofcom's proposal to treat a prospective licence-exempt service as if it were a licensed service
- we would not represent the approach documented in the Consultation as cautious and urge Ofcom to reconsider its approach

Sustainability

- the future for TV white space is uncertain as licensed use of the DTT spectrum increases and possibly further spectrum is removed from broadcasting use in the future

Although Digital UK does not directly use PMSE services, broadcasting relies on content which can often only be produced with the support of PMSE equipment. We therefore strongly support PMSE use of the spectrum and believe that it should be rigorously protected from White Space Device operation. We note that:

- DTT has successfully shared spectrum with PMSE for many years in a synergistic relationship: DTT provides spectrum to PMSE which in turn facilitates the creation of content for carriage on the DTT (and other) platforms
 - The PMSE/DTT sharing arrangement is licensed; well managed and is significantly more cautious than that proposed for TV white space
 - Localised DTT reception may suffer increased degradation due to displacement of TV white space into fewer channels if a PMSE event reduces the amount of spectrum available for TV white space
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3. Response to Consultation Questions

Question 1: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to DTT services? Please state your reasons for your comments?

We have comments on:

- the assumption that degradation of existing DTT reception, a licensed service, to permit the introduction of TV white space, a licence-exempt service, is both inevitable and acceptable
- expectations about the absolute coverage of the DTT transmitter network
- the lack of protection for reception using internal aerials
- the categories of transmitter for which reception is to be protected
- the assumptions about the typical separation between addresses in rural, suburban and urban areas

We give our comments in the paragraphs below.

Degradation of DTT coverage thresholds

We are **concerned** that the starting point for this Consultation is that degradation of existing DTT reception, a licensed service, to permit the introduction of TV white space, a licence-exempt service, is both inevitable and acceptable. This immediately confers a status onto TV white space which is greatly in excess of that recognised by the generally accepted rules of spectrum management, and we believe the WTAct itself.

We are **concerned** that this proposed change comes on top of the fact that the definition of what constitutes a DTT “service” has been, and continues to be, eroded, with each change seeming insignificant compared to the previous position, but which cumulatively constitute a significant move. Simultaneously, at least until now, it has also been a major concern of both Government and Ofcom that consumers are protected from changes to actual reception quality, sometimes almost regardless of cost to Government or the broadcasters.

The changes in DTT coverage definitions over the years have been a matter of public record, as set out in the following statements and extracts from the relevant documentation:

- the original low power DTT network coverage was determined using a 90% locations coverage threshold – *“all households in areas within which at least 90% of the locations are predicted to be served”*⁴
- by 2005, the coverage threshold had been revised downwards: *“Served and Marginal Coverage: When considering who is covered by a service the planners aim to ensure that householders should be capable of receiving services which*

⁴ ITC Note for Applicants on Coverage for Digital Television, 25th April 2002 – paragraph 8, page 4.

meet internationally agreed standards of picture quality and reliability. When households are predicted to be able to receive a service of this quality they are deemed to be Served. However, it is known that a large number of householders live outside these Served areas but still receive adequate services. This is achieved either by installing higher gain receiving equipment or tolerating a slightly poorer level of quality or reliability. To allow for these households the planners also use a slightly more relaxed coverage criterion. Households within this area are referred to as being in Marginal Coverage.”⁵ While this paragraph referred to analogue television, the coverage criteria were rolled forward into digital and the subsequent analysis of DTT coverage described in paragraphs 4.14 and 4.15 included two further categories, “marginal” and “sub-marginal”, being 70% locations 99% time, and 70% locations 95% time respectively. “Served” and “marginal” were now jointly considered to provide a service, as for analogue television. “Sub-marginal” was also permitted to be considered a service in special circumstances. 96% of households lie within served coverage, and 2.5% in marginal coverage.

- The broadcasters were obliged to commission the construction of additional relay transmitters as part of the Digital Switchover programme to ensure the continuing availability of a terrestrial television service in parts of the country where conversion of the existing transmitter network would not provide an adequate service after switchover, i.e. the 70% location threshold was not met. The new transmitters include those at Bexhill, Clacton, Rouncefall, Skelmersdale and Budleigh Salterton.
- Some areas of the country (e.g. parts of Bridlington and the South and East coasts) fall outside of official 3PSB marginal coverage but Ofcom agreed that a relay would not be provided as part of switchover on the basis that no suitable site was available and households in these areas were already using significantly better than standard receiving installations. Protection of reception in such areas is therefore required but is not addressed in this Consultation.

DTT reception margins are now also being affected by the introduction of 4G networks in the adjacent 800MHz spectrum and it is not clear to us that the TV white space modelling takes account of this pre-existing margin degradation.

The importance of protecting reception

The switchover and subsequent 800MHz clearance programmes have been conducted against a background of Government and Ofcom concern that households should suffer the minimum disruption to their ability to receive a satisfactory terrestrial television service, with those lying outside the “official” coverage area also being considered in this:

- The original Government objective for digital switchover was *“to ensure that everyone who currently receives public service channels in analogue form...can*

⁵ Ofcom Consultation Planning Options for Digital Switchover, 9th February 2005: paragraph 3.4

continue to receive them in digital form...” and that “...whatever route is chosen must not place unreasonable cost on the consumers.”⁶

- In offering the Digital Replacement Licences to Channels 3, 4, 5 and Public Teletext – Ofcom stated that “Ofcom considers that the 2003 Act does oblige it to require that current levels of analogue coverage be met, or substantially met, by the public service broadcasters through DTT transmission as from DSO.”⁷
- In June 2005, Ofcom stated “the figure of 98.5 per cent of UK households is an important benchmark in considering the future coverage of DTT since it represents the current percentage of households with predicted analogue TV coverage today. However, Ofcom is also concerned with the interests of the 1.5 per cent of households (around 375,000 households) who are currently not served by the four analogue public television services. We are currently undertaking further research on these households, considering if and how they are using TV at present and what options will be available to them after switchover. The aim of this work is to seek to ensure that the interests of all UK television households continue to be protected through switchover.”⁸
- In March 2008, Ofcom issued three fact sheets on DTT coverage. Fact sheet 1 states: “Because the model calculates predicted reception only for part of each 100 metre square, a safety factor is used to give added assurance that other locations within the square will be covered. For digital, a safety factor of two times the signal strength is used. This safety factor means that for a square to be considered only just covered the predicted coverage will extend to 70% of locations within the square. For the majority of squares the percentage figure for locations would be much higher.”⁹ [our emphasis].

Paragraph 1.17 notes that the requirements for digital are more stringent than analogue “...because a slightly degraded analogue TV picture may still be watchable, while a degraded digital picture is likely to be unusable.”

Paragraph 1.22 notes “...The coverage predictions are very accurate for most households, because the signal levels for most of the country are sufficiently high that small variations or errors in the modelling are insignificant. For the small percentage of households where predicted signal levels are closer to the minimum, these small variations in the model take on greater significance. In a small number of practical tests for homes in marginal coverage areas it was found that the modelling accurately predicted coverage for approximately 7 out of 10 households in these marginal coverage areas.” This means that for approximately 30% of households the model is not correctly predicting [the best-serving transmitter], rendering these households more susceptible to interference.

⁶ letter from the Secretaries of State for DCMS and DTI to Director General, BBC, dated 6th May 2004

⁷ Ofcom Statement 29th November 2004: Point 47, page 15

⁸ Ofcom Consultation Statement “Planning Options for Digital Switchover” June 2005 S3 page 9

⁹ Ofcom fact sheet on coverage No 1, March 2008, paragraph 1.16

- Ofcom fact sheet 2 on coverage, paragraph 1.14 states *“Conversely, a slightly smaller number of households will move out of predicted coverage as a result of switchover. However, this does not mean that all of these households will be unable to receive DTT services at switchover. We discuss below how this affects different types of household.”*¹⁰

Paragraph 1.15 states *“The vast majority of these households are already in areas which suffer from occasional interference for their analogue services (noted in Table 1 as “marginally served”) but at a level within the range considered acceptable under the analogue planning criteria. This occasional interference may happen only in particular weather conditions. These households might suffer high levels of interference for up to 5% of the year, so they are covered at least 95% of the time. The threshold for DTT coverage is normally set higher at 99% of the time because digital signals are more likely to fail completely in the face of such interference whilst the quality of the analogue pictures, although severely degraded by interference, can often still be watched.”*

Paragraph 1.16 comments *“If the analogue coverage criteria were applied to post switchover digital coverage, Ofcom estimates that a significant majority of those households would then be considered covered. This means that many of these households will continue to be able to receive DTT television signals most of the time. They will, however, experience higher levels of interference than “fully served” households.”*

Paragraph 1.17 states *“This leaves a small number of households that are in locations predicted to be the worst affected, either because they will experience interference for more than 5% of the time, or because they will experience constant levels of interference meaning that DTT reception may be impossible.”*

Paragraphs 1.21 to 1.23 address those outside DTT coverage:

1.21 *“The planning models are predicting that around 1.4% of UK households (around 350,000 households) will not be fully covered by the three public service multiplexes at switchover. The majority of these households (predicted to be around 275,000 or 1.1% of UK households) will still be able to get a signal most of the time (between 95% and 99% of the time) but will experience so called time varying interference for the rest of the time. This figure includes the 220,000 households moving out of predicted coverage discussed above.”*

1.22 *“Ofcom is working to better understand the consumer experience from this type of occasional interference. Preliminary indications are that at 99% time coverage, households may experience disrupted viewing for up to around 10 evenings per year. Households predicted to be in the range 95 to 99% time coverage (1.1% of households, mentioned above) might experience disruption to viewing for between around 10 and 50 evenings per year.”*

Regarding those who are not covered by any services (analogue or digital)

¹⁰ Ofcom fact sheet on coverage No 2, March 2008, paragraphs 1.14 – 1.17

1.23 *“Only 0.3% of UK households (around 75,000 households) are unlikely to receive any usable DTT signal at all. These households are overwhelmingly not covered by the existing analogue terrestrial services and in general already acquire their television services via digital satellite or using a self-help transmitter”.*

- During 800MHz clearance, Ofcom required the Broadcasters to undertake detailed analysis of those households that could be affected by changes to their DTT reception arising from the change in RF channels used for their particular, or a neighbouring, transmitter, and also required that an interference management process be established.
- When Arqiva and SDN requested permission to change the FEC rate of their three multiplexes, Ofcom required extensive theoretical studies and also field work, including customer surveys, to establish whether any adverse change would arise, before granting permission for the change to take place.

It can be seen that Ofcom used the evidence set out in the Fact Sheet on Coverage 2 document to allay concerns that large numbers of households would lose access to a terrestrial television service at switchover. Ofcom clearly expected households to continue to access terrestrial television in areas outside “official” core coverage. By ignoring these relaxed criteria and assurances which formed part of the DSO plan in the proposals for TV white space, Ofcom threatens to remove reception from those it previously strenuously sought to protect.

We note that paragraph 5.18 of this Consultation sets out an unequivocal approach to protection of DTT reception which is not strictly accurate. While it is true that Ofcom has never overtly sought to protect out of area coverage of DTT reception, nevertheless it is a fact that the entire switchover and 800MHz clearance programme was predicated on maintaining reception to existing aerials so far as was reasonably possible. This process took into account any likely out of area viewing and, where there was doubt about the ability to protect reception of a particular transmitter; field survey work took place to establish actual viewing preferences on the ground.

We also note that the introduction of 4G services in the adjacent 800MHz spectrum has eroded DTT reception margins for some households near to the base stations. This erosion has been tacitly accepted as inevitable and yet is not accounted for in any DTT coverage modelling, or in the TV white space proposals.

Given this background of the importance of coverage and the relaxation of coverage targets, we are concerned that Ofcom is entertaining a further reduction in coverage threshold of up to 7% locations to facilitate the introduction of TV white space. The 7% reduction means that, for households currently on the edge of marginal coverage at 70% locations, it would be permissible for TV white space to reduce the coverage to 63% which is officially unserved. The same applies to addresses located in areas with up to 76% location probability. Were such a reduction to happen in any other circumstances, Ofcom would require the construction of a new relay transmitter or other remediation, as can be seen from the actions which took place during switchover and Clearance. Similarly, addresses enjoying anywhere

between 90% and 96% locations served coverage would be moved to marginal coverage. This approach does not appear to be either cautious or reasonable.

Reception using internal aerials

While reception of DTT using internal aerials has never been given any formal status, nevertheless it is not a secret that it is widespread and a valued advantage of DTT compared to cable or satellite. This was recognised in the original switchover Cost Benefit Analysis (CBA) and has been a matter of periodic research throughout DTT's existence:

- The 2005 Government CBA of switchover allowed for set-top reception, both in terms of the costs and the benefits:

“12. The CBA model takes account of other reception based costs. An allowance is made for those homes predicted to have to use digital satellite at switchover. The CBA also includes an allowance for aerial upgrades. From estimates provided from by Ofcom (previously the ITC), the CBA assumes that 10% of non-voluntary households would need to replace their roof-top aerial. The cost of replacement was assumed to be £150. This figure was used as a proxy for costs for communal systems (generally higher than individual roof-top aerials) and for set top aerials (typically 10-15% of that cost)

19. The main consumer benefits are to consumers who are currently not served by DTT and who are unable to access the BBC's digital services via terrestrial networks. There is also a benefit for people who currently live in marginal reception areas or who are unable to have set-top aerial reception, who will gain from improved reception due to transmission power increases”
- Ofcom's own research in 2009¹¹ showed high consumer expectations for set-top aerial reception: *“Extensive indoor (set top) aerial use was reported by participants across the three focus groups. They were perceived as a cheaper alternative to roof or loft aerials, and an opportunity to test at low cost the signal they received. Participants' expectations of set top aerials were relatively high. Some possibly over-estimated set top aerial performance and considered new models to be much improved on more dated set top aerials.”*

“Use of indoor aerials was commonly reported. In fact some participants viewed indoor aerials as a first-stop solution to reception problems – to test or try out terrestrial reception with a low-cost solution.”
- Early and recent studies indicate that approximately one quarter of DTT receivers rely on internal aerials.^{12 13} We therefore believe that set-top and loft aerial reception should be duly considered and afforded a reasonable level of protection. Our 2012 Technical Note is attached as Annex A, for ease of reference.

¹¹ Aegis/i2media research: Domestic TV Aerial Performance 2106/HAC/3.0 14th December 2009, pages 40 and 58

¹² ITC Household Technology Survey 2003 – Digital Television Project TEG03(09)

¹³ DUK Technical Note: Set-top and Loft Aerial Usage, 26th April 2012

We note that paragraph 5.15 of this Consultation attempts to offer some comfort about set-top reception by stating that the Ofcom proposals will forbid WSD operation in channels that are in use by DTT in any given area. This statement is, in fact, incorrect, as paragraph 4.23 of the technical report explicitly states that “...we propose to allow WSDs to operate co-channel with DTT within the coverage area of a DTT transmitter subject to stringent WSD emission limits...”. We are therefore **concerned** that this means that the indirect protection to set-top and loft aerial reception envisaged by paragraph 5.15 will not, in fact, occur with the proposed protection criteria.

We **support** the statement in paragraph 5.11 that the coexistence proposals should maintain the current level of DTT coverage. We believe this should apply to households both within and outside the “official” coverage of DTT and should maintain alternative reception options where these are demonstrably and/or reasonably in use, including the use of internal antennas.

Reception by systems incorporating an aerial amplifier

We are **concerned** that the TV white space proposals do not consider the impact of relatively high power devices operating in close proximity to DTT receiving systems which incorporate an aerial amplifier, whether these are part of a communal aerial system or a domestic installation. The 4G co-existence work has shown that the overloading of aerial amplifiers is a major factor and we believe that Ofcom should evaluate and allow for the impact of TV white space on amplified systems.

DPSA layers to be protected

We believe that paragraph 5.21 of this Consultation omits two important categories of alternative transmitter use which must be recognised and protected:

- English regional transmitters
 - A small number of 3-multiplex transmitters have been constructed solely to provide the correct English regional services to households otherwise served by an out-of-region six multiplex transmitter. In some examples a second receiving antenna is required; in others both are received by the same antenna. It is expected that households will wish to access signals from both transmitters and so reception of these transmitters needs to be protected in addition to the six-multiplex transmitter. The English regional transmitters include the three north Norfolk relays (Kings Lynn, Wells-next-the-Sea and West Runton), and Derby.
- Alternative transmitters in areas where there is no single dominant source of signal
 - In some areas there is no single dominant source of DTT signal but there are two transmitters of similar, but not notably good, reception quality. In these areas, households will have opted to receive one or the other transmitter based on a complex combination of history, regional preference and local reception conditions. In these areas, reception of

both (or all three) transmitters should be protected to avoid significant levels of viewer disruption and in extreme cases, total loss of service.

The former Joint Planning Project (JPP), now the DTT Frequency Planning Board, has developed the concept of the Digital Protected Service Area (DPSA) specifically to predict likely transmitter usage and we believe the entire family of DPSA layers are a suitable tool which should be used in assessing which transmitters should be afforded protection in any particular area.

Nearest Neighbour

We are **concerned** that Ofcom has concluded that minimum separation distances of 10m and 20m should be assumed for addresses in suburban and rural clutter areas respectively. We believe there is no basis for this assumption and our own studies have confirmed that the CDF distributions and the most frequent nearest-neighbour distances are virtually independent of clutter type. We believe that the Ofcom proposals will not provide adequate protection to the majority of suburban and rural households affected by calculations which are a function of the minimum separation distance. We believe that the distance of 5m, proposed for urban areas, should be applied in all cases. A summary of our findings is set out in the response to Question T5 below, and a supporting report is attached.

Comparisons with 4G interference

Paragraph 5.29 - we believe that it is much too early to determine the likely level of harmful interference arising from the introduction of 4G. The 4G networks are in the early stages of roll-out, primarily in areas of good DTT reception, and there are currently few, if any, Block A transmissions in operation. We further note that the prediction model was designed to assess the number of households that potentially would have the quality of their DTT reception degraded; not how many households would immediately lose DTT reception and call to complain. Additionally, the causes and mitigations for 4G interference differ from those for TV white space, which operate in the same spectrum as DTT transmissions, rather than in adjacent spectrum.

Question 2: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to PMSE services? Please state your reasons for your comments.

Digital UK **fully supports** the need to protect PMSE services, which are extensively used by our Shareholders and which form a vital element in the production of content for transmission on the DTT platform, but we do not offer a specific view on the Ofcom approach.

Question 3: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to 4G services above the UHF TV band? Please state your reasons for your comments.

Paragraph 7.3 – we **find it surprising** that Ofcom should be so concerned about protecting licensed 4G and licence-exempt TV white space from interfering with each other to the extent of requiring an 8MHz guard band, but the criteria for protecting licensed DTT services

from suffering interference appear to be far less stringent. This does not appear to be equitable regulation.

Question 4: Do you have any comments on our proposed approach to ensuring a low probability of harmful interference to services below the UHF TV band? Please state your reasons for your comments.

We **acknowledge** the need to protect the important services using the spectrum immediately below channel 21, but do not offer a view on Ofcom’s proposals.

Question T1: Do you have any comments on our proposal to cap the maximum in-block EIRP of all WSDs at 36 dBm/(8 MHz)?

We **recognise** that the demands of international standardisation are driving the need to align the permissible technology across jurisdictions. However we observe that the DTT protection framework in the United States is completely different to that proposed in this consultation, so citing the FCC limits in setting a UK emission limit of 36dBm/(8 MHz) is not necessarily appropriate since there are other factors to be considered as well.

We **note** that many licensed DTT and self-help transmitters, over which there is a significant degree of control, operate at powers as low as 30dBm/(8 MHz) so we are concerned that the proposed limit for licence-exempt devices over which there is virtually no control is some 6dB higher.

We also **note** that other licence-exempt technologies using dedicated, rather than shared, spectrum have much lower power limits. Some examples are shown in Table 1.

Application	Maximum power	Equivalent in dBm
GSM handset	2W	33dBm
Non-specific Short-Range Device 869.4MHz	500mW	27dBm
LTE (4G) handset	250mW	24dBm
UMTS (3G) handset	125mW	21dBm
WiFi router (EN 300 328)	100mW	20dBm
Wireless microphone (body-worn)	50mW	17dBm
Wireless microphone (hand-held)	10mW	10dBm

Table 1

We **believe** that operation at powers of up to 36dBm/(8 MHz) both indoors and outdoors poses a significant risk of DTT receiver or aerial amplifier overload, and also disruption to reception in the significant number of households using internal aerials. We therefore

suggest that a limit of not more than 30dBm/(8 MHz) would be more appropriate for TV white space.

Question T2: Do you have any comments on our proposed approach for calculating WSD emission limits, as expressed in Equation (4.3), in relation to DTT coexistence calculations?

We are **content** with Ofcom's approach as described.

Question T3: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of DTT receivers in relation to DTT calculations?

We **agree** that the WSD-DTT geometries should take into account the inherent uncertainties in the locations of DTT receivers. We note that the number of households lying within each 100m × 100m pixel is known to a good degree of accuracy and that it is both reasonable and feasible for a DTT receiving antenna to be located at any position within a pixel with a non-zero household count. It is also possible, though rare, for a DTT receiving antenna to be located remote from an address in an otherwise uninhabited pixel e.g. for the purposes of receiving a signal in areas where the terrain precludes good DTT coverage.

Same and first-tier pixel geometries

We **agree** with the use of a reference coupling gain for each of the same-pixel and first-tier pixel geometries, but we do not agree with using the average coupling gain across the combined area of the same and first-tier pixels. This is likely to underestimate the coupling gain in a significant number of cases and cannot therefore be considered to be a cautious approach. We believe that the same and first-tier pixel coupling gains should be calculated separately.

Second-tier pixel geometries

We **agree** with the principle of using angular discrimination as part of determining the coupling gain but believe that the method described needs **modification** in two ways:

- 1) The pure angular geometries should not be based on three pixel-centre to pixel-centre calculations, but should consider all 16 pixel-corner to pixel-centre angles as originally proposed in the Technical Working Group. The currently proposed approach may underestimate the coupling gain in a significant number of cases and cannot therefore be considered to be a cautious approach.
- 2) The use of horizontal orientation of the DTT receiving antennas based on the DTT network plan introduces a degree of assumption about household viewing choices which needs to factor in the possibility of more than one transmitter being used in a single pixel. This is already entertained by the family of Digital Protected Service Areas envisaged in Q1 and hence is not an additional requirement. The reference geometries therefore need to assess each transmitter DPSA for a pixel and use the most restrictive coupling gain in the calculation.

Larger separation geometries

We **agree** with the use of modelled path loss for calculating coupling loss for pixel separation distances greater than two.

Question T4: Do you have any comments on our proposed target 1 dB rise in the noise-plus-interference floor at the edge of DTT coverage, and our approach for allowing greater rise in the noise plus interference floor in areas inside DTT coverage?

Our response to this question is primarily addressed in our response to Question 1, above, but in summary:

- We **do not agree** that a 1dB target reduction in signal-to-noise-plus-interference ratio (SINR) at the edge of DTT coverage (equivalent to a reduction of 7% in location probability) is a cautious approach.
- We **do not agree** that a fixed reduction in location probability at all locations is a cautious approach.
- We **do not agree** that an exceedance probability of 30% is a cautious approach.
- We **do not agree** that a co-channel protection ratio of 17dB is a cautious approach.

Question T5: Do you have any comments on our proposed approach for calculating coupling gains in relation to DTT calculations, including the use of 70th percentile coupling gain values for same pixel, tier 1 pixel and tier 2 pixel scenarios, and the use of median coupling gains for tier 3 pixel (and beyond) scenarios?

WSD height

We **do not agree** that, where the height of a WSD is reported, the White Space database should select the nearest height. We believe that the next highest standard height should be used, i.e. the WSD device height should always be “snapped” upwards and never downwards.

Same and first-tier pixel geometries

We **agree** that the use of nearest neighbour statistics is a useful tool in determining appropriate coupling gains, but we **do not agree** with the conclusions about its use reached by Ofcom, as we explain below.

The nearest-neighbour statistics data was provided by Digital UK to Ofcom’s Technical Working Group, and an earlier version of the data (reaching the same conclusions) was incorporated into CEPT ECC report 186 “Technical and operational requirements for the operation of TV white space under geo-location approach”, approved in January 2013 and supported by Ofcom. The later Digital UK analysis¹⁴ covered 36 UK post areas with a range

¹⁴ Digital UK Technical Note: UK Address Separation Distances, 23rd March 2012

of geographies, representing 7,546,955 addresses. It showed that, except for the very remote rural areas covered by the HS, ZE, and to a lesser extent, IV post areas, the typical Ordnance Survey address separation distance across the UK is 6m. The report noted that this will often tend to be an over-estimate because the address position used by the Ordnance Survey is located somewhere within the dwelling, and in many cases addresses in the sample areas are terraced or semi-detached which means that parts of the adjacent dwellings are much closer to each other than 6m. The analysis also shows that, except in the sparsely populated remote rural areas, at least 60% of addresses have the nearest neighbour within 10m, and over 80% of addresses are within 20m of their nearest neighbour.

We **do not agree** that the smaller separation distances can be completely ignored when considering nearest-neighbour data. Separations of less than 2 metres were excluded from the Digital UK analysis because the way in which Ordnance Survey treats co-located addresses where the separation is vertical rather than horizontal (flats over shops; blocks of flats etc.) would have resulted in a large number of addresses with zero separation which would have skewed the results, but clearly such separation distances do exist and, had they been included, the proportion of addresses with neighbours nearer than 6m would have been even higher. Note that the majority of addresses within the UK (circa 77%) share at least one boundary with a neighbouring property, being a flat, terrace or semi-detached (Census England/Wales 2001) so it is entirely plausible that a WSD could be located within 2m of a neighbouring address. This is clearly the case for terraces and semi-detached houses where a Type A White Space Device and television aerial could be attached to the same chimney stack or parapet wall.

We **do not agree** that the Digital UK nearest neighbour analysis supports the Ofcom conclusion that minimum values of 5m, 10m and 20m are more representative of nearest neighbour line-of-sight WSD-DTT antenna separations in urban, suburban and rural environments. We are disappointed that Ofcom has elected to cite the nearest-neighbour analysis data and then to ignore it when reaching a conclusion, particularly when there is no explanation as to how the conclusion was reached. Approximately 60% of suburban addresses and 80% of rural addresses (taking the UK average CDF) have nearest neighbours closer than the Ofcom values, meaning that the majority of addresses in these areas would not be adequately protected from TV white space.

We **note** that Ofcom is proposing the use of 50m Land Cover 2007 clutter data for performing the calculations for the White Space Device pilot. Digital UK does not have access to the clutter data at this level, but we are able to access the Land Cover Map 2007 dataset at the 1km grid level. This dataset is a parcel-based classification of UK land cover which explicitly includes urban and suburban classifications, and hence implicitly rural classifications. We have undertaken a further nearest-neighbour analysis using this data in one post area, a 100km x 50km National Grid tile and also in a typical sparsely populated rural area to determine whether our original results would have been affected if clutter were taken into account. This new analysis shows that the typical nearest-neighbour distance is 6m in all clutter types and housing densities, the same as that calculated in the original report and that the majority of addresses in suburban and rural areas have nearest neighbours at or closer than the proposed Ofcom values. This means that the Ofcom reference geometry proposals that include an assumed value for the nearest-neighbour

distances will not provide adequate protection for the majority of addresses located in these areas.

We **believe** that all the nearest-neighbour analysis data supports the conclusion that 5m would be a suitable reference geometry assumed separation distance regardless of the clutter environment. We have reattached the original Digital UK report in Annex B, and our new study as Annex C, for ease of reference.

Second-tier pixel geometries

Our comments in relation to geometries, as discussed in our response to Question T3, also apply here.

Larger separation geometries

We have no specific comments on the proposal.

Type B devices

We **do not agree** that it is a safe assumption that a Type B device reporting a height in excess of 2 metres is located indoors, particularly given the limited reliability of GPS reception within buildings. Such a device could equally well be located outside on an upper floor balcony, a roof-terrace, in a multi-storey car-park, on scaffolding, in a crane cab or on the deck of a large boat or ship, to cite a few other possibilities. For a cautious approach, we believe the calculation should be on the basis of the device being located outdoors.

Question T6: Do you have any comments on our proposed protection ratios in relation to DTT calculations, including the use of 17 dB for co-channel protection ratio, and 70th percentile values for adjacent channel protection ratios?

We are **concerned** that the Protection Ratio measurements were made using a single type of White Space and using a relatively benign waveform. Additionally, we are **concerned** that the tests included an element of subjectivity which introduces unquantifiable human factors which reduce the reliability and repeatability of the results. We note that Ofcom recognises some of these limitations.

We **welcome** Ofcom's desire to see further tests conducted using a range of White Space technologies, and would encourage Ofcom to require that such tests are undertaken in an automated way which maximises the reliability and repeatability of the results.

Question T7: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of WSDs in relation to DTT calculations?

We **generally support** Ofcom's approach as described.

Question T8: Do you have any comments on our proposed approach for calculating WSD emission limits, as expressed in Equation (5.2), in relation to PMSE coexistence calculations? TV white spaces: approach to coexistence.

We do not offer a view.

Question T9: Do you have any comments on the PMSE wanted signal power levels that we propose in relation to coexistence calculations?

We do not offer a view.

Question T10: Do you have any comments on our proposed approach for calculating coupling gains in relation to PMSE calculations?

We do not offer a view.

Question T11: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of WSDs in relation to PMSE calculations?

We do not offer a view.

Question T12: Do you have any comments on our proposed approach for dealing with the uncertainty in the locations of PMSE receivers in relation to PMSE calculations?

We do not offer a view.

Question T13: Do you have any comments on our proposed approach for the derivation of WSD-PMSE coupling gains for non-geolocated slaves in relation to PMSE calculations?

We do not offer a view.

Question T14: Do you have any comments on our proposed protection ratios in relation to PMSE calculations?

We do not offer a view.

Question T15: Do you have any comments on our assessment that a margin for uncertainties in radio propagation is not necessary given the proposed parameters for derivation of coupling gains in relation to PMSE coexistence calculations?

We do not offer a view.

Question T16: Do you have any comments on our proposed WSD emission limits in relation to PMSE use in channel 38?

We do not offer a view.

Question T17: Do you have any comments on our proposal not to permit WSDs to operate in channel 60?

We do not offer a view.

Question T18: Do you have any comments on our proposal that, if the unwanted emissions limit (over 230-470 MHz) in the draft ETSI standard (EN 301 598) is tightened by 8 dB, there should be no further restrictions on the operation of WSDs in relation to services below the UHF TV band?

We do not offer a view.

Question T19: Do you have any comments on our proposal that, if unwanted emissions limit (over 230-470 MHz) in the draft ETSI standard (EN 301 598) is not changed, there should be restrictions on the in-block powers of WSDs in channels 21 to 23?

We do not offer a view.

Annex A

Digital UK Technical Note: Set-top and Loft Aerial Usage, 26th April 2012



indoor_aerial_update_20120426.pdf

Annex B

Digital UK Technical Note: UK Address Separation Distances, 23rd March 2012



uk_address_separation_20120323a.pdf

Annex C

Digital UK Technical Note: Address Separation and Clutter Category, 6th December 2013



address_separation_by_clutter_type_20131206a.pdf