Ofcom Consultation on future use of the 700MHz band

Response from Ericsson Ltd

August 2014

Ericsson is grateful for the opportunity to respond to the Cost Benefit Analysis performed by Ofcom in respect of this potential band with great potential for increasing coverage.

In general the view that we take from the material presented is that the actual values of the cost benefit ratio are not terribly important other than as input to the pricing structure surrounding a possible auction. The key principles are that the broadcasting system can be made to accommodate a loss of the spectrum while its use by mobile systems will allow a way of adding spectral capacity with earlier availability than other frequencies could. It is that speed of reaction to demand rather than cost which is the main benefit of the 700MHz band. That benefit is not available until clearance and so the potential benefit in terms of responsiveness the need for more network capacity is made stronger by an early release date. These points are not brought out by a concentration on costs and their strategic significant is lost in the detail.

We have identified some themes which we believe underpin our response to the questions from Ofcom in this consultation.

- *We believe that the capacity benefits of DVB-T2 should be leveraged to provide ample HD capacity - meaning all "primary" channels should be available in HD, primary being the top 80% viewed*

  In many places in the consultation document there appears to be an underlying wish to conflate the lowest cost to be attributed to change of use for the purpose of the Cost-Benefit Analysis with actual policy to be adopted. This is particularly of concern in choosing the policy for frequency re-planning where there is not time to do the work more than once. We fully support use of the 700MHz band for mobile coverage but we believe the re-plan should give maximum value for DTT to continue to flourish whist evolving to being a hybrid technology with fixed and mobile Internet facets.

- *Mobile demand will grow 8x between now and 2019; the key prediction for Western Europe from our Ericsson Mobility Report June 2014*

  This growth prediction excludes customer choice use of WiFi in the home or at work. It relates solely to the need for licenced spectrum for consumer related mobile broadband. To re-iterate this is growth we expect that is not affected by customer led offload to unlicensed spectrum. In general this need is for capacity that reaches inside buildings in urban areas and 700MHz has the right characteristics. The consultation underplays the uniqueness of the

700MHz band in meeting this coverage need by concentrating on comparison with a substitute network for costing.

- *700MHz for mobile operators is really important for coverage both indoors and outdoors*

  Availability of 700MHz means operators can add capacity using existing grids of antennas which is of great economic benefit. This is, of course, recognised as the basis for the benefit in the Analysys Mason study. What is less recognised is that whilst spectrum above 1GHz has utility it is not certain that coverage would be universal and that it's the basis of the costing of a substitute network. We see spectrum 2600MHz and above being used extensively for small cells in high demand areas. The real value of 700MHz is in the extra value it brings to rural areas where macro coverage would not be likely above 1GHz.

- *Urgency should be given to the switchover*

  The response time for changing the band's use is so long that we cannot wait until the right time. The Ostensible purpose for the Cost Benefit Analysis was to determine the best economic time for change if the European Union position was to determine that the band should be used for Mobile Broadband. The decision on changeover is clear and the study do not give an over-riding cause for delay or speediness. However the ability to bring forwards a changeover plan is the most important single piece of evidence in the consultation. It leads to a clear conclusion that early change is best. That early change should not be the lowest cost and lowest benefit to the DTT; instead we recommend confident and beneficial change to achieve higher spectrum efficiency.

- *Softer benefits should be highlighted in Ofcom's analysis*

  The benefits of low speed data and Public Safety use of the band give rise to additional benefits which leverage the existing antenna grid. Those values could not be replicated by the use of an alternative architecture.

- *Consider real consumer behaviour and work out the likely responses before deciding on a strategy for communications*

  Remember too that the aerial installer community do not serve the public interest in the same way that broadcasters do. Getting best value for consumers is more complex in this environment than before. Consider carefully whether the existing products are in the public or industry interests before just continuing to laud wide-band aerials as the answer.

In some ways we are reinforcing the basis of the study that the use of this band for Mobile Broadband offers benefits which are not able to be valued in the conventional sense but that the issue is when to change. We have fears that the values will be used by some to suggest that the case for change is not clear cut enough. We reject that position using the argument that this band represents a unique opportunity but urge that Ofcom brings that uniqueness forward much more strongly in the subsequent statement following this consultation.

In the statement we urge Ofcom to draw a line under the Cost Benefit stage. To set an ambitious plan for getting the best out of the spectrum re-plan for broadcasting and Mobile broadband and urge a speedy changeover.

Responses to individual questions follow:

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

The Analysys Mason (AM) work assumes quite large offload fractions. We have observed that the propensity to use WiFi rather than mobile broadband stems in some part from the behaviour of the 3G network. Users believe it to be slow and prone to failure. However we also observe that view is not carried forwards to 4G evidenced by EE's 4GEE Mobile Living Index which shows users are more likely to use 4G than seek out WiFi. Therefore we are sceptical that the current technology reasons for using WiFi in preference to Mobile broadband will hold up until the time that 700MHz is used. Our own Mobility Report[1] published in June 2014 shows that we expect traffic, excluding offload, to grow between the end of 2013 and end 2018 by a factor of eight in Western Europe.

When we forecasted growth globally in 2011 our estimate was subsequently shown to be slightly conservative. When these growth expectations are considered in relation to the chosen case from Real Wireless and AM the mid case they choose post offload is rather too low. The AM figures assume a constantly increasing degree of offload and it is likely that the difference assumes too aggressive a use of offload by MNOs. Ofcom have new figures from the communications market review which can be used to confirm UK growth in an up to date way.

We agree that the build-out of 700MHz as an enduring Macro network will yield ongoing savings to operators as envisaged by AM. The work by AM appears to generate the savings (as a benefit) in investment costs whilst the total value of required investment is not quantified. It would appear that the premise is that extra capacity was needed and would have been provided by a more expensive route using existing spectrum had 700MHz not been available. It is further assumed that the savings permitted by use of 700MHz are a public good. This assumes that the cost savings are pre-dominantly passed to consumers.

It is assumed that the business case for further rollout was made even though the underlying premise is that more and more use is made of unlicensed spectrum. It is not entirely clear why, if unlicensed spectrum usage is so inevitable, the MNOs would not have made that investment first instead of more licenced spectrum first.

Our forecasts do not appear to make such aggressive assumptions about use of unlicensed spectrum as a substitute for licenced spectrum.

[1] Ericsson Mobility Report June 2014 can be found at: http://www.ericsson.com/res/docs/2014/ericsson-mobility-report-june-2014.pdf

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

The document assumes that PPDR use will provide benefits if it is used as reserved spectrum for PPDR use. If instead the PPDR use is as currently envisaged in the Home Office proposals as pre-emptive use of the 700MHz commercial spectrum then some additional value accrues. This is because the cost of providing capacity beyond the use of 800MHz is reduced because no dedicated network costs are incurred but greater capacity can be provided for the emergency services. As this is provided as a re-use of commercial spectrum the value of saving by the emergency services is in addition to the commercial value to the general public. Therefore usage of this spectrum for a dual purpose adds to the value rather than the revenue reduction discussed in the consultation document. In terms of saving it is correct to use the values in the Home Office business case because it is not double counting in the conventional sense even though the decisions are related. The total saving due to 700MHz use other than for Broadcasting is relevant to the Cost Benefit Analysis done by Ofcom even if that saving is made by Government. The part of the saving due to use of 700MHz is a proper consideration in the choice of future use of 700MHz whoever makes the saving.

The proposal from Vodafone to provide a paired 3MHz band for use with machine to machine communications has not been considered. It does offer an opportunity for a new application of wide applicability with availability equal to the expected 700/800/900 coverage. This represents a significant availability with possibly marginal costing opportunities and should be investigated.

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

Our own prediction about mobile data growth to 2019 is eightfold from the figure at the end of 2013. It seems highly dubious to predict beyond that point given that the handset market is subject to enormous change. This is particularly important when one compares the increase in spectrum before 700MHz is available and the likely demand to the same date at eight times whilst the spectrum capacity shown in the MBB statement is expected to be only 4 times by that date. Considering that the additional spectrum to be made available up until that date is predominantly suited to capacity use, and will meet requirements principally in Urban areas, the 700MHz spectrum will be the first additional spectrum for rural and suburban areas since the rollout of 800MHz.

The effect of off-loading may well be overplayed by many commentators and our own estimates are after what might be called off-loading in other studies as well as after elective use of WiFi in homes. It is relatively easy to show that WiFi offload is not very predictable at all and requires investment by mobile operators to make it seamless and offloading with the effect of spectrum substitution. The elective use of a WiFi access for data is not offloading per-se; it is not a substitute because it does not allow use of the user's profile on the MNO network and it does not provide continuity of voice at this time. Use of WiFi in the home with full use of the user profile is equivalent to small cell use and requires additional investment in the networks, which is not taken into account or offset against the cost savings in the AM study. The providers of fixed network WiFi routers should not be assumed to provide modified equipment to allow connection to the mobile network. It will either be in the

handsets or use specific hardware, or possibly a mixture of both methods. Whichever way the connection is made into the mobile network there will be costs both in the home/office and in the network which are not included in the AM costings. The Analysis figures are net of Femto usage for which it does not consider the costs. It therefore underestimates the value of 700MHz in its haste to reduce spectrum estimates.

The assumptions made by Analysis Mason include increasing use of offload to WiFi over time. However it does not seem to take account of needing to deal with consumer traffic in their places of work. Users are expected to make increasing use of video material and that will include whilst at work, at lunch and break times for example. This effect can already be seen in the City of London today. Now the user's choice of network may not be the same as his employer's. The level of operator diversity is presumably at the retail level so that one only a one in five chance exists that the user has the same network choice as his employer. In any case the employer is going to have to consider whether the video use at lunch times may actually exceed his business use at other times and therefore not permit other than its own approved devices to be connected to the network. The assumptions on offload as it affects spectrum requirements may well be overestimated.

A further issue is that the efficiency of unmanaged 802.11 is rather low compared with LTE. As Ofcom have noted elsewhere the existence of unmanaged WiFi on the same channel as MNO usage would cause the capacity to be reduced and the amount of WiFi spectrum that can be used for offices is limited. The assumption of continued growth made by Analysis Mason assumes that Access Points can be added without reducing overall capacity. It is difficult to see how that can happen when the spectrum is shared between the general public's internal networks and public access networks controlled by multiple players in the confines of workplaces. The assumptions in the models seem to require that offload is a strategic part of the plan; indeed the Analysis Mason report says that in terms. However the performance and predictability that one could expect from WiFi are more appropriate to a tactical tool than a strategic one.

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

In general Ofcom's view of the opportunities is too negative. We think that users will embrace new receivers to a greater extent than is assumed. We see all new devices as being DVB-T2 capable because chip manufacturing volumes means that DVB-T only is no longer viable. We see connectivity via the internet growing and the broadcasters catch up and internet connected TV mechanisms being more important than assumed so far; certainly more important than assumed by the consultation document. As an example, BBC3 using Connected TV would be indistinguishable from over the air delivery when viewed through a suitable TV or Set Top Box. Certain genres will work as internet only channels without requiring viewers to use computers and that will be a source of technological changes. Now TV with access to Sky may be an early example of this kind of change.

We recommend grasping change more fully. The use of DVB-T2 to give more capacity would be a great benefit in permitting additional services. The BBC could benefit greatly from this and in return

could be asked to undergo a small Top-slice of any licence fee settlement past 2017. That would allow rearrangement of a suitable set of channels and new BBC services, perhaps including BBC 2+ (assuming BBC 1+1 is then already on PSB1). The approach taken in the consultation document is very conservative and whilst this is valid for costing purposes we should not allow that to prevent us from using the opportunity for change to the full. The industry is changing anyway we should change with it.

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

The highly redacted cost model is not very helpful.

There could be any number of reasons why the balance of costs is inappropriate ranging from the use of Local TV to the refusal to contemplate SFN distribution via satellite and sticking to RBL links with transposers and re-transmitters. Whilst the use of SFNs for the COM muxes where regional advertising is not needed is reasonable it is not clear that sufficient effort has gone in to considering whether SFNs could have been used for some of the relays where distances permit. The exercise has the feel of an overly simplified estimate leading to the risk of an artificially high cost.

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

The timeframes are closely linked to the frequency allocations and the number of major operations needed. It is reasonable to maintain a fair degree of conservative costing at this point. However it is probably not the best policy for DTT to provide a programme with so little ambition in terms of maintaining only the number of channels that were available before the temporary multiplexes commenced operation.

The performance to date of the temporary multiplexes are somewhat of a distraction and may falsely lead to a conclusion that nothing much needs to change and there is no demand for new content. We are concerned that the value of DVB-T2 is not being exploited. The broadcasters are looking at a rock bottom opportunity where three out of four of the largest coverage transmitters in terms of homes are using much lower power than the existing channels and the channels used are either just beyond the edge of grouped aerials or well beyond well using DVB-T2 with its reduction in coverage. Somewhat unsurprisingly the broadcasters have responding by putting something which does not increase their production costs on the multiplex which claims 70% coverage. The 70% coverage is only true if everyone who needs a wideband aerial has one and they simply do not. The acid test of whether the broadcasters are serious is laid bare in the BBC decision to move BBC3 online to make way for BBC1+1 on DVB-T. It could have put in on the DVB-T2 mux immediately but the coverage and users wish to use COM7 is too low. Now if STBs and TVs generally had features which caused them always to display an HD version if one is available then there might be a change. The issue of EPG placement is not such a hot issue without reason. The general public do not choose to press 101 for BBC1; it was always 1 and so on for the other channels. There is no way to make TVs

always choose the HD version and the channel numbers are not transposed into the 1xx range; 107 is not BBC3 and 109 is not BBC4. Further the absence of Channel5 and More4/E4 make it clear that the offering is mostly to show willing but change nothing. The reasons are perhaps more complex and involve transport arrangements elsewhere, e.g. satellite conveyance agreements, but COM 7's success or otherwise cannot reliably be used as proof that the existing 5+1 mux arrangement is all that is needed regionally and nationally.

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 700MHz band?

The use of DVB-T2 upgrade costs as a proxy for loss of value of DTT seems to be less than obvious. It is clear that the cost of re-engineering the transmission network for 700MHz is a legitimate expense. However the costs of upgrading the capacity to match what would have been possible if the 600MHz Interim multiplexes were made permanent is questionable. There is very limited take-up of the capacity on the operation COM 7. There is no major non-PSB broadcaster of note other than Al Jazeera Arabic. There is little evidence of demand, without which it is difficult to impute that value has been lost. The evidence so far is that adding HD for commercial channels is far less attractive than more "+1" channels or new channels. This is understandable since a significant amount of audience can be gained from the plus 1 channel but moving to HD does not increase audience share figures. It seems likely that adding BBC+1 channels to the COM muxes may offer an increased value to the public which may justify user's expense in obtaining DVB-T2 equipment and should be offset from the costs. The BBC has shown that this is appropriate by its use of COM muxes for Red Button services during 2014. It seems that there is cause to believe that the proxy cost for loss of services may contain excessive receiver replacement costs.

It is also the case that none of the COM multiplexes are running with significant capacity allocated to NULL streams; they are essentially full. Indeed the ARQA and ARQB multiplexes now carry an extra video stream taking the capacity to 13 each. This suggests that the rollout of DVB-T2 might be more attractive to broadcasters to add channels than it is for increased HD. Since the plans permit the existing (5+1) multiplexes to be maintained the possible proxy loss relates to the temporary multiplexes which have poor coverage and poorer viewership. The purported loss is of a value which is yet to be realised and one that broadcasters are not falling over themselves to take up. The fact that only Al Jazeera Arabic and Jewellery Maker are available as a true extra services on COM7, the latter being an hours extension for an existing sharer on SDN, casts doubt on the actual lost value of COM7 and COM 8. We have to conclude that the current value of capacity on COM7 is extremely small and certainly less than a slot on one of the existing DVB-T COM muxes. We suggest that these costs should be removed from the analysis as they are little more than speculative.

Given that it will be soon impossible to buy DVB-T only boxes because the market is changing we would also question whether there is sufficient consideration of the replacement lifecycle of STBs and PVRs. One of the second generation PVRs already suffers from excessive entries in the Event Information Table (EIT) and this affects its ability to operate the accurate recording facility from the EPG. This kind of problem is not new and there was previously a problem with the Network Information Table being split as more channels were added. As more channels are added for Online

services this issue will grow. The use of online services requires HD codecs but not DVB-T2 so the EPG information is allowed to be sent on DVB-T. No account is taken of this kind of obsolescence where boxes will be too old in 2022 to expect manufacturers to provide fixes. Indeed the use of the update facilities seems to be much lower than it used to be with devices more often updating over the internet (or not at all) these days. It seems that Ofcom may be overestimating the ability of devices to last 8 more years and still provide a good service. We note that many devices installed in 2009 are starting to be less capable only 5 years into service and have had no updates for three years. The change to connected TV will also put pressure on consumers to consider changing their receivers. We feel that the current position taken by Ofcom does not take account of the probability that the platform will evolve and users will buy new receivers for many reasons.

The low value attributable to the Temporary multiplexes as well as the likelihood that user equipment will change over time as a consequence of service evolution leaves us of the opinion that loading the Cost Benefit analysis with costs of upgrading user's equipment as a proxy for opportunity costs of spectrum loss is not appropriate and those costs should be taken out.

We welcome innovation in the DTT and connected TV market and believe it will add value to Broadcasters and consumers by offering greater choice. The change of use of 700MHz is not going to significantly change the value but it may use different technology.

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?

Our concern is that the maintenance of what we have today is not enough to maintain DTT's position in a market which is subject to other external change, particularly from satellite. The range of programmes slips behind all the time and the addition of Ka band capacity will accelerate the trend. It is questionable whether the position of DTT can be maintained without at least more HD in the future and Ofcom should consider making PSB stations put all their output on HD.

There is a need to consider receiver change out in a more active way than today, The first of the really big sites at Winter Hill went digital in Nov 2009 nearly five years ago. The indicative programme leaves those STBs and PVRs in use for another 4 years and then potentially for a period beyond then up to 2030. This will leave the equipment market moribund and consumers needing replacements will be left paying high prices for obsolete equipment in a seller's market to get no improvement in service.

We were surprised by the high penetration of wideband aerials that was found in the survey. In the past the rate of replacement of aerials has seemed to be much lower as evidenced by the earlier DTI study. There has been a concerted campaign to promote the use of "digital aerials" despite there being no such thing and we are concerned that the high replacement rate may be due to that. A look at the CAI website shows that the industry has moved wholesale to promoting new aerials with inbuilt LTE filters. There is a lingering doubt that continuing pressure to install wideband aerials will result in fitting these devices which may not be needed and negate the efforts of At800 as a

campaign. The potential over fitting of such aerials may add to consumer costs in a way not taken into account in the consultation.

Turning to the costing we were surprised to see that the total number of affected aerials before making adjustments for those who have installed wideband aerials and those who do not use terrestrial TV was only 770,000. The reason for surprise is that this number is less than the declared Digital Protected Service Area for Winter Hill which is a group C/D area. Winter Hill, Oxford, Pontop Pike as high power group C/D sites have a DPSA total of around 3.7 million. Following a call to Ofcom it seems that the 770,000 figure was obtained by using a spread of aerial types and calculating how many locations in C/D transmitter areas would fall outside the performance of the UK planning model if the reference channel was moved to channel 31 and the aerial was not changed. The figure was recalculated with a wideband aerial bas and the difference between the two calculations was 770,000.

This approach is of course technically correct but does not allow for real consumer behaviour. In order for the number to be as low as 770,000 all the affected users would have to wait until the change was well defined and then have no losses greater than assumed in the UKPM and the DigitalUK reception site would need to give accurate predictions about whether they need to change. However the use of a spread of aerial types in the simulation makes it impossible to tell any particular consumer whether or not he will be affected without him knowing what his aerial performance is and what his cable losses are in practice.

Furthermore waiting until the change happens is not an option because getting an installer at that point of maximum demand will entail a loss of service. So rather like with the digital aerial issue raised earlier we can expect the practical solution to be that all terrestrial TV users will need to change their aerial in advance.

For some users who have poor cable, perhaps “low loss” coax inside the stud walls of new-build homes changing the wiring is not practical. Additionally many users will have one or more splitters, which could be in lofts, with or without their knowledge. Changing to wideband aerials may work whilst they are receiving C/D group transmissions but subsequently have insufficient gain when they change to lower channels. For some the right aerial choice after the change will be group A. As things are the market will have stopped supplying grouped aerials and amplifiers will be needed in more cases.

All of the above does not take into account the further 1+ dB loss caused by the 700MHz filter needed in addition to the possible 800MHz filter in the aerials that are no longer required but can’t be taken out.

The ratios of non-terrestrial TV users and the aerial replacements can be taken as given in the consultation but there may also be aerials that need replacing again because the wideband performance is not good enough for that installation. Given that the fraction of wideband aerials was over half where it was not needed we can only guess at how many C/D group aerials were replaced unnecessarily.

We could guess that only 30% of DTT users in C/D transmitter groups would be motivated to change aerials. Given that 25% do not use DTT and only 75% see the need to change then a figure of 0.75x0.3x2.7 million, i.e. 607,000, can be deduced. If that were to be so then the number of aerials estimated to be changed could be estimated too low by a factor of seven or more, yielding an increase in cost of over £70 million. These costs are likely to be incurred even if they are not ultimately necessary because viewers will act cautiously. Whilst the number may be subject to large errors the likelihood is that the aerial change costs will be an underestimate of actual consumer spending on changes to aerials.

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?

We suggest that buying behaviour between now and changeover both for aerials and receivers should be researched. It would be helpful to know how consumers would behave when faced with different messages about future changes and when/how they would act. In this regard it would be helpful to know if the current messages about antenna purchases are right and when different products would be purchased. It would also be useful to see whether equipment is less reliable than consumers would like and whether they would consider buying replacements to improve performance. It should be noted that the flexibility of TV Anytime standards result in data usage varying between broadcasters which appears as equipment reliability issues to consumers. This is a problem with a long pedigree going back to PDC on VCRs. Improving performance would just add to the value of using new equipment. However that is just a theory and asking users what they would like to see improved in a new purchase is what should be researched and put before the broadcasters and manufactures to help build a roadmap for change.

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?

The market's success in making users choose wideband aerials even when they didn't need them is of some concern. There is a danger that this type of selling will continue; with LTE interference concerns being used to sell group T filtered aerials. The filters that are fitted will not ameliorate potential 700MHz UE interference since it is within the highest gain part of the pass-band. Furthermore these devices when used in C/D group areas will have to be replaced once more. It is not clear that pushing wideband aerials hard before the new band plan is known is actually in consumer's best interests. Certainly for those in areas that will change to channels which are in in Group A users will suffer a considerable gain penalty by choosing a wideband aerial earlier when a grouped aerial would be better suited to their needs particularly when used in fringe areas or lofts. Using filters after the down lead also makes changing the filter less costly than allowing it to be integrated into the aerial and needing a further costly installation. Given that the single hop plans to be considered both cause C/D users to receive Group A transmissions and that wideband CAI

standard 2 (which is the best available) appears to have a penalty of 4.5dB when compared with a group A Yagi 18 it does not seem a rational choice to change now to a filtered group T aerial.

If it was intended to change to SFN with a wider spread of frequencies used at most locations then the policy of pushing wideband aerials could be justified but that appears to have been ruled out. In such circumstances the planning assumptions would need to change since the CAI Standard 2 Group W aerials offer only a minimum 7dBd within group A channels making it 9.15dBi compared to the planning value of 10dBi. The cheaper aerials using Standard 3 only offer 7.15dBi in the band which will be used making almost a 3dB loss against the plan. The situation on cable loss is difficult to predict but new homes usually have ordinary low-loss coax but more than 10m of cable and more often than not a signal splitter.

It is sensible to consider a holistic approach to how to get changeover to occur. The tendency for new homes to have poor quality low loss coax (truly a misnomer) installed by electricians underneath stud walls means that re-use of it in fringe areas may need greater use of masthead amplifiers with the consequentially greater opportunities for interference that they bring. It is not just the aerials that are getting worse as the length of these cable runs are longer than assumed in the UKPM and the cable loss worse. A greater depth study into what is needed for C/D group changeover is needed and not just an approach based on carrying on changing the aerials to wideband.

The underlying suggestion that we make is that a further calculation should be made based of observed behaviour of the public rather than a simple technical analysis of the situation. Users are very loath to see any loss of TV at all and will try to act in advance to secure a required result. This usually results in over-reaction leading to an excessive cost. This behaviour should be anticipated and re-modelled.

Making the specifications for DVB receiving equipment more precise would help with clarity on whether optional features are supported. As a trivial example the use by broadcasters of Series CRIDs is quite different and results in different behaviour on different channels. In one case a PSB channels had different interpretations from one week to the next. All of the interpretations were within the specification. Perhaps the D-Book and public conformance declarations would help. Having a clearly laid out view of what may happen to table data rates, transmission media and sizes are examples of how to make equipment future proof. The difficulty is that it needs an approach where options are laid out that may not be taken up but that the technical performance of the system is not able to be used as a differentiator between broadcasters. Ofcom is clearly in a position to guide this by making it clear that where equipment is built to the standard and fails to work with broadcaster's data then it cannot be treated as an equipment fault as happens today.

There may also be a case for Ofcom's Technical Conditions to be more fulsome, including making it clear what variation between multiplexes there may be. There is considerable variation between the data rates in the EITs on various multiplexes and it is not clear that present/following data is interacting correctly with PVRs or that they are always the same on all multiplexes. Differences in such rate may affect accurate recording and programmed channel changing.

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

No comments.

Question 12: Do you have any comments on the mitigations for loss of access to the 700MHz 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?

No comments.

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

No comments.

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

The Spackman method was designed to consider the use of private capital in cases where the improvements generated benefits which mainly accrue to the public. The costs in the Arqiva paper are explicitly based on cost of capital derived from grants. Therefore those funds are not intended to be raised in a way which makes the cost of capital to the Arqiva business relevant. Further the effect of creating an Annuity from the charges is to increase the overall costs.

The benefits included appear to be in the form of network cost savings to operators and purport then to be in the public good by virtue of cost savings being passed onto consumers. However this ignores the fact that the savings only accrue if an operator would have chosen to expand his network anyway to meet the predicted demand. Therefore the cost savings have to be seen in the context of a much larger investment programme. Given that the finance for the main program is financed privately at rates which are derived from the operator's WACC and the savings are set against that cost the net program still attracts costs at the WACC rates without being annuitized.

The Spackman method uses WACC rather than the STPR because there is actually a probability that the public utility will fail before it or its successors finish the project. However in this case the actions of Ofcom in setting out the future of DTT give a period of 15 years over which there is certainty about the anchor tenants of DTT and in turn the major share of Arqiva's recovery of costs. In practice these costs will be guaranteed up front by Treasury in the form of grants that will be committed before any auction in order to ensure that the programme can be finished. Therefore the use of Spackman's method and the consequent inflation of costs is not justified. This is because the costs are government backed and the results are a variation in the borrowing requirements on the commercial markets. So the costs should be discounted at STPR and the benefits at WACC, the opposite of what happens in the Spackman method.

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?

At the point where the equipment is replaced it will be a significant way though the asset life. Without the detail of cost elements we cannot see which assets require early replacement. However in principle the use of early replacement appears to be appropriate.

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

We have found numerous places where we believe the costs are inappropriate and should be re-estimated. These points are addressed in answers to other questions and we ask that those other answers are used rather than restating our concerns here. We believe that the details of the answer may not be as significant and the general principle that benefits exceed costs irrespective of where they fall and that the important question is when and not if the change should happen.

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

As described in the response to Question 8 there is potential for users to change to Wideband aerials in group W or K because of the passage of time when the actual change and their location mean that a Group A aerial is more appropriate. In such cases there will be a greater cost which will offset the predicted savings due to delay to a certain degree. It is sensible to consider the UKPM model with an additional 4dB loss for at least one practical single splitter in doing these calculations.

These extra costs should be estimated to a first order in order to see if more detailed work is worthwhile since the actual frequencies used will be a material issue. It should also be noted that some CAI approved aerials (standard 3) currently fall short of the assumption in the UKPM by 0.5 dB.

The change Broadcast system costs do indeed seem to vary only as a result of changing dates and hence the NPV. However the savings in the mobile network build assume that the alternative investment costs not already been incurred as sunk costs. If work to roll-out a dense grid at 3.4GHz were to have commenced then there would be less saving possible by substituting 700MHz capacity.

The optimum timing of release is actually linked to existing rollout of 800MHz and subsequent upgrades. The changes to allow Emergency Services use of the network and the phasing and costs to provide an Emergency Services Network are also a material factor. There is significant inefficiency in doing national rollout changes and capacity upgrades at different times on the same base station.

The existing cost savings assume a uniform and continuous roll-out of technology change which is not very practical. However it is also clear that an accurate value of savings is extremely difficult to capture and would be subject to many errors caused by incorrect assumptions.

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

Yes. We strongly agree that the band should be made available for Mobile Broadband.

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

We observe that the original intention that the CBA should determine the optimum time for change has not given a clear outcome. We believe that right time is a soon as possible but subject to being able to secure the optimisation of rollout programmes. There is not an infinite workforce capable of doing the necessary changes and there are increased security needs given the 700 and 800MHz networks could both form part of the ESN. There is also the issue of roll-out of the 2.3GHz system to be considered and Ofcom's present analysis does enough to suggest that we should go ahead.

In truth we have to go ahead because handsets for use in Europe will include the band anyway. Users will see there to be a need to offer the band as soon as that happens and we should use that to inform the view that the earliest practical date is the best. The devil is in finding that practical date without damaging competition.

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?

The work undertaken by Arqiva will need to be done with a financial guarantee. It may seem attractive to seek to hold an auction earlier than release to secure those funds. In practice this will simply reduce the auction return because of the lower NPV of the spectrum due to the period where the asset must lay fallow. The auction should be as close to the point of availability of the spectrum for use as possible. This allows buyers to make valuations as accurate as possible. In essence evidence as to take up of broadband and remaining capacity could be seen as guide to when the auction is needed but in practice the issue is when the spectrum can be used without constraint.

The 800MHz spectrum was available on a timetable based on clearance but in practice this was too hard to use and full clearance was needed. This can be expected again because the costs of planning base stations with restrictions and the possibility of having to return as later roll-out continues is a means of increasing costs which the industry would prefer to avoid. Channels above 48 are used for output on 505 of the 1157 Core3 transmitters. Given that the topology of MNO and broadcast networks are dissimilar the possibility of interference is rather large if an attempt is made to use the spectrum before full clearance. Further it seems that deciding on a frequency plan to aid mobile roll-out would not give an optimum one for the design of the broadcasting network.

The network plan for broadcasting appears to be constrained by the existing topology such that there is little room for changing the plan as the broadband capacity crunch shows itself to be moving closer. The insistence on retaining re-broadcast links appears to be at the heart of this problem. If all of the distribution links were moved to satellite then a greater degree of independence of regional planning could be achieved. However that would reduce the security compared to that which is achieved by a wholly terrestrial distribution system. A satellite system would be cheaper for those sites that must be modified only because they are fed by C/D rebroadcast links. Perhaps an initial

move to satellite and add re-broadcast later to achieve the security needed would be a way forwards.