Vodafone Response to Ofcom Consultation:

Consultation on future use of the 700 MHz band -

Cost-benefit analysis of changing its use to mobile services

SUMMARY

Vodafone welcomes the opportunity to comment on Ofcom's consultation on changing the usage of the 700MHz band to mobile.

We agree with the conclusions reached, although consider that Ofcom's analysis has overstated the costs and understated the benefits to the UK economy. Vodafone believes that given the unstoppable impetus internationally to change the usage of the 700MHz band, a better approach would have been to determine what circumstances could justify the UK *not* aligning with other countries.

Accepting the approach adopted in the consultation, i.e. to compare the costs of transition with the benefits, Vodafone believes that Ofcom has erred in using the *status quo* as the counterfactual. We consider that with the introduction of Administered Incentive Pricing (AIP) for Digital Terrestrial Television (DTT) usage of spectrum, a more likely scenario in 2020 absent vacating 700MHz is that the television industry would be fundamentally reconsidering whether all of the current channels delivered on DTT need to continue to be so delivered. In this response, we illustrate how the costs of AIP would mean that carriage of some channels currently using DTT will be uneconomic – although this does not mean that such channels cannot be delivered using alternative delivery methods. This would mean that many of the costs identified by Ofcom as associated with 700MHz migration would have been incurred in any case.

Vodafone believes the benefits of usage of 700MHz for mobile have been underestimated, because the approach assumes that absent the additional spectrum, mobile network operators will fulfil forecast demand by rolling out additional mast sites. We do not consider that this will be the case, (a) because economic externalities mean the benefit of serving the demand do not flow to the network operators but instead to third parties in the mobile ecosystem and (b) even if the mobile operators could make a business case to roll out the additional masts, in many cases it won't be physically possible. As such, absent 700MHz some of the demand would be unfulfilled, so the benefit of making 700MHz available is the network saving where operators would have rolled out, and avoiding the cost to the UK economy of unfulfilled demand where they would not.

Notwithstanding the above comments, Vodafone notes that Ofcom's analysis still proves a positive case for transitioning 700MHz to mobile usage in all but the most extreme scenarios. We welcome and agree with this conclusion.

APPROACH TO ASSESSING THE ECONOMIC CASE FOR CHANGING THE USE OF THE 700MHZ BAND

The cost-benefit analysis conducted by Ofcom demonstrates that there is a positive business case to transition the usage of the 700MHz band from DTT to mobile broadband. However, Vodafone fully expects that some stakeholders may seek to query the figures in Ofcom's analysis, and weaken the business case by chipping away at individual elements. Ofcom should be robust in rejecting speculative or over-baked assertions on the cost of transition, and recognise that beyond all reasonable doubt the migration to mobile broadband represents the most efficient usage of spectrum.

Vodafone considers that while the approach adopted by Ofcom in proving the case is rational, an opportunity was missed to demonstrate a more compelling business case in a far simpler manner. International harmonisation means that the 700MHz band will be used for mobile in the majority if not all countries, indeed the band plan developed by CEPT is intended to ease the task of handset manufacturers in developing products suitable for multiple markets. For example:

- Australia and New Zealand have already made 700MHz spectrum available
- Governments in Finland and Sweden have announced plans to release the spectrum by 2017
- The French President's office was reported to announce that the band would be auctioned, potentially by 2016
- Germany is understood to be making preparations for auction in spring 2015
- The Ministry of Economics in the Netherlands began a consultation in July 2014

Against this backdrop, if the UK is not to be isolated, the question that should be under consideration is whether there is any compelling reason why the 700MHz band should not be transitioned from DTT to mobile usage. Framed this way, it can be quickly established that the only combination of events that could support the UK not following our European neighbours is if both growth in mobile broadband stalled so that the 800MHz band was sufficient, and television viewing habits meant that there was sufficient demand for channels[1] to require more than six multiplexes even after the introduction of Administered Incentive Pricing (AIP) fees for broadcast spectrum. Vodafone considers that the possibility of both these conditions being met is vanishingly small, and therefore the case to change the usage of the spectrum is compelling.

[1] With owners willing to pay their proportion of the relevant Administered Incentive Pricing spectrum price post 2020.

Notwithstanding this, Vodafone accepts that the methodology adopted by Ofcom is valid and provides a broad brush answer to quantifying the benefit of the exercise. As set out in our response to the questions below, we consider the approach to assessing the benefits is reasonable, but represents the absolute lowest level of benefit that can be anticipated. We can foresee realistic scenarios where the benefit is substantially higher. On the costs, Vodafone considers that Ofcom has been extremely cautious in its choice of effectively today's *status quo* as its counterfactual, and a more realistic counterfactual would incorporate the likely behaviour of broadcasters when they become subject to AIP. We also believe that some of the costs incorporated are probable rather than certain, hence should have been subject to a modifier to reflect this uncertainty. We explore these themes in our responses to the individual questions raised by Ofcom.

THE FUTURE OF DIGITAL TERRESTRIAL TELEVISION

Vodafone welcomes Ofcom's associated analysis on the future of television in the UK which accompanied this consultation. We consider the key requirement for the future of television is that UK citizen consumers are able to consume the content they desire, rather than public policy supporting one delivery mechanism over another. We disagree with statements such as needing to determine "how TV platforms might need to develop in the future in order to remain competitive"[2], because there is no specific need for *platform* competition in itself, rather a need for viewers to gain access to content in a manner in which bottleneck providers cannot exploit their position. In this context, we believe:

- Such bottleneck providers are unlikely to emerge when the TV marketplace is considered as a whole. The most extreme example would be the hypothetical case of there being no DTT platform. Even in this case neither Virgin nor Sky could exert market power as they could mutually constrain one another's behaviour in a scenario where consumption of TV via IP continues to become increasingly main stream, and Freesat would also become a far more viable proposition and competitive constraint. If the most extreme example shows there is little scope of bottleneck providers emerging, then more probable outcomes will present even less danger.

- DTT will remain a key delivery mechanism for some channels for the foreseeable future, but in the longer term although DTT has an important role to play, it should not be assumed that the current number of channels must be supported by that delivery mechanism. In Vodafone's critique of the Communication Chambers analysis of the value of DTT, annexed to this response, we highlight that relatively few channels receive significant DTT viewing figures: this is backed up by Ofcom's own analysis which shows

[2] Section 1 of "The Future of Free to View TV: a discussion document"

that the main five PSB and their portfolio channels make up over 70% of television viewing[3]. Clearly, at least some of the remaining channels could migrate to other delivery mechanisms without damaging the Freeview brand.

- The economic cost of using spectrum should be a factor in the choice of delivery mechanism: where spectrum has not been subject to commercial auction, this means that application of AIP is necessary. With ongoing technical advances, it may make sense for minority channels to migrate from DTT delivery to other mechanisms. In particular, we share Ofcom's optimism that hybrid DTT/IPTV platforms present a promising opportunity: correctly designed, the viewer will neither know nor care whether the technical implementation means content is being delivered to them via broadcast spectrum or IP.

- While sympathising with a desire for greater HD viewing and even 4K, it should not be presumed that broadcast DTT spectrum must be provided to support this. In of themselves, public policy goals should not mandate a particular resolution of television viewing; this is a matter for the market. If it is possible to support a particular viewing resolution economically within a given bandwidth of spectrum subject to AIP, then if there is demand this should occur. However, if this is not achievable because for example the AIP fees cannot be supported by the viewership being willing to pay, then ultimately greater choice of high definition channels is a premium service rather than basic right, and viewers wishing to obtain this largely have the opportunity to do so via alternative mechanisms such as cable and satellite.

- Further research is needed to ascertain the juxtaposition of various "have not" households. For example, in Figure 5.3 it is identified that *"more work [is] needed to understand the overlap between those unable to receive satellite signals and those unable to receive broadband*". Only with this knowledge can a clear picture emerge of whether a DTT platform is actually an ongoing long term requirement and how many channels would be required. Vodafone reminds Ofcom that mobile technology is able to support delivery of video streams, so the 98% of households subject to 4G rollout obligations should also be overlaid, to determine just how many households truly fall in the absolute "notspot" of being unable to receive satellite TV, having poor fixed broadband performance and no access to 4G services. It's also worthy of note that a key driver for 700MHz deployment in Germany is to provide superfast broadband via mobile.

[3] Ofcom Communications Market Report 2014, Section 2.3, http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr14/UK_2.pdf

Vodafone is satisfied that the analysis regarding the future of television is sufficient to allow the cost-benefit analysis for 700MHz spectrum release to be concluded. However, the issues raised in the document represent significant talking points for Government, Ofcom and the television and telecommunications industries to explore when considering spectrum requirements post-2020. We also welcome consideration by the Ofcom Spectrum Advisory Board (OSAB) of whether the model of high power high tower DTT transmission is appropriate in the long term.

ANSWERS TO QUESTIONS

Question 1: Do you have any comments on Analysys Mason's approach to quantifying the network cost savings and performance benefits?

Mobile data growth is reality

With tablet sales outstripping laptop sales by the end of 2013[4] and UK mobile retail e-commerce sales forecast to be some £8Bn[5], the transition to a mobile economy is real. Vodafone agrees with Ofcom's assessment that additional spectrum will be required to meet the expected growth in demand for data, wherever and whenever the consumer may want it.

The cost savings identified by Analysys Mason are predicated on demand for mobile data being sufficient that networks based solely upon 800MHz will become supply constrained (whether from a capacity or speed perspective). As there are multiple competing forecast models, it is inevitable that some stakeholders will seek to question this assumption and assert that demand may level off before the capacity of existing networks is reached. We would note, however, that in all but the most pessimistic of industry forecasts, demand will outstrip supply in the medium term. For example, Real Wireless[6] considered three cases for low, medium and high demand, and even the lowest of these estimates exceeds capacity in the 2015-2020 timeframe[7]. Cisco[8] continues to forecast 50% compound annual growth in the period to 2018, with little sign of a levelling off of demand during this period. Vodafone is cautious of extrapolating demand growth figures, particularly as we are at an inflection point as 4G is deployed. However, we would note that in the last 12 months data traffic on our network has grown by [✂] and with owners of 4G devices consuming [✂] times as much data as those with other devices; we expect this trend to

[4] "Tablet Shipments Forecast to Top Total PC Shipments in the Fourth Quarter of 2013 and Annually by 2015, according to IDC", http://www.idc.com/getdoc.jsp?containerId=prUS24314413

[5] "Tablets to Account for Over 10% of UK Retail Ecommerce Sales", http://www.emarketer.com/Article/Tablets-Account-Over-10-of-UK-Retail-Ecommerce-Sales/1010421#3XBvHwZks6RTRyl0.99

[6] Study on the future UK spectrum demand for terrestrial mobile broadband applications; produced by Real Wireless on behalf of Ofcom; Version 3.1, April 2014,Figure 1 http://stakeholders.ofcom.org.uk/binaries/consultations/cfi-mobile-bb/annexes/RW_report.pdf

[7] Low demand scenario indicated 1,080MHz of dedicated spectrum needed by 2020. There is currently around 600MHz of capacity licensed for mobile access usage, with another 190MHz due to be auctioned next year.

[8] Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013–2018 published February 2014, Table 6, http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white_paper_c11-520862.html

continue into the future and although growth will level-off at some point in time, we believe this will be beyond the level where usage of 700MHz is needed. Vodafone is experiencing similar growth levels in other European markets.

Quantification of the benefits is conservative

While acknowledging the approach to quantifying benefits, Vodafone considers that the Analysys Mason approach represents the floor of these potential benefits in transitioning the 700MHz band to mobile usage.

One outcome of 700MHz not being available for mobile usage would be that mobile operators would be forced to implement successively smaller cells in order to achieve the data rates demanded in Table 2 of the consultation: it is this result which has been modelled by Analysys Mason. However, an alternative outcome is that given the significant expenditure involved in this rollout, mobile operators would instead conclude that an insufficient return could be made on the investment to deploy additional cells, hence supply would be capped and demand left unfulfilled[9].

This is particularly the case if economic externalities apply, i.e. the surplus created by the consumer benefit of increased data throughput does not accrue to the mobile operator, but instead to third parties such as application providers or advertisers. In a DCMS study[10], Analysys Mason concluded that as much as 80% of the value of mobile services is consumer surplus rather than accruing to mobile operators. Vodafone agrees that externalities do indeed exist in the mobile data markets, but it is difficult to draw conclusions about the degree to which revenues/surplus are diverted so as to deter network investment. A likely scenario absent availability of 700MHz is that extra cells would be deployed in some locations, but would not be so in more marginal locations because the business case would not make sense narrowly for network operators, even though it would when taken holistically for the mobile ecosystem and UK economy.

If the required masts to satisfy demand were not capable of being economically deployed by network operators and instead services were capacity-constrained, then rather than the benefit of mobile 700MHz usage being avoidance of mast deployment costs, instead it would be the avoidance of cost to the economy of having a throttled mobile data capability, particularly when compared to competitor nations: this would be a much higher figure, indeed if Analysys Mason's study of the mobile market is accepted, a figure four times as high. Although we recognise that

[9] This is alluded to in para 4.45, but only in the context of the *performance* benefits of 700MHz usage over and above what would be achieved via additional cell rollout.

[10] Impact of radio spectrum on the UK economy and factors influencing future spectrum demand 5 November 2012, https://www.gov.uk/government/publications/impact-of-radio-spectrum-on-the-uk-economy-and-factors-influencing-future-spectrum-demand

Ofcom has a duty of prudence in constructing cost-benefit models, this point should have been drawn out in the analysis and thus the benefit figure will almost certainly be an underestimate.

The calculated cost of a counterfactual network rollout is understated

Making high-level estimates of the cost of a theoretical network rollout, some way in the future, is bound to be fraught with difficulty. Nevertheless, we believe that the approach adopted by Analysys Mason – calculating the incremental number of mast sites and using an average cost per site – is reasonable. Inevitably this leads to a wide range of benefits according to the assumptions used, but taking the "central range" estimate is sensible. Vodafone considers the benefit is likely understated, because:

1. Successively smaller cell sites are likely to be connected via point-to-point radio, rather than using wired backhaul solutions. Such point-to-point radio consumes spectrum, which in itself has an opportunity cost. This is particularly the case as we look to the longer term, where 5G technologies needed to meet the demands identified by Ofcom will make further demands for access spectrum, constraining the spectrum available for backhaul purposes. We do not believe that these spectrum opportunity costs are built into the model.
2. The additional sites required could not be produced from thin air. Mobile operators face increasing problems in securing suitable mast sites, and negotiating equitable arrangements with landlords. [✂]. Absent 700MHz availability, if the spectrum crunch became more publicised, issues of site access at reasonable pricing would be exacerbated and hence it is also likely that the per-site costs would increase.
3. Analysys Mason uses various assumptions of spectrum availability in carrying out their study, as depicted in Figure 3.12 and 3.13. We note that in the scenario adopted, it is assumed that the 3.6-3.8GHz band would be available for mobile use in 2018. We do not share this optimism, as this band is already licensed to UKBroadband. It is unclear what the effect of removal of this band would be to the value of sub-1GHz spectrum, but Analysys Mason should be asked to clarify this.

On the whole, however, we agree with the main thrust of Analysys Mason study's conclusions.

Question 2: Do you have any comments on the other benefits we have identified including the likely magnitude or how they may be quantified?

Lower service and equipment costs will result

Vodafone agrees with the nature of the additional benefits identified by Ofcom. Of course, any identified benefit of lower consumer prices needs to be seen as relative to the higher levels that may exist in the counterfactual, i.e. where there is no additional spectrum made available by Ofcom.

The benefits aren't restricted to customers experiencing lower relative pricing than would otherwise have been the case: such benefits may also take the form of larger data consumption. Also some customers who would not otherwise have afforded a mobile data package will be able to do so if the price is lower. It therefore follows that the benefit to the economy is higher than the simple price reduction, because inherently customers will gain greater utility than the price differential[11]. Vodafone acknowledges that these additional benefits are difficult to quantify (and in some cases would represent a double-count with the benefit of network cost savings), so consider that Ofcom are probably correct to exclude them in the interests of prudence, so long as the final outcome of the cost-benefit analysis is explicit that some unquantifiable benefits have been excluded.

We also agree that the prospect of globally harmonised frequency bands will reduce equipment manufacturer costs, which all things equal should result in lower handset costs.

Centre-gap and Guardband Benefits will be accrued

As Ofcom notes, the centre gap of the 700MHz bandplan – and also the spectrum between 694MHz and 703MHz – could be used for other purposes, and this use will bring benefits. In addition to PMSE and SDL, other possible applications include machine-to-machine communications and public safety, or a combination of these. As with the benefit of lower consumer prices, a conservative cost-benefit analysis could omit this value and acknowledge unquantified benefits. However, some attempt to quantify the benefit would have been worthwhile.

Question 3: Do you agree with our assessment of the likely benefits of changing use of the 700 MHz band?

Subject to the caveats outlined in the responses to Questions 1 and 2, Vodafone agrees.

[11] Basic economic theory dictates that a customer must yield at least as much (perceived) utility as the price they pay for a given service, but in general they must achieve more otherwise they'd be ambivalent to the purchase.

Question 4: Do you have any comments on our analysis of the implications change of use of the 700 MHz band would have for the DTT platform?

Vodafone agrees that although migration to DVB-T2 is potentially an efficient approach from a technology evolution standpoint, the costs of implementing this simultaneously with the band release should be ruled out of scope for the purposes of assessing the business case for repurposing 700MHz to mobile broadband. DVB-T2 technology evolution is not necessary to achieve the 700MHz clearance while maintaining the existing (permanent) channel count, so simultaneous migration must be out of scope.

With this in mind, we agree that the end-point in the cost benefit analysis for the repurposing of 700MHz is a DTT ecosystem supporting up to six multiplexes in the 470-694MHz range. However, we question the assumption that the *status quo* – i.e. eight multiplexes spanning 470-788MHz – should be treated as the counterfactual. Ofcom has signalled that from 2020 DTT will be subject to AIP, and that the likely fee absent 700MHz clearance will be of the order of £40M/yr/multiplex[12]. Faced with an additional cost of almost £300M/yr, it is inconceivable that the television industry would not take a long hard look as to whether current usage could be justified, indeed if that process did not occur, it would be evidence that AIP as a concept was failing.

Vodafone considers that the multiplex operators would pass these costs on to the channel broadcasters. With the prospect of an additional bill of perhaps £5M/yr, it is highly likely that those channels achieving low DTT viewing figures would assess whether continuing to use the DTT platform could be justified, versus migrating to alternative delivery platforms (see box). This is particularly the case where overall television viewing is at best level, but probably declining[13], and households increasingly have access to alternative delivery mechanisms such as IP delivery to their television[14] and/or to other devices that can stream or download television programming.

According to the Communications Market Report, Ofcom considers TV revenues to be ~£12.9Bn/yr, and average viewing figures to be 232 minutes/day. This equates to ~85k mins/person/yr, or ~5 trillion mins/yr collectively, which means average industry revenues of 0.25p/viewer/minute.

AIP costs of £5M/yr equate to £13,700/day. This means that *to cover AIP costs alone*, channels would need to achieve ~5.4M DTT viewing minutes per day. BARB data suggests that only approximately 20 channels have such viewing figures.

Note that these numbers flatter DTT, as almost half of revenues are from subscriptions, which predominately use cable, satellite and IPTV delivery.

[12] Spectrum pricing for terrestrial broadcasting, Ofcom, March 2013, para 1.29, http://stakeholders.ofcom.org.uk/binaries/consultations/aip13/summary/aip.pdf

[13] Ofcom Communications Market Report 2014, Section 2, average viewing has dropped from 241 minutes in 2012 to 232 minutes in 2013; Ofcom believes this could be as a result of the 2012 Olympics, but this is questionable as the decline is even greater against the (non-Olympics) 2011 average figure of 242 minutes.

[14] Ibid, Figure 2.6 shows 45% of television sales are now Smart TVs, Figure 2.7 that 82% of such televisions have actually got the internet connection in use, and Figure 2.9 that of these 73% are using catch-up television services.

Against this backdrop it is flawed to necessarily assume continued demand for sufficient channels to fill the six existing multiplexes, let alone for eight multiplexes as the counterfactual. More widely, DTT stakeholders as a whole could take the view that an industry initiative to accelerate the pace and intensity of the migration to DVB-T2 to minimise spectrum usage might make sense (that is a migration that would occur driven by the needs of the DTT industry alone, and unrelated to any policy drive to re-use 700MHz for mobile).

We submit that a restructuring of DTT multiplexes could very well occur organically as a result of the introduction of AIP in 2020 – indeed maximising the efficient use of spectrum is the principal purpose for spectrum fees in the first place. In this scenario, many of the costs identified in the analysis would either be sunk (if the DTT industry were to be preparing for 2020), or would already be scheduled to be incurred far earlier or at the very least for a different purpose than the Ofcom counterfactual suggests. This would mean that in this scenario many of the cost elements identified in Ofcom's analysis as being relevant only to 700MHz clearance would be significantly lower.

Although we acknowledge that these cost reductions are probable rather than certain, Vodafone believes they are more likely than the *status quo* counterfactual adopted by Ofcom. Therefore, we consider that the analysis overstates the costs of 700MHz clearance quite dramatically.

Question 5: Do you agree with our assessment of the likely costs of upgrading DTT transmission infrastructure?

Vodafone notes that the costs have largely been compiled by Arqiva, who have best visibility of the likely scale of cost of upgrading DTT transmission infrastructure. Nevertheless, as Arqiva are a key stakeholder in the usage of the 700MHz band, it is quite right that Ofcom should have obtained third party audit of the analysis. While this has modified some of the likely costs, we welcome Ofcom's plans to examine the cost estimates in detail.

We are disappointed that, given the transition of 700MHz to mobile usage has been on the agenda for quite some time, equipment has been deployed which seemingly will be unsuitable and incapable of being updated to use different frequencies.

We agree with Ofcom's approach of assessing the time-value of early equipment replacement, rather than factoring in the total equipment replacement costs.

Question 6: Do you have any comments on our assessment of the timeframes within which it might be possible to complete a DTT replan?

Vodafone believes that the 700MHz band should be transitioned to mobile usage in a timeline that is consistent with its wider availability in the rest of Europe. We accept that international agreement on coexistence between national DTT networks will take the time described in the document, but query whether such negotiations need to wait until post-WRC15, as it is only the final agreement/endorsement which is predicated on the 700MHz band harmonisation changing to co-primary. Although more rapid agreement would not necessarily lead to the 2018 commencement date being brought forward (we acknowledge that lead-time is necessary to ensure end-users are prepared), it would allow greater time for planning in order that the DTT industry can "hit the ground running".

Vodafone provides mobile communications services, and our core competence is not the operation of television broadcast networks. However, from the perspective of rolling out a 4G network of thousands of masts over a period of two years, our view is that there is potential to compress – but not by much - the timeframe for clearance. 2022 represents an absolute backstop on what can be considered a reasonable timeline for making 700MHz universally available for mobile usage. We hope that it will be possible to make the spectrum available prior to this, but any acceleration must be balanced against consequent increased costs that reduce the benefit of the change.

Technically, geographic release may be possible, but Vodafone does not believe it will be practicable or useful to do so. Planning the rollout of a mobile network is complex, and constraints such as restricting when spectrum can be used in specific areas is too much of an added complication with very limited associated benefit, given demand for mobile spectrum will likely not coincide with where DTT has been able to release spectrum.

Question 7: Do you have any comments on our assessment of the loss of value from existing DTT services in case of change of use for the 700 MHz band?

Vodafone agrees that the three scenarios set out in para 5.62 are possible outcomes, but we believe that Ofcom has erred in assuming that Scenario Two should be built into the cost-benefit analysis unvaried.

Vodafone does not believe that the likelihood of varying levels of demand can be assessed independently of supply costs: if costs are passed onto consumers, then demand will be modified until equilibrium is achieved. Therefore, it is not the unfettered demand from viewers which needs to be considered, but instead the likelihood of broadcasters wishing to fulfil this demand given the costs of doing so. In this context, under AIP the charges would ripple through

to the channel providers. These costs could only be passed directly onto DTT HD viewers where subscriptions apply; we note that the proportion of television funding generated by subscriptions has risen from 39% to 46% over the last five years[15]. Nevertheless, for the majority of channels a more likely outcome is that commercial HD providers would seek to raise advertising revenues to offset the AIP charges. However, as they would be operating in a competitive marketplace against other advertising media, their ability to do this would be limited, particularly in a scenario of television advertising being one of many avenues to market[16]. Therefore, as it is implausible that channel providers would seek to provide HD content if to do so would mean lower profit margins, the *broadcaster* demand for more HD channels is unlikely to be significant beyond subscription DTT channels.

Scenario Three postulates insufficient capacity to meet the demand for HD channels with six multiplexes operating using DVB-T2. Although theoretically possible, we believe that even with no extra viewer charges for HD over SD viewing, the probability of this arising is minimal. Usage of the temporary multiplexes has shown a slow start, with business failures[17] and even those local channels serving the most population-dense areas seeking to water down their licence commitments[18] to broadcast less content. Even on the "core" permanent multiplexes, much of the capacity is taken by time-shift "+1" or even "+24" services which are better addressed via PVRs and broadband-based solutions. As described in our response to Question 4, Vodafone considers the most likely outcome in a world of AIP will be fewer DTT channels rather than more. We therefore consider that by far the most likely outcome is either Scenario One or Two, namely that there is sufficient capacity to meet HD demand within six multiplexes, in Scenario One with no DVB-T2 upgrade, and Scenario Two with the upgrade being required.

Vodafone considers that the categories of costs and benefits identified with Scenario Two are broadly correct should such a migration prove necessary on capacity expansion grounds. However, we would have preferred to have seen alternate analysis whereby that level of demand was experienced but the DVB-T2 migration did not occur, and instead the most marginal channels migrate off DTT and onto alternate delivery mechanisms such as cable, satellite or IP. It is possible that this alternate approach would lead to a lower cost than the £80-100M estimate of the net cost of a DVB-T2 upgrade, hence be the most efficient mode of meeting demand.

Notwithstanding the assessment of the costs of Scenario Two, Vodafone questions Ofcom's methodology in factoring these into the costs associated with 700MHz clearance. Seemingly the

[15] Ofcom Communications Market Report 2014, Figure 2.1.
[16] Ibid, TV is only 26% of advertising spend, and is proportionately declining.
[17] TBI Vision August 2014, "UK local TV operator calls in administrators", http://tbivision.com/news/2014/08/uk-local-tv-operator-calls-administrators/315941/
[18] Notice of proposed change to L-DTPS licence obligations of ESTV Limited (the local TV licensee for London), http://stakeholders.ofcom.org.uk/binaries/consultations/estv/summary/condoc.pdf

full cost of Scenario Two has been built into the analysis, on the basis that although it's possible that Scenario One could occur (hence incorporating Scenario Two would overstate the cost), it's also possible that Scenario Three could occur (hence incorporating Scenario Two would understate the cost). We do not believe this appropriate as it implies that the probability and magnitude of potential under/over-statements is equal so cancels out. As stated above Vodafone considers that Scenario Three is implausible so should be discounted outright.

Vodafone believes that given the imposition of AIP, if the core counterfactual assumed by Ofcom is accepted then Scenario One is most likely and should have been assumed for the analysis. We believe that as the net cost of having to carry out a DVB-T2 migration is one that could occur but that we cannot say with any certainty will do so. Therefore the cost of this migration should have been omitted from the analysis, thus reducing costs by £80-100M.

If Scenario Two is to be incorporated into the analysis it is in effect (in financial terms) an option that may or may not be sensibly exercised. As such, Ofcom could have better incorporated this into the cost-benefit analysis by using the Real Options Valuation approach[19] to constructing business cases, albeit unusually the option being on the cost rather than benefit side. This would reduce the costs to a small fraction of the £80-100M suggested.

Notwithstanding the above points, we must again highlight that a fairer counterfactual would have been to assume that the DTT industry would, irrespective of the 700MHz release, have consolidated its spectrum usage in a 2020-2025 timeframe to minimise AIP fees, and this consolidation would have incorporated a migration to DVB-T2. This would mean that the cost/benefits of this exercise should be omitted from the 700MHz analysis outright as they would be likely to occur whether or not 700MHz was used for mobile.

Question 8: Do you have any comments on our analysis of the implications of potential changes for DTT viewers and for the platform? Are there any effects that may be important to viewers that we should consider further?

Question 9: Do you have any comments on our consideration of consumer information and support measures and on the factors we should focus on in the next stages of work?

Question 10: Do you have views on the activities that Ofcom and other stakeholders could undertake now to help ensure that DTT equipment that consumers might buy in the coming years is as future-proof as possible?

Retuning Televisions

Vodafone agrees with Ofcom's assessment in this area. The evidence of the Digital Switch Over and subsequent exercises where a channel rescan has been needed is that UK citizen

[19] This would have involved carrying out analysis for the probability of each of the Scenarios occurring at multiple points in time, taking the NPV of that probability occurring.

consumers are well able to understand how to tune their televisions. We consider that the costs incorporated for carrying out this exercise are the absolute maximum, because in practical terms the majority of people will find something else to do while their television retunes.

Aerial Replacement

We note Ofcom's analysis on volumes of aerials that are likely to require replacement, and associated costs of doing so. Although we welcome Ofcom's liaison with the installer community to ensure that unsuitable grouped aerials are no longer fitted, Vodafone believes that an achievement of fewer than 10% of new aerials being of this type is insufficiently ambitious. Ofcom should consider other avenues to pursue delinquent installers that sell equipment known to have a limited lifespan, for example via involvement of Trading Standards organisations. The Sale of Goods Act[20] states that unless the purchaser is made aware, goods supplied should be fit for purpose and durable (defined as what a reasonable person considers satisfactory quality/lifespan). Clearly, an aerial that will no longer be fit for purpose as little as three years after its sale cannot be considered durable, so the aerial installer would *prima facie* be in breach of the Sale of Goods Act. Critically, however, until Ofcom issues a statement to the effect that 700MHz will no longer be used for DTT and a time window in which this will happen[21], an installer could reasonably argue that there is no stated public policy that would lead to the grouped aerial being unfit for purpose, hence the installer was acting in good faith selling such aerials. This reinforces the need for Ofcom to conclude its policy deliberations in a timely manner.

Vodafone considers that Ofcom's estimates for aerial replacement represent an upper bound for these costs. We agree that £150 is a reasonable estimate of average costs *where a replacement aerial is installed.* However, in some cases identified by Ofcom as being those where a replacement aerial is needed, the consumer may opt to take a cheaper approach. For example, where the household concerned has their primary television viewing delivered via satellite, it would probably work out cheaper to upgrade a secondary set to Freesat using spare slots on their LNB than it would to install a replacement aerial. Similarly, a Virgin customer could extend their channel pack with multi-room – gaining greater utility - for almost two years[22] for the price of said aerial.

Interference

Vodafone is optimistic on the subject of interference. Whilst welcoming additional research, we believe that there will be considerably less interference than was the case for the deployment of 800MHz LTE networks – which of themselves have so far resulted in far less interference than was originally postulated. The immunity performance of TV receivers will have improved

[20] Sale of Goods Act 1979 Section 14.2, http://www.legislation.gov.uk/ukpga/1979/54
[21] And potentially even until the DTT frequency re-plan has been determined
[22] £6.50/month/additional box

substantially by the time that 700MHz band is used, now that the manufacturers are aware of the deployment of mobile services within UHF spectrum (and the new Radio Equipment Directive will make this a statutory requirement).

For the 800MHz band, one reason why there were far fewer interference cases than predicted is that there is typically more margin in the received DTT signal level and quality than was assumed. This will also be the case for the 700MHz band. As the consultation document notes, the combination of factors that give rise to the maximum interference (which include a single terminal using all uplink resource blocks at full power) will occur very infrequently.

The nature of the band plan for 700MHz mobile usage means that unlike 800MHz it is the uplink which is immediately adjacent to the remaining DTT frequencies. This means that the location of the mobile handset will be more material than the location of base stations, giving the triple advantages that the transmit power is lower than for a base station, that the handset is unlikely to be in close proximity with rooftop aerials (albeit set-top aerials may be more challenging), and that the handset can be moved from proximity of any equipment if it does cause interference.

It is possible that there may also be a few interference cases from base stations. The 700MHz base stations will be deployed on the same sites as 800MHz, and the older TV receivers will be more vulnerable. Therefore, almost of these cases will occur in the same localities and to the same households as experienced interference from 800MHz. They can therefore be targeted very effectively and pro-actively, and almost all cases can be avoided by replacing the existing down-lead filter with one for 700MHz.

While it may be possible that base stations may interfere with equipment where these have poor filtering of out-of-band frequencies (i.e. the interference mode is one of television equipment failing to filter out LTE signals in the 700MHz band, rather than LTE signals spilling into the DTT bands), Vodafone's experience with the mitigation of interference with 800MHz LTE has shown that this predominately occurred where the performance of the DTT installation has been marginal, and the deployment of 4G mobile networks has nudged this performance over the edge. Work by at800 has typically resulted in a better performing DTT installation than was the case prior to the rollout of 4G networks. In this context, Vodafone acknowledges that although (subject to additional research) there may need to be some form of programme to remedy interference, we question whether the cost of doing this should be built into the 700MHz cost-benefit analysis, because the outcome will be DTT installations which are considerably more robust to interference than they were prior to the exercise. To put it another way, if the costs of this mitigation exercise are to be incorporated into the analysis, then so should the consequent benefits of a better-performing DTT system.

Question 11: Do you have any comments on our assessment of the impact change of use of the 700 MHz band would have on PMSE?

Question 12: Do you have any comments on the mitigations for loss of access to the 700 MHz band including whether we have correctly identified the replacement bands suitable for further study and whether we have correctly identified actions that the PMSE industry could adopt to improve spectrum efficiency?

Vodafone considers that Ofcom has captured the key issues the change of use may present for PMSE. We note that the future of PMSE is an issue which seems to arise in almost every consultation on spectrum, and can sympathise with the PMSE community around the uncertainty of their tenure. Ofcom should develop and consult on an overarching strategy for PMSE spectrum, in order to provide regulatory certainty to stakeholders, rather than addressing the issue piecemeal via consultation on individual spectrum bands.

The highest demand for PMSE spectrum occurs at only a small number of locations – the West End, major provincial theatres, television studios, concert venues and music festivals – probably less than a hundred sites in the whole UK, most of them indoors. This very localised demand can best be met by sharing with another service, perhaps in the 960-1215MHz and/or 2025-2110MHz bands.

Vodafone notes that the centre-gap and the guardband of the band plan for 700MHz potentially allow for PMSE provision. Analysis of the potential and implications of this should form a core part of the PMSE strategy consultation exercise, which should be concluded prior to any final decision on the usage of the centre-gap for the UK. In addition, we would recommend consideration of the 2025-2110MHz band, which is only just above 2GHz. We welcome the intention of Ofcom to examine the assumption that frequencies above 2GHz are inappropriate for PMSE applications, and we note that Ofcom has itself tested radio microphones operating above 2.4GHz for the public sector spectrum release of the 2.3GHz band.

Question 13: Do you have any comments on our assessment of the impact of the change of use of the 700 MHz band on the TVWS availability?

Inherently, if the amount of spectrum available for DTT diminishes, then so will the availability of white space within that spectrum which could be utilised on a geographically shared basis. However, it is important that Ofcom does not leave itself in the situation of “the tail wagging the dog”, in that spare capacity in a given spectrum application is considered to be a factor in deciding whether a more efficient application can take over the spectrum allocation. Vodafone is therefore sceptical that loss of value for White Space Device (WSD) applications should form part of the cost-benefit analysis for 700MHz clearance.

However, this matter of principle is a somewhat moot point: WSD is at a nascent stage, with trials to establish the viability of the technology and likely economic benefit, and technical tests underway to determine the coexistence issues with DTT. It would be incredibly speculative, therefore, to ascribe any likely value to WSD usage of TVWS, and to do so could only undermine the rigour of the analysis. Vodafone therefore agrees that while the potential impact should be noted, no quantitative analysis should be incorporated into the cost-benefit analysis.

Question 14: Do you agree with our use of the Spackman method for discounting both the costs and benefits of change of use?

This question is asked in Section 9, in which Ofcom calculates the costs of the change of use of the 700MHz band to the existing users. It obviously also has significant application in the calculation of the benefits to consumers arising from the change of use, as discussed in Section 4. Our response then relates to both costs and benefits collectively - Ofcom is clear that the Spackman method has been applied in both[23].

As Ofcom is aware, Vodafone has disagreed with the use of the social rate in other contexts. However, in this particular consultation, provided that the method has been consistently and symmetrically applied for both costs and benefits, the detail of the method of discounting over time becomes less critical – although obviously it may have some relevance to the result to the extent that the timings of the costs and benefits differ.

This reduced importance of the particular discounting method selected applies is significantly furthered by the consideration that Ofcom's calculation of the balance of costs and benefits unequivocally gives the result that 700MHz should be transferred to mobile use. Provided that this clear difference of 2:1 or 3:1 continues to apply (and Vodafone's view from elsewhere in this response is that this difference is in fact understated), then it is very unlikely that the substitution of a particular discounting methodology for another or the use of a different WACC could change the overall outcome.

We do in fact note that the use of the Spackman method is not entirely symmetrical. Vodafone believes that the practical impact of the implementation decisions that Ofcom has taken with reference to deriving present values will tend to understate the Present Value of the benefits of the change of use. These benefits have been arrived at by using a network cost avoided approach. We see two areas of potential benefit understatement.

- Firstly the methodology specifically excludes the terminal value of the calculation. Analysys Mason note on page 4 of their report:

[23] Footnote 12 re section 4, paragraphs 9.10 and following re section 9

"As requested by Ofcom, our results are presented excluding any terminal value arising beyond the modelled period. We note that the exclusion of a terminal value does not take account of any cost savings which may occur beyond the modelled period and therefore provides results which may not fully illustrate the overall level of network cost savings likely to be achievable by operators."

(Vodafone emphasis)

We would tend to agree with this observation.

- Secondly, the assessed benefit consists of two discrete components:
    - *"reduction in costs of meeting increased demand for mobile data capacity from having to build and to operate fewer network sites*[24]*"*;
    - *"Improvement in the performance that mobile users would experience, also measured as the reduction in costs…*[25]*"*

  Given that the second benefit is unequivocally a consumer rather than an industry benefit, and the network cost is used simply to derive a rough proxy of it, we would question whether the use of the industry discount rate is relevant in this particular calculation. If Ofcom is content to use the social rate to produce a PV of consumer costs, as it does in the cost calculation, we suggest that once the network cash flows are computed by the model as a proxy for the consumer benefits, a PV of them should be obtained by the social rate, without the intervention of an industry rate at all. We believe that the outcome of this more consistent approach would tend to give a higher benefit than Ofcom has computed.

Both of these considerations thus suggest that the PV of the benefits is likely to be understated in comparison with the PV of the costs

Given the unequivocal outcome of the analysis we are as a result in the present context relatively unconcerned with the use of the Spackman method or of the particular adopted industry discount rate, but do consider that Ofcom has erred in its approach.

[24] Consultation at table 1
[25] Ibid

Question 15: Do you agree with our approach of estimating the cost of early replacement or should we be considering the full cost? Do you have any comments on how we have estimated the costs of early equipment replacement?

Vodafone agrees in principle to Ofcom's approach of estimating the cost of early replacement. It would be wholly incorrect for the full replacement cost to be built into the analysis, because to do so would mean that the party replacing the equipment would be left in a better situation at the conclusion of the programme than they were at commencement (or, to put it another way, were the full replacement cost to be incorporated, then a corresponding benefit would have to be incorporated reflecting the advantage of not having to replace equipment until later than would otherwise have been the case).

Once again, however, the choice of the correct counterfactual is key. If there is any evidence that equipment would have been replaced early due to other factors – for example AIP leading to a contraction in the number of multiplexes, or an upgrade to DVB-T2 driven by DTT requirements – then the "previously envisaged replacement date absent 700MHz clearance" for DTT broadcast equipment should reflect that evolution rather than relying on a simple N-years beat cycle.

Question 16: Do you agree with our overall assessment of the costs of change of use of the 700 MHz band?

Vodafone re-iterates that Ofcom's choice of counterfactual is very conservative, and that many of the costs identified may well either be sunk, or would prospectively be incurred in any case (i.e. the implication of 700MHz release would be to bring forward these costs). Notwithstanding this, and the detailed points raised in our responses above, Vodafone agrees that Ofcom's assessment identifies the absolute worst case of costs that could be incurred.

Question 17: Do you have any comments on our assessment of the impact of earlier or later change of use of the 700 MHz band?

Vodafone understands that the timing falls within a core caucus of European states that foresee making 700MHz spectrum available in 2020, +/- 2 years. We agree that a later release would not substantially reduce the costs of migrating DTT, but would run the risk of constrained mobile networks causing economic harm.

At such an early stage of 4G service rollout, it is difficult to assess when our other sub-1GHz spectrum capacity[26] will become constrained. It may be beneficial to pull forward availability by a year or two, but this requires careful assessment as to the costs and risks for the DTT ecosystem. Vodafone stands ready to work with Ofcom and other stakeholders to determine a mutually acceptable release schedule.

Question 18: Do you agree with our proposal that we should make the 700 MHz band available for mobile broadband?

Vodafone considers the case is very strong. On a standalone basis, the analysis undertaken by Ofcom, which we consider very conservative, demonstrates that in every plausible scenario the benefits outstrip the costs. However, when international harmonisation means that every competitor nation is making this spectrum available for burgeoning mobile data usage, the case is utterly compelling.

Our introductory text describes how Ofcom could have made the case in a far simpler way. We have then explained how the counterfactual chosen by Ofcom will tend to increase the perceived costs compared to other highly probable outcomes if DTT were to retain access to 700MHz. We have demonstrated that the benefits quantified by Ofcom represent the absolute floor of the value to the UK economy of making 700MHz available for mobile usage, and that in reality externalities mean the benefit foregone of not doing so would be substantially higher.

Ofcom's analysis shows that even against this approach of calculating the worst-case costs and least benefits, the business case for 700MHz release is substantially positive. Vodafone agrees.

Question 19: Do you agree with our proposal that we should seek to implement this change at the earliest possible opportunity?

Vodafone believes that the change should be implemented at the earliest possible opportunity that allows an orderly transition. Acceleration from an availability date of 2022 would be welcomed, provided that any increased costs do not outweigh the benefits.

Question 20: If, as a result of this consultation, we decided to go ahead with the proposed changes, what factors and evidence should we take into account when considering whether to hold an auction near to the time of availability of the spectrum or earlier?

Vodafone has considered this issue and strongly favours the conventional approach of the auction occurring shortly before the spectrum is made available.

[26] 800MHz and re-farmed 900MHz

We acknowledge that an auction decided in 2016 would provide superficial certainty so that mobile operators – winners and losers alike – could plan their network rollouts in the knowledge that they had access (or did not have access) to 700MHz spectrum. In principle, it would allow the new licensees to commercially negotiate with the DTT community to accelerate (or indeed, if appropriate, to defer) availability of 700MHz spectrum to suit their business needs.

Set against this, there are fundamental issues. As at 2016, it will be impossible for mobile operators to ascribe a precise commercial value to the spectrum: we will be asked to make forward projections on the state of a fast moving market five years hence. It will certainly be possible to state that we want/need the spectrum, but it would be very difficult to determine a value with the rigour needed to satisfy shareholders.

We do not consider that Ofcom's vision of successful bidders commercially negotiating with the DTT industry is realistic. Firstly, there isn't a single entity that represents the DTT industry, which would be in a position to carry out such a negotiation. Secondly, [✂]. Thirdly, there would not be an entity that could negotiate collectively on behalf of the winning mobile bidders, and it would be likely impossible to form one without there being significant competition concerns. Finally, such accelerated rollout would likely only result in 700MHz spectrum being available on a geographic basis, according to regions where it had been possible to migrate DTT to sub-700MHz. As stated in our response to Question Six we see no benefit in a geographic rollout of 700MHz spectrum for mobile usage.

The development of technical standards for 5G mobile could also have implications. We expect that on the whole, the 5G ecosystem will have greatest impact at higher frequencies. However, the introduction of new technologies in this area could have implications for the value of spectrum at lower frequencies. We anticipate 5G technical standards will reach maturity in a 2019 timeframe: in time to influence an auction scheduled with conventional timing, but too late for the ramifications to be factored into a 2016 timeframe.

For these reasons, while it was valid for Ofcom to raise the idea of an early auction, Vodafone continues to favour the conventional approach of auctioning the spectrum shortly before it becomes available for use.

Vodafone Limited
August 2014