Review of spectrum fees for satellite and fixed links services

About Arqiva

Arqiva is a communications infrastructure and media services company operating at the heart of the mobile and broadcast communications industry. Arqiva provides much of the infrastructure behind television, radio, mobile and other wireless communication in the UK.. We are at the forefront of network solutions and services in an increasingly digital world. We provide much of the infrastructure behind television, radio and wireless communications in the UK and have a growing presence in Europe.

We are active in the telecommunications sector, providing access to over 8,000 sites and infrastructure for mobile phone operators. We are building and running a national Internet of Things ("IoT") network, which is now live, starting with 10 of the UK's largest cities. In addition, our smart metering communications service, connecting 10 million homes using long-range radio technology, will be one of the UK's largest machine-to-machine deployments. This will require sites across northern England and Scotland.

Arqiva is a founder member and shareholder of Freeview. We broadcast all eight Freeview multiplexes and are the licensed operator of four of them. We own Connect TV, the first company to launch a live IP streaming channel on Freeview. In terms of radio delivery, we are the licensed operator of Digital One – the national commercial DAB digital multiplex.

Arqiva is a major player in the UK's satellite communications business, operating over 80 antennas to geostationary satellites, providing telemetry, tracking and command support services to some of the leading satellite operators. We are a major provider of permanent satellite services to both Freesat and Sky customers. We also provide global satellite based services to the broadcast, communications, security, oil/gas, and exploration sectors, using our five UK teleports as well as facilities in the Middle East, Asia and the Americas. Our satellite customers include Turner and NBC.

Our other major customers include EE, BT, H3G/Three, Telefónica/O2, Vodafone, BBC, ITV, Channel 4, Five, Sky, Classic FM, Airwave, Heathrow and Premier Inn.

Arqiva is owned by a consortium of long-term investors and has its headquarters in Hampshire, with major UK offices in London, Buckinghamshire and Yorkshire and operational centres in Greater Manchester, West Midlands, and Scotland.

A. Overview

Arqiva welcomes the opportunity to respond to the Ofcom Initial Consultation on spectrum fees for satellite and fixed links services. We are grateful to Ofcom for the transparent approach it has adopted in this project, inviting informed views of its stakeholders as it seeks to form views at an early stage of policy development.

We have significant reach as a terrestrial and satellite infrastructure provider with our customers operating at both a domestic and at a global level. Accordingly, and as a licensed provider of fixed link and of satellite services, we have a clear interest in any future proposals in this area.

Ofcom is aware of the profound concerns that satellite operators have over the principle of applying administered incentive pricing (AIP) to this sector. In particular, due to the characteristics of satellite systems, AIP implemented at the national level is not an effective incentive for efficient use of spectrum. Furthermore, this approach bears no relation to the economics of satellite businesses meaning that crippling fees could be introduced. This could lead to uncertainty about return on investment, stifling innovation and harming current services. Where alternative uses of spectrum are considered, such an approach could also undermine international harmonisation of spectrum, which is essential to satellite services.

That being said, we recognise that Ofcom has confined itself to the narrower issue of how to revise the AIP charges that are already in place, taking into account changes to the approach to service delivery as it relates to spectrum use. However, in the event that changes to AIP fees are considered appropriate then it is important to ensure that such fee changes are based on the best information available to Ofcom.

Our principal concern with the approach as set out in this Initial Consultation is the direction of travel as it relates to future of satellite use of the 3.6-3.8 GHz band. While we acknowledge that there are *some* moves toward harmonisation in this frequency range for mobile use, there remains substantial uncertainty in the international process in terms of the extent to which this will be harmonised in reality.

In addition, we also note Ofcom's long-established policy of using conservative assumptions when calculating opportunity cost fee levels based on alternative use. The report from Plum Consulting does not appear to be consistent with such a conservative approach in this band.

We are keen to continue a dialogue with Ofcom to ensure it is aware of the challenges of implementing mitigations in response to increased fees in the 3.6-3.8 GHz frequency range. AIP is explicitly a tool to send long-term signals to spectrum users so that they can consider measures to use this resource more efficiently.

Our second key interest is the spectrum at 28 GHz, of which Arqiva is already a licensed fixed link operator and also intends to be satellite user from 2016. On this issue, we are broadly supportive of the conclusions that are being drawn by Ofcom – namely that whilst demand for satellite broadband services may drive an increase in demand for this spectrum,

the nature and extent of this increase is too uncertain to merit any increase in AIP levels for some time to come. In this respect, we welcome Ofcom's initial approach of erring on the side of caution in setting AIP fees.

On the broader question of other fixed links and satellite spectrum, we question whether demand for this spectrum is actually increasing and, as such, warrant higher fees. For example, Ofcom's recent annual report[1] suggests that fixed link licence numbers have decreased by 25% in the last 6 years. In that context and given Ofcom's long-standing approach of setting AIP conservatively, we are surprised that a 10% *increase* in fees for fixed use below 20 GHz has been suggested.

[1] http://www.ofcom.org.uk/content/about/annual-reports-plans/1262041/annual-report-14-15/annual-report-14-15.pdf, Annex G

B. Responses to questions

Question 1: Do you agree with Plum's view of the potential higher value alternative mobile use of the 3.6-3.8 GHz band over the next seven to ten years?

We note Plum's view that the value of the frequencies between 3.6-3.8 GHz is likely to have a higher value over this timescale stipulated. However, we are unclear that the case for this has been persuasively made. Moreover, even if the case *had* been more clearly made, we are sceptical over the magnitude of the suggested increase for satellite use of this spectrum (a twelve-fold increase) as suggested by Plum on page 61 of its report *Support to Ofcom's review for fixed links and permanent earth stations.* This is for two reasons:

1) There is still significant uncertainty on what the demand will be for this spectrum and what the appetite would be for using it on an international basis; and

2) Historically, harmonising these frequencies at an EU level has led to very limited interest in deploying services. Indeed, the most prevalent examples of spectrum being returned to the regulator because of technology and market demand not emerging as expected by operators are in the adjacent 3.4 GHz band. Decision 2008/411/EC harmonised the conditions for availability and use of this band. That Decision led to these frequencies being made available across the EU for ECS, with an expectation that mobile services would be deployed across Member States. There were, however, a number of instances where operators were awarded spectrum in the 3.4 GHz band but then did not deploy networks and provide broadband services as they had expected.

Moreover, we note the established Ofcom approach to AIP of setting fees conservatively in the first instance, especially where they are based on alternative use.[2] We would certainly question its characterisation of the figure £1,095/2x1 MHz being "a very conservative estimate of the value of the spectrum for mobile use".

That being the case, we would urge Ofcom to await the result of auction results across the EU before considering any firm proposals on this band.

We are also concerned that Ofcom may not appreciate the challenges inherent to industry in mitigating higher spectrum fees in the 3.6-3.8 GHz band. For example, in paragraph 4.10 of the Initial Consultation it says:

> *Increased use of the 3.8-4.2 GHz band and higher frequency ranges will probably mitigate this* [mobile use of the 3.6-3.8 GHz band]

[2] http://stakeholders.ofcom.org.uk/binaries/consultations/srsp/summary/srsp_condoc.pdf Paragraph 3.125

This exposes a mistaken belief that ground segment operators can request from the satellite operators downlink frequencies above 3.8 GHz. There are two reasons why this mitigation may not be available:

- Satellite operators are typically now flying 3.625 to 4.200 GHz payloads, i.e. 575MHz in total to satisfy recent growth in demand. There simply is no spare capacity either above or below 3.8 GHz; and

- With most current satellite systems, the downlink and uplink frequencies are pre-determined by the beam routing of the connection. Any request for only using frequencies above (say) 3.8 MHz may be impossible in certain routings.

Even it were possible to use only those frequencies above 3.8 GHz for satellite downlinks, the effects on the receive performance of transmit/receive systems is not negligible. This is due to out-of-band compression effects, where the presence of energy below 3.8 GHz (even as low as 3.4 GHz) raises the operating level of the Low Noise Amplifier, closer to the 1dB Compression Point, causing an overall noise floor to rise. This is our experience based on measurements at our teleports. While the fitting of filters is possible, the reality is that roll off between pass band and stop band is not a cliff edge. Therefore, there will always be some impact due to terrestrial links the other side of the defined cut off frequency.

With Ku-band, there is already significant congestion in the conventional C-band, i.e. downlink frequencies 3.7 to 4.2 GHz. In recent years, we have seen more satellite operators flying payloads in “extended C-band”, i.e. an additional 75 MHz from 3.625 to 3.700 GHz. Recently, only frequencies in this lower band tend to be made available. Due to congestion in C-band it seems that, rather than conveniently consolidate to frequencies above 3.8 GHz, there is actually a need to use frequencies below 3.7 GHz.

We could consider a number of other mitigations but we note that Ofcom has not assessed the impact that some of these might have on fees (for example, whether any sharing arrangements with mobile services might lead to a reduction in AIP for satellite services). However, our observation at this stage is that mitigations present specific challenges that we consider Ofcom need to take into account when developing its policy. These include:

- Natural screening from tree planting – this would take a number of years to establish;

- Sunken pits – these come at significant expense and would require local authority planning permission and landlord consent; and

- Above ground screening includes fences and bunds – again permissions are necessary, as is locating adequate physical space.

Question 2: Do you agree with Plum's analysis of current and future demand for spectrum for fixed links? Please give your reasoning.

As mentioned above, there appears to be a disconnect with the falling number of fixed link WT Act licences and the suggested need to alleviate future congestion in bands below 20 GHz. We would suggest that Ofcom errs on the side of caution and maintains or reduces fee levels in this spectrum.

Question 3: Do you agree with Plum's analysis of current and future demand for spectrum for PES and TES? Please give your reasoning.

Ofcom has correctly identified the Ka band as having the potential for increased demand within the coming ten years. However, the satellite industry is quite concerned about being able to match current levels of service availability due to increases in water vapour absorption at these shorter wavelengths. Nevertheless, new High Throughput Satellite (HTS) constellations are being launched that potentially offer up to 20 times more speed and between 10 and 100 times as much capacity as conventional satellites. HTS is, in theory, applicable to Ku and C-band too.

The vast majority of 180 satellite launches, expected between 2016 and 2020, are likely to fully or partially adopt HTS technology. Lower cost (per Mbps) will generate intense interest and demand from existing and new satellite data users, both B2B and consumer broadband providers. By the early to mid-2020s, we expect the GEO HTS market to have increased significantly.

However, the introduction of HTS, particularly at Ka-band, is a longer term prospect and it is unclear, at this stage whether it will provide ubiquitous coverage.

Current Ku-band downlinks (10.7-12.75 GHz in region 1) allow for combining the FSS and BSS bands. However, this offers a maximum of 2.05 GHz per polarisation at ITU Region 1 orbital slots. Within these, between around 8 West and 36 East are already very heavily loaded and, in some cases, at saturation.

HTS at Ku-band may *appear* to resolve some congestion issues. The reality is that Ku-band capacity servicing Europe is delivered using frequencies on pan-European beams, limited by aperture sizes on board spacecraft. As a result, there is little opportunity for frequency reuse. In contrast, a similar total bandwidth at Ka-band is barely utilised at present, and would largely be provisioned on smaller spot beams than in Ku-band. This would allow multiple frequency re-use opportunities. Ka-band, therefore, offers the sector significant growth potential in an uncongested spectrum.

However, we agree with Plum that the extent of any such increase is very unclear at present and fees should be set at a conservative level to reflect that uncertainty.

Question 4: Do you agree with the approach taken by Plum to calculate the opportunity cost of the spectrum? Do you also agree that this methodology is likely to provide a more conservative estimate?
and
Question 5: Do you agree with that Plum has identified the correct options for its LCA analysis?

We agree that the approach taken by Plum is broadly sensible.

Question 6: Do you agree with the cost assumptions that Plum has used in its analysis? Please provide documentary evidence if you disagree.

We have no comment at this stage.

Question 7: Are there any pieces of publicly available evidence we could use to estimate the opportunity cost of the use of 3.6-3.8 GHz for mobile use now?

Because of the lack of relevant data available from awards in C-Band, any attempt to estimate the opportunity cost of this spectrum now is speculative at best. Clearly, and as stated above, it would make more sense to wait for the award of this band in the UK (at the very least) before a credible estimate can be made.

Question 8: Do you have any comments on Plum's suggestion to remove the path length factor?

We have no comment.

Question 9: Do you have any comments on Plum's suggestion to add a location factor?

We believe, as set out below in our response to question 14, that there may be some benefit in amending the algorithm to reflect the clear differences in service demand between urban and rural areas.

Question 10: What are your views on the need to revise the bandwidth factor in the fixed link algorithm?

We have no comment.

Question 11: What are your views on the benefits of additional incentives for the use of high performance antennas? How might these be implemented in our fees algorithm?

We believe that, in principle, there should be additional incentives for using high performance antennas. Increased investment in such antennas could be incentivised by lower spectrum fees.

Question 12: What are your views on the suggestion that we further consider ways to incentivize the use of automatic power control, a suggestion that we are minded not to take up?

We recognise the logic of automatic power control (APC). In particular, in the absence of APC, links could operate with significant margins, transmitting excessive power. Arqiva, for example, already deploys automatic APC (Uplink Path Power Control, “UPPC”) for many of its satellite services. This reduces the clear sky EIRP levels 10dB headroom at Ku-band and 5 dB at C-band

Question 13: What are your views on the proposed revisions to the PES algorithm and TES ratio? In particular, do you agree that we use the relative denial areas to reflect the opportunity cost between PES, TES and fixed links? Do you have any other suggestions for improvement?

We have no comment

Question 14: Do you agree that the benefits of implementing geographic pricing are sufficiently high to warrant us considering this further? Should we look at both where mobile is, and is not, an alternative use? Do you have ideas on how this could be implemented?

We recognise that there may be some benefits of implementing geographic pricing. In particular, we note Ofcom’s initial approach that this would be of particular relevance where mobile is deemed to be a higher value alternative use of spectrum. Clearly, the value of spectrum in urban areas will be higher than in less dense locations and this is likely to be particularly true for these higher frequencies (relative to the 800/900 MHz bands or, indeed, the 1800/2100/2600 MHz bands).

In that context, Plum’s suggestion that Ofcom could consider using larger grid squares (eg 100 km x 100 km) seems counter-intuitive to us. Areas that large would cover a multitude of greatly varying populations. Central London could be grouped with, for example, villages in neighbouring counties. We would assume that under those circumstances the rural locations would attract a fee based on its value to the urban centre.

Therefore, we suggest that Ofcom considers a greater level of granularity than that suggested by Plum and one which more truly reflects the actual value of the spectrum to mobile operators in specific locations. For example, with the 3.6-3.8 GHz band, the grid square reference should be compatible with the typical cell radios for a mobile cell

Question 15: Do you have any comments to make on any issues related to next steps and implementation?

On a process level, we have some concerns that Ofcom has launched two consultation processes almost simultaneously which are inherently linked but where no joined up approach is apparent. This Initial Consultation coincides with a Call for Inputs on *Strategic review of satellite and space science use of spectrum*. In a few limited areas, both documents ask similar questions, particularly on the issue of future demand trends (therefore duplicating effort from stakeholders). There are also other inevitable but unrecognised interchanges between them. For example, Ofcom may establish from the *Strategic Review* that a particular band will likely see a significant rise in satellite demand in the short to medium term.

With Ofcom being an evidence-based regulator, we could expect to see such evidence translate to a parallel increase in AIP fees for the same band within this Initial Consultation process (based on the established principle of own-use congestion).

Ofcom, therefore, needs to provide greater clarity for stakeholders as to how it intends to coordinate the inputs between these two projects.