About Arqiva

Arqiva has its headquarters in Hampshire, with other major UK offices in Warwick, London, Buckinghamshire and Yorkshire. It now has 9 international satellite teleports, over 70 other manned locations, and around 9000 shared radio sites throughout the UK and Ireland including masts, towers and rooftops from under 30 to over 300 metres tall.

The company is owned by a consortium of long-term investors led by Canadian Pension Plan Investment Board (CPPIB) and has 3 operating divisions: Terrestrial Broadcast, Satellite & Media and Wireless Access.

Arqiva is technology- and service-neutral and operates at the heart of the broadcast and mobile communications industry. We are at the forefront of network solutions and services in an increasingly digital world. The company provides much of the infrastructure behind television, radio and wireless communications in the UK and has a growing presence in Ireland, mainland Europe and the USA.

Arqiva is a founder member of Freeview (Arqiva broadcasts all 6 Freeview multiplexes and is the licensed operator of 2 of them) and was a key launch technology partner for Freesat. Arqiva is also the licensed operator of the Digital One national commercial DAB multiplex.

Alongside the BBC, Arqiva's Spectrum Planning Group plays a critical role in planning Digital Switch Over (DSO).

In addition, for broadcasters, media companies and corporate enterprises Arqiva provides end-to-end capability ranging from;

- outside broadcasts (10 trucks including HD, used for such popular programmes as Antiques Roadshow, Question Time, Proms in the Park, a wide range of sporting events and the IIFA Awards 2007 "BollyWood Oscars" with a huge worldwide audience);
- satellite newsgathering (30 international broadcast SNG trucks);
- spectrum management for Programme-Making & Special Events (PMSE) through subsidiary JFMG;
- 10 TV studios;
- playout (capacity to play out over 70 channels including HD);
- digital signage, including managing the output for CBS Outdoor's digital escalators and cross-track projection on the London Underground; to
- satellite distribution (over 1200 services delivered).

In the communications sector the company supports cellular, wireless broadband, video, voice and data solutions for the mobile phone, public safety, public sector, public space and transport markets.

Major customers include the BBC, ITV, Channel 4, Five, BSkyB, Classic FM, the five UK mobile operators, Viacom, Turner Broadcasting, Metropolitan Police and RNLI.

Executive Summary

Arqiva welcomes the opportunity to respond to this consultation.

Arqiva supports the release of spectrum to market and welcomes Ofcom's ongoing commitment to the Digital Dividend process. However, as a consequence of a significant number of events, as noted by Ofcom, since the last substantive consultations relating to the clearance of this spectrum in 2008 it seems appropriate to test the demand for and urgency of deployment of this spectrum now. To this end, we see additional national Digital Terrestrial Television (DTT) services being the principal source of demand for this spectrum. In particular, we believe that the 600MHz spectrum is critical to the long term sustainability and development of the Digital Terrestrial Television platform – without this spectrum the platform will have little scope to innovate, to launch more HD channels and new services such as 3DTV, and ultimately remain competitive in the Broadcast Landscape. The consequences of such an outcome would be a loss of choice, reduced availability of content and information for the consumer and an enhanced digital divide which runs contrary to Government initiatives such as Digital Britain and Digital Switchover. Our observations on service demand are summarised below;

- **Demand for more spectrum to support the DTT platform**

  In order to offer the DTT platform scope to develop and innovate to remain competitive and attractive to the consumer, we believe that the 600MHz spectrum band is fundamental to the future of the platform. With the roll out of HD services to PSB 3 and recent launches by Sky of 3DTV the diversity of consumer experience is expanding and, without appropriate spectrum to allow the DTT platform to expand its service offering, we are concerned that the platform will be devalued over time and lose its relevance to the consumer, ultimately damaging the level of competition in the market. Interestingly the Swedish regulator, The Radio and TV authority, are currently running a beauty contest for capacity on two new national multiplexes to add to the existing five. Out of a total of 40 applicants 20 are for HDTV services. Furthermore, we continue to see strong demand for capacity on our multiplexes and we believe this can be sustainable over the long term, with the DTT platform highly desirable to FTA and Pay operators.

- **Alternative Services / applications**

  The 'lower block' (600MHz) spectrum is co-ordinated and currently being deployed across Europe for Digital Terrestrial Television services. As such the UK clearance and release of this spectrum band is unique and hence any alternative uses of this band, other than PMSE, will be unable to benefit from the scale economy principle that formed the basis for the Europe-wide harmonisation of the 'upper block' (800MHz) spectrum. Furthermore, there is no International co-ordination of mobile standards within this spectrum band, further limiting the scope for investment by vendors in handset and base station technology to support the launch of mobile type services. To this end we believe that the economic basis for the deployment of cellular type services within this spectrum band is limited and hence there is little likelihood of the spectrum being secured for these types of services

We have noted the importance that this spectrum has for the long term sustainability of the DTT platform, but we also note the challenges and uncertainties faced by the market in terms of acquiring and deploying services with this spectrum.

In particular, Arqiva notes the following:

- **Economic Challenges**

  Economic factors have a significant bearing on the demand for services and hence the timing of spectrum acquisition and service launch. The recent declines seen by the Free to Air broadcasters in advertising income and the subsequent rate of recovery will have a direct impact on their willingness / ability to commit to the launch of new services and formats. The capital markets still remain tight and we believe will remain so for the foreseeable future, leading to a drag on available funding for spectrum acquisition and network deployment. Increasing unemployment and the challenges faced by the broader economic climate also will have a direct bearing on the timing of service launch once the spectrum has been acquired.

- **World Radio Conference 2012 (WRC-12)**

  The World Radio Conference represents a significant milestone in a spectrum co-ordination sense and it would seem sensible that Ofcom consider the outcome of this event in conjunction with the release of the 600MHz spectrum. The certainty of long term availability of the 600MHz spectrum for more DTT services will have a considerable bearing on the future attractiveness of the DTT platform.

- **International Spectrum Co-ordination**

  The harmonisation of the 800MHz spectrum across Europe and the resulting clearance of channels 61 and 62 in the UK have led to a further co-ordination programme which is ongoing. Whilst we note that Ofcom is hoping to complete this activity towards the second half of this year we believe that without certainty over the impact on spectrum channels, both cleared and interleaved available on a site by site basis, the release process would be unable to progress effectively.

- **European Union Plans for enhanced Spectrum co-ordination**

  The European Parliament and Commission recently hosted the first European Spectrum Summit and a principal theme of the summit was ‘how to optimise spectrum use across Europe’ through better spectrum co-ordination. Ofcom’s plans to release the 600MHz spectrum as part of the UK Digital Dividend is inconsistent with the plans of other jurisdictions in Europe and if services other than DTT were to be deployed in the band this would be contrary to the intentions outlined by the European authorities. Ultimately, this would result in an inefficient spectrum outcome, and we welcome the co-ordinated approach proposed by the European authorities where this supports continued access to the spectrum for DTT services. This highlights an inconsistency of policy between Ofcom and Europe, and greater certainty with regard to the approach would be welcomed.

- **Protection Clause Issues**

  Ofcom has recently launched a programme of work to ensure that existing DTT services are protected from LTE services in the 800MHz band. This is a significant

undertaking and we are supportive of the initiative. Ofcom has indicated that more details of the method for applying the protection clause need to be developed before it can be fully appraised. To this end, we believe that the point at which mitigation is required and the type of mitigation employed both need to be decided in consultation with the broadcasters and multiplex licence operators. Ofcom has already identified that filtering cannot provide a solution for viewers in all circumstances, and the notion of transferring the more extreme cases to an alternative platform will directly impact both Public Service Broadcasters and Commercial Multiplex Operators. Hence, in addition to consultations and stakeholder engagement we encourage field based trials to test the effectiveness of mitigation measures. Furthermore, any disruption to the DTT platform post digital switchover will have a detrimental impact on the consumer experience and the attractiveness of the platform, which should be avoided at all costs. We endorse Ofcom's stated aim that any new services should not impact existing DTT services, and this principle must be adhered to in full.

- **Licence Term**
  The initial licence term for the released spectrum is scheduled to complete in 2026, coincident with the end of the second term for the existing Multiplex licences. Ofcom notes that this is to enable a comprehensive assessment of the efficient use of UHF Bands IV and V at that time. The timing proposal has considerable implications on the investment term for the acquisition of the spectrum and investment in network infrastructure. Unfortunately, little detail is provided and we encourage Ofcom to provide greater clarity as to what will happen in 2026. In particular, if a fundamental reorganisation of the spectrum occurs at 2026, will this result in the channels secured at the cleared award being reallocated, with the subsequent network re-design costs being borne by the spectrum owner?

- **No early deployment due to DSO and clearance of channels 61 / 62**

  The deployment of Digital Terrestrial Television services within the cleared spectrum will be impractical prior to 2013/2014 due to the ongoing programme of work to achieve Digital Switchover and the clearance of channels 61 and 62. In particular, any disruption to the DSO programme and DTT services as a consequence of a new service launch should be avoided at all costs, as this could ultimately lead to a delay to the DSO programme and hence the timing of clearance.

In summary, Arqiva believes that the principal service that this spectrum is ideally suited to deliver is Digital Terrestrial Television, to complement existing services and allow the platform to grow and remain competitive. However, we have also noted the key uncertainties that we encourage Ofcom to address as part of the 600MHz Digital Dividend Review process. We believe that the significance of these issues to the commercial deployment of services within the 600MHz spectrum is such that they need to be addressed before the release process should be initiated. Finally, we wish to reiterate the high demand that we are seeing for DTT services, which we believe is sustainable over the long term and supports the need for this spectrum to be available to facilitate more DTT services, enhanced consumer services, and healthy competition between TV platforms in terms of enhanced technical capability.

Digital dividend: 600 MHz band and geographic interleaved spectrum

Consultation on potential uses

Response to consultation questions

Question 1: Do you have any comments on the application of the protection clause to all new licences for the 600 MHz band and geographic interleaved spectrum?

Arqiva agrees that the application of the protection clause consistently to all new licences for the 600 MHz and geographic interleaved (GI) spectrum will have advantages over a more fragmented approach. This will be simpler and clearer than applying it only in certain cases, and its universal application should not apply any additional restrictions to stations co-sited with DTT that might otherwise have been excluded under the original June 2008 Ofcom proposals. Nevertheless, it is important to acknowledge that every effort should be taken to ensure that disruption to DTT services is avoided in order to protect the services to the viewers and the overall integrity of the platform.

It will be important for the protection clause to take account of the DSO plan as it will be after the clearance of channels 61 and 62, even if some spectrum were to be made available before the clearance process had completed.

As well as DTT services, transmitters for mobile TV, not co-sited with DTT, and wireless base stations or mobile terminals must be covered by the protection clause in the same way, to avoid hole-punching and other interference issues.

Nevertheless, although the idea of a protection clause to augment the use of SURs does at first sight appear to be a reasonable way of protecting DTT coverage, as yet there are many unanswered questions as to exactly what levels of service will be protected and by what means they will be protected.

Post-DSO broadcast services will be sharing spectrum with GI services that may or may not be co-located with DTT services, along with white space devices. In addition to these interference sources directly within the broadcast bands, broadcast services, which previously have been well removed from adjacent services with significant interference potential, will potentially be subject to interference from new services in the cleared 600 MHz and 800 MHz bands.

Terrestrial broadcasting in the UK has never previously had to share spectrum with another ‘high power’ user, but all this is about to change. At the end of DSO, broadcasters will have to share their spectrum with various third parties occupying the same spectrum (GI and white space devices) or which are immediately adjacent (services in the 600 MHz and 800 MHz bands). Whereas, previously, broadcast planners have had complete control over the spectrum they used and could thus manage and control interference, post-DSO protection of broadcast services will be solely down to a set of rules that will be

implemented by third parties with no interest in protecting broadcasting beyond what is mandated by those rules, and whose main objective will be to minimise their costs. To this end we would encourage Ofcom to ensure that the protection of the DTT platform is managed (at least jointly) with the Multiplex Licence Operators through funding provided by the Mobile Networks Operators or Ofcom.

Access to spectrum is recognised as important for the development of the 'digital economy'. However, this access cannot be unfettered and both broadcaster investment and viewer choice will need to be protected. It is thus very important that the rules implemented to protect DTT draw the correct balance between allowing new applications access to spectrum whilst fully protecting existing DTT services. As such, to extract best value from the spectrum, planning rules will have to be far more sophisticated than those presently employed.

A better definition of DTT coverage is required that recognises broadcaster investment, viewer choice and the need to provide national services. This definition of coverage also needs to recognise that although 1.5% of households will be officially classified as not receiving a PSB service and 10% will not officially be covered by a Commercial service, many of these viewers will be watching what they consider to be an adequate and usable service as their main (or only) source of television, and this will need to be protected.

In assessing the impact of interference, a distinction needs to be made between continuous and time varying interference, and the number and type of channels impacted. Long-distance interference that is only present for short periods of time, whilst annoying, is more tolerable than a continuous source of interference that eliminates a service on a continuous or near-continuous basis. This has been borne out by the relative levels of viewer complaints received during the DSO process. Digital services, whilst tolerant of interference, have a very abrupt failure mode – this must be recognised in planning and protection, especially when margins are eroded.

The extent of predicted DTT coverage is based on the final broadcast network with appropriate allowance for interference from Irish and Continental broadcast services. The viewers' perception of DTT coverage is what is available to them at the time of digital switchover. These scenarios establish the baseline for DTT coverage and both are prior to the introduction of any additional services resulting from the Digital Dividend awards. At each location, a viewer will have a reception margin that varies with time. Protection of DTT will be based on understanding how this margin can be eroded, taking into account time and location variability, without unduly affecting the reception of a service.

The introduction of new GI, white space or adjacent band services will erode the margin in all cases. There is a danger that whilst each new service in isolation may not cause a noticeable problem, the combination of all services will. The rules for protection of DTT services must recognise this accumulation of interference from different sources.

The protection clause must require those causing interference to use all reasonable endeavours to minimise damage to existing DTT services. Where damage cannot be avoided mitigating measures must be supplied, and it is important that these measures are applied proactively and not reactively.

Supplying mitigation reactively will not provide sufficient protection to DTT. The coverage of the DTT network is limited by long distance interference and the network is designed to cope with interference resulting from enhanced propagation conditions for 99% of the time. The introduction of new services, which may appear at first sight not to impact a DTT service, will result in a reduction in the time availability of the service due to the eroded margin.

A viewer may not suffer any interference at the time of introduction of a new service and it may be many months before propagation conditions are such that interference is apparent. The question will then be whether the interference is due to anomalous propagation conditions or to the new service, since both will be present – not a question a viewer will be able to answer. As a consequence, interference caused by the new service may not be reported as such; broadcasters will not meet their coverage targets and viewers will suffer a degraded service. Because of the nature of the DTT network, the only way broadcasting can be protected is to apply mitigation proactively to ensure that time availability is not reduced.

As Ofcom indicates, more details of the method for applying the protection clause need to be developed before it can be fully appraised. The point at which mitigation is required and the type of mitigation employed both need to be decided in consultation with the broadcasters. It has already been identified that filtering cannot provide a solution for viewers in all circumstances, and the notion of transferring the more extreme cases to an alternative platform will directly impact the business model for commercial broadcasters relying on DTT coverage, whilst PSB broadcasters will not meet their 98.5% DTT coverage obligation. Ofcom's stated aim is that any new services should not impact existing DTT, and this principle must be adhered to in full.

Question 2: Do you have any comments on our approach to technical licence conditions for the 600 MHz band and geographic interleaved spectrum?

The protection of DTT coverage from mobile transmitters potentially operating in the 600 MHz band is a difficult issue.

The success (or otherwise) of the SUR approach will depend on detailed proposals that have yet to be put forward. Arqiva agrees that the application of a substantial minimum frequency separation between services of unlike types will be essential, and would welcome further consultation and discussion on this issue. The approach of using a minimum guard band of 8 MHz appears to be a satisfactory approach in many cases, but we note that for FDD uplink or TDD wireless transmissions this would need to be increased to 16 MHz, as detailed in Ofcom's June 2008 consultation document.

Because of the problems involved in controlling interference on a nationwide basis, Arqiva believes that GI spectrum will only be suitable for mobile use if tight protocols can be implemented to prevent harmful interference being caused, by preventing operation of the mobile device co-channel with, or closely adjacent to, DTT services in or near to any area in which it might be required to operate.

The SUR for new DTT services would need to allow for a network of similar design and with power levels similar to those in the post-DSO network. The SUR for DTT at the band

edges (for instance adjacent to other DTT services) should not differ from that applied to other 8 MHz blocks in the 600 MHz spectrum. In particular, we do not think that this SUR should be derived from the additional constraints in the spectrum masks defined in Ofcom document IR2022 for band-edge channels. These additional constraints are unnecessary, and any interference considerations can be dealt with by the proposed protection clause.

Question 3: Do you have any evidence using frequency offsets with DVB-T2 EC signals might have an adverse impact on uses of adjacent interleaved spectrum?

Although offsets, whether for DVB-T or DVB-T2, will cause an increase in the noise floor for adjacent spectrum, in the vast majority of cases this will have a negligible effect on DTT coverage. In the past their use has been assessed entirely within the broadcast domain under which any potential impacts could be clearly identified and service availability maintained.

Whether or not offsets are applied, the use of extended carrier (EC) mode with DVB-T2 should continue to be permitted as it provides a valuable additional resource in the form of 2% additional capacity, which provides a direct increase in spectral efficiency and as such is to be welcomed by all broadcasters. Although DVB-T2 offsets with EC mode must have some potential for adversely impacting adjacent interleaved spectrum, we do not think that offsets should be disallowed as they can have value in a number of cases, such as enabling the use of adjacent channel re-broadcast links, which can outweigh any minimal loss of availability in the adjacent spectrum.

The primary, but not the sole, reason for the use of offsets is to comply with the requirements laid out in Ofcom IR2022 for band edges. Arqiva believes there is a strong case for reviewing IR2022 with the aim of removing the requirement to offset at band edges, even if a DTT service uses a non-critical mask. We would welcome the opportunity to discuss with Ofcom the results of our technical investigations into this issue.

Going forward, other technologies may be sharing the UHF spectrum and the use of offsets should therefore be discouraged where they are not essential, in order to minimise adjacent channel noise. However, where offsets have already been implemented with no noticeable DTT impact we see no reason to change them retrospectively, for either DVB-T2 or DVB-T. In the other direction, out-of-channel noise from any such adjacent new services will need to be assessed similarly, to ensure that the availability of existing DTT services remains fully protected.

Question 4: Do you have any evidence mobile services using the 600 MHz band and geographic interleaved spectrum could cause harmful interference to cable television?

Although Arqiva is aware that interference between mobile terminals using the UHF spectrum and cable systems in the same frequency band is a cause for concern, we have no direct evidence to quantify the extent of any problems that might exist.

Question 5: Do you have any comments on protecting PMSE in channel 38?

As discussed in the response to question 3, the impact of offsets on adjacent spectrum is negligible in the vast majority of cases, to this end where they are shown to be

unnecessary their use could be avoided in regions where DSO is yet to take place. This applies directly to offsetting band-edge channels 37 and 39 with the aim of providing additional protection to PMSE services, as any offsets applied will have knock-on effects to other DTT or cleared spectrum channels.

PMSE currently co-exists with broadcasting, without broadcasting adopting any special measures to protect PMSE. This situation should continue, and where DTT services use either channel 37 or 39 they should not have any offset requirements or additional filtering demands placed upon them beyond those required by a non-critical mask. The only constraint that needs to be applied to these channels is they must not be offset towards channel 38.

Question 6: Do you have any comments on non-technical licence issues and the way we propose to approach them.

Our response to this question focuses primarily on technical interoperability between any new and existing DTT services, as detailed below, but we also note concerns with regard to the limited initial licence term and the challenge that this poses in terms of economic deployment of new services into this spectrum, as emphasised in our response to question 10.

Arqiva (and National Grid Wireless) presented views on the interoperability of new DTT services in their responses to the June 2008 consultation on the cleared spectrum.

We agreed with Ofcom's facilitation approach to interoperability but stated our belief that Ofcom should mandate and not just facilitate certain aspects of interoperability between existing DTT multiplex operators and new operators to protect existing services. Specifically, we commented that Ofcom should mandate interoperability with respect to some essential navigation elements of Service Information such as:

- The Logical Channel Number (LCN); and
- Original network, transport stream and service identifiers.

Co-ordination should just be facilitated for other technical aspects such as:

- The participation in the common DTT platform electronic programme guide (EPG); and
- The cross-carriage of non-essential service information (SI) elements such as Service Description Table (SDT), Network Information Table (NIT) and Event Information Table (EIT).

Since the UK DTT platform relies upon the careful management of complex SI to ensure that receivers operate correctly and provide users with fair and equal access to all services on the platform, unregulated use of SI by new operators could provide an environment in which the behaviour of receivers might be affected in ways that would create disruption to consumers.

Regarding participation in the common DTT platform EPG and the cross-carriage of non-essential SI elements such as SDT, NIT and EIT, we believe that ‘light touch’ regulation

through the role of facilitator would be appropriate, as it would allow operators to develop innovative and cost-effective service offerings.

Finally, we noted that for new technology standards such as DVB-T2 and MPEG-4 Ofcom should ensure that the adoption and introduction of technical enhancements should be undertaken in a controlled way such that their introduction does not negatively impact the operational integrity of the existing horizontal platform, to avoid confusing and disenfranchising consumers.

Question 7: Do you have any comments on our assessment of the most likely uses of the 600 MHz band and geographic interleaved spectrum? Are there any potential uses we have not mentioned that should be considered?

Arqiva believes that DTT and (to a lesser extent) mobile TV are the most likely uses of the 600 MHz band. Mobile broadband, although technically feasible, would appear to be of limited commercial relevance, as there is no harmonised European approach for this band or standardisation of equipment, and this would result in inefficient spectrum use. Other countries in Europe are using (or proposing to use) this spectrum for DTT. The guard bands required to separate mobile broadband (in particular, the uplink) from DTT usage will place additional constraints that would make it difficult to create a viable band plan for mobile broadband (especially for FDD). It should be noted that guard band issues would also apply to mobile TV use of channels in the 600 MHz band, and for that reason we do not consider that the use of channel 36 for mobile TV would be consistent with efficient spectrum use.

We agree that the 600 MHz spectrum is an opportunity to accelerate the use of DVB-T2 and MPEG4, to the long term benefit of the DTT platform and overall spectrum efficiency. This is consistent with the EC proposal on the Digital Dividend.

Although the band plans shown in Figures 7, 8 and 9 of the Ofcom consultation document are described as ‘illustrative’, we have some concerns over the technical basis for them. In particular:

- 1 MHz guard bands are shown between adjacent DTT services and at the band-edges alongside existing DTT services. None of these are necessary for co-located DTT services. As a result, many of the DTT channels are shown in the 600 MHz spectrum as only 7 MHz (or even 6 MHz) wide.
- Where there is a DTT service in channels 31 to 37 which is not co-located with adjacent DTT services, such as would be the case for a DVB-H mobile TV service, there will need to be a suitable guard band. Ofcom originally proposed 5 MHz in its June 2008 consultation document, but we note in the June 2009 statement on clearing the 800 MHz band that Ofcom then proposed not to implement this between mobile TV services and new DTT services. We believe that the successful commercial operation of such services without a guard band is questionable.
- A 5 MHz guard band was also proposed between FDD downlinks and mobile TV services, but this is not included in any of the band plans.

- None of the wider guard bands (from 10 MHz to 19 MHz) proposed by Ofcom for FDD and TDD uplinks are implemented in the band plans.
- The application of a 1 MHz guard band between FDD uplinks and PMSE is inconsistent as it is not shown in all situations.
- It is possible that PMSE would need protection from mobile uplink services, but apart from the 1 MHz referred to above none is included.

In all cases it is clear that the use of guard bands between different service types in the 600 MHz spectrum would result in inefficient spectrum use. Furthermore, there would be additional need for protection via guard bands to protect the adjacent existing DTT services if alternative technologies were to be deployed, further exacerbating limitations on the usable spectrum for the new services.

It is noted also that FDD downlinks are separated from existing DTT services by a 1 MHz guard band, and these would therefore be subject to the proposed protection clause to avoid interference to those services, consistent with the approach being taken for the 800 MHz band. As noted earlier, the principle of new services not causing interference to existing DTT services must be adhered to in full.

With regard to likely spectrum use, the likelihood of success of a communication or broadcast technology is dependent on harmonisation of its use across a large region such as Europe or the United States. A single small country in isolation, such as the UK, does not represent a large enough market to provide the economies of scale and investment needed to successfully bring a new technology to the mass market.

At present, other than for broadcasting, there are no known plans or technologies targeted for use in the 600 MHz band across Europe. Only two administrations, the UK and Ireland, are known to have plans to free spectrum in the 600 MHz band and to date there have been no clear proposals for the use of this spectrum beyond broadcasting.

Question 8: Are there any distinctive considerations and uses for this spectrum in the nations and regions of the UK?

The maximum overall value to the UK of the 600 MHz spectrum will be derived from its availability on a pan-UK basis, and any subsidiary use within the nations would detract from that value. As the Arqiva and National Grid Wireless studies commissioned by Ofcom have shown, the use of specific GI channels in Scotland and Northern Ireland could provide effective networks in these nations, should there be a commercial case (or devolved government funding) to enable it.

Although the impact on GI spectrum from the clearance of channels 61 and 62 (and also the MoU with the Irish Republic for Irish services in the North) will affect the coverage achievable, additional services for the nations should still be possible. It has already been established that similar services for England and Wales will not be possible using GI spectrum, although channel 51 is co-ordinated at Wenvoe and could be used across the whole of South Wales and parts of central and West Wales. There would be no need to use 600 MHz cleared spectrum to support such services in any of the nations.

Scotland in particular has been seeking a platform for locally generated content and news. Arqiva believes that such a need could be met by national multiplexes as described by Ofcom. In Northern Ireland, the quality of available spectrum is such that both the required Republic of Ireland and additional Northern Irish services could be carried on the same multiplex.

However, if a case is not established for such services in the nations in the approach to the spectrum auctions, then the GI channels suggested for these (as modified by channel 61 and 62 clearance requirements) would form a valuable addition to the GI spectrum package in terms of additional channels, and should be included within it.

This discussion can be extended to the use of GI spectrum for local television services. Although the commercial viability of such services is, in the main, unproven, there may still be a certain level of demand for local services as noted by Ofcom. However, we believe that these can be provided effectively using spectrum that Ofcom originally included in its 'medium' and 'small' GI lots, so there would be no reason to reserve 'large' lots of GI spectrum specifically for this purpose. This again would have the effect of enhancing the value of the GI spectrum package overall. Local television demand could be satisfied by the auction of specific local GI channels on demand (as was achieved for the Manchester and Cardiff areas).

Question 9: Do you have any comments on our continued inclusion of channel 36 in the award of the 600 MHz band?

We agree that the separation of channel 36 from the remainder of the 600 MHz spectrum would now distort the outcome of the main award, and think it unlikely that any failure to acquire this channel in order to implement a high value use of the 600 MHz band would be remedied by any subsequent secondary trading 'on a mutually beneficial basis'.

We also agree that the demand for mobile TV spectrum appears to have dropped significantly since 2007, and with the potential release date for channel 36 now being much closer to that for the remainder of the 600 MHz spectrum we can see no justification for its early auction. Arqiva therefore supports channel 36 forming a part of the main auction process. Further discussion is included in our response to question 11.

Question 10: Do you have any comments on our intention to maintain a market-led approach to awarding the 600 MHz band and geographic interleaved spectrum?

We acknowledge Ofcom's proposal to adopt a market-led approach for the award of this spectrum, but we encourage Ofcom to be pragmatic in terms of the design of any such award. As noted in our response to question 7, we believe that the predominant application for this spectrum is the provision of more Digital Terrestrial Television and hence we would encourage Ofcom not to overcomplicate the award design in an attempt to accommodate applications that have little commercial likelihood of being deployed.

In addition, we note the challenges and uncertainties that face the relevant parties in terms of actively competing in any such award. In particular we are concerned that:

- The timing of an award in 2011 is poor in terms of the economic cycle and relevant parties would struggle to co-ordinate an appropriate challenge for the

spectrum. Furthermore, the financial markets are 'tight', access to capital is limited and this situation is likely to persist, directly impacting the extent to which entities will be able to engage in any award process over the short-to-medium term.

- Ofcom's plans to clear and release this spectrum to market are inconsistent with the plans of other European Member states, where this block continues to be used for broadcast purposes. Furthermore, it may prove advantageous to consider the outcome of the World Radio Conference in 2012 in light of the release of this spectrum. It may therefore be inappropriate to award this spectrum before there is greater clarity on its long term availability and purpose.
- The European Union's plans to better co-ordinate spectrum use may have a direct bearing on the long term availability of this spectrum for broadcast purposes and we would be encouraged if that were the case, particularly in support of the deployment of more DTT services.
- The initial term ending in 2026 is a key limiting factor in the deployment of new network infrastructure to support services in this spectrum. Greater clarity is needed as to what happens to this spectrum right post-2026 – i.e. might the existing DTT spectrum plan be re-organised to enable further clearance and re-allocation of spectrum? Such an outcome would require considerable additional investment in network infrastructure and challenge the economics of service provision post the 2012 award and prior to 2026.

Discussions are under way with regard to the clearance of the upper block spectrum and protection of existing Digital Terrestrial Television services. We actively support Ofcom in this initiative, but note that whilst uncertainties exist with the protection arrangements for existing DTT services spectrum release should not be agreed.

Question 11: What information can you provide on packaging and award design considerations?

The packaging of 600 MHz cleared spectrum and GI spectrum needs to be given separate consideration, but Arqiva's view is that they would most usefully be offered to the market in a combined auction. In effect the GI spectrum would be another 'block', albeit allocated on a regional basis, which would be a valuable addition to the cleared spectrum channels should a bidder wish to acquire it. As noted in our response to question 7, we believe that the most commercially attractive and efficient use of this spectrum is the deployment of additional DTT services. To this end we encourage Ofcom to select packaging and award design arrangements that easily facilitate an auction outcome that allows two UK-wide multi-frequency DTT networks to be deployed, thus achieving what we believe to be the optimum outcome from this award process. Generic lots are not appropriate for DTT network planning and should be avoided.

In its June 2008 consultation document, Ofcom proposed that cleared spectrum lots in the auction should be available in various combinations of both 8 MHz channels (to suit DTT and Mobile Media Services, MMS) and 5 MHz channels (to suit wireless services). Arqiva is of the opinion that this would give rise to an over-complicated auction process, and that

there are good reasons for auctioning the spectrum in multiples of 8 MHz only, as discussed below:

- Each of the 8 MHz television channels has its own specific template restrictions due to co-ordination under GE06 and subsequent international negotiations. To have Digital Dividend channels that overlap these channel boundaries would require two sets of restrictions to be observed since our Continental neighbours will continue to use the 600 MHz spectrum for DTT, and this would result in inefficient spectrum use in some geographical areas.
- Clearly, 8 MHz channels would suit new DTT services. If, in the unlikely event that MMS services were to be deployed, 6 MHz channels can be used for both DVB-H and MediaFlo, which would ideally suit 8 MHz auction channels when including a 1 MHz guard band at each boundary.
- For other wireless technologies such as LTE and WiMAX, there has been a preference for 5 MHz channel multiples. This lends itself to the use of pairs of 8 MHz channels, where three blocks of 5 MHz could be accommodated with a 1 MHz guard band separating these services from adjacent technologies such as DTT. However, LTE, which currently seems to be preferred technology for Telco operators, can make use of smaller sub-multiples that can efficiently be tailored to most channel widths. 8 MHz channels would therefore not present a problem. Nevertheless, as noted in our response to question 7, we do not believe that these types of services would either be commercially attractive or spectrally efficient.
- For technologies that do actually require a 5 MHz channel, a single 8 MHz channel might be seen as inefficient use of the spectrum. However, a single channel used in this way would need guard bands between it and adjacent services of different technologies, so the 8 MHz channel would in effect be efficiently used.
- PMSE services, being low-bandwidth applications, can fit into channels of almost any width and are therefore suited to 8 MHz channels. It is believed that no guard bands outside PMSE channels will be required to protect PMSE services.

The consultation document suggests that individual spectrum requirements may lie anywhere between 8 MHz and 48 MHz. Although the above considerations would allow for any of these spectrum bandwidths, Arqiva believes that the technology boundary issues resulting from the auction of small blocks of spectrum (e.g. as small as 8 MHz units) would lead to inefficient spectrum use if mixed technologies were to be deployed.

The above reasoning for 8 MHz blocks does not attempt to take into account the issues raised in the response to question 7 above regarding the actual guard bands that will need to be implemented, whether on a regulated or a ‘voluntary’ basis, to allow mixed technologies to share the 600 MHz spectrum. However, this is something that will need to be considered for any mixed use of the spectrum to achieve efficient usage.

Each of the Digital Dividend channels has its own specific characteristics due to international co-ordination, as noted above. Channel 36 could be seen as a slight exception since it is not co-ordinated for UK use under GE06.

However, the most important characteristic defining channel 36 was originally that it would be available several years in advance of the other 600 MHz spectrum, and could be used for the early deployment of new services such as MMS. As noted in the response to question 9 above, we no longer see this as an important consideration and we believe that channel 36 should be auctioned with the other 600 MHz channels.

Working on the basis of 8 MHz channel multiples, the packaging of these in the auction process then needs to be considered. For any technology used, it is desirable to have contiguous blocks of spectrum to minimise boundary issues.

Because of the individual channel characteristics specific to DTT deployment, generic lots should be avoided for this award as it will be highly desirable for bidders to be able to choose individual groups of channels that best suit their needs. For DTT use, it was shown in the Arqiva study of March 2009 that 3-channel MFN blocks comprising channels 31, 32, 33 and 34, 35, 37 might achieve a maximum DTT coverage of 93.16% and 91.68% respectively from 97 sites, assuming the use of post-DSO PSB antennas and similar power levels to existing services.

Question 12: When would you like to start operating new services using the 600 MHz band and/or geographic interleaved spectrum?

As noted in our response to question 10, we believe that there are considerable uncertainties with the long term availability of this spectrum which will need to be addressed before an effective award process can be undertaken. Most notably, we believe that the timing of WRC-12 and European Union plans for greater spectrum co-ordination are key reference points in terms of providing greater certainty with regard to the long term availability of this spectrum for broadcast purposes. We believe that this would lead to the appropriate timing of an award process being scheduled towards late 2012 or into 2013, and this timing would be consistent with the timing of 600 MHz spectrum clearance and its availability for new service deployment.