Arqiva submission to Ofcom's consultation, *5G spectrum access at 26 GHz and update on bands above 30 GHz*

Arqiva is pleased to have the opportunity to respond to Ofcom's consultation, *5G spectrum access at 26 GHz and update on bands above 30 GHz*. Our principal interest in this consultation rests on consultation question 4.7 which asks:

> *What are the characteristics of 5G at 26 GHz which make this band particularly suited to the service you plan to deploy? What other spectrum bands could be used as an alternative, or in preference to, the 26 GHz band? To what extent could carrier aggregation and other techniques reduce your reliance on 26 GHz?*

We fully support the objective as set out by Ofcom and the Radio Spectrum Policy Group (RSPG) to promote the 26 GHz band for future 5G services. There are clear significant opportunities within millimetric spectrum to harness large bandwidths to provide high speed broadband data services. These opportunities offer the potential to deliver massive increases in Gbps connectivity through what is effectively a "wireless fibre" solution.

Millimetric spectrum offers real opportunities to develop wireless solutions to rival fixed broadband services, creating new channels of network competition. We set out within this submission details of the trial we are currently undertaking with Samsung, the purpose of which is to realise the potential offered by millimetric spectrum – in this case the 28 GHz band

About Arqiva

Arqiva is a communications infrastructure and media services company operating at the heart of the mobile and broadcast communications industry. Arqiva provides infrastructure for television, radio, mobile and other wireless communication in the UK.

Arqiva operates shared radio site assets throughout the UK working with the mobile industry for over two decades and with a significant presence in suburban and rural areas. Our portfolio includes over 8,000 active mobile, radio and television sites.

Arqiva worked with DCMS to build new shared sites in 'not-spots' as part of the Mobile Infrastructure Programme (MIP). We also extend the MNOs' coverage and capacity into challenging environments such as Canary Wharf and the ExCel Centre.

Arqiva is building a national Internet of Things ("IoT") network, starting with 10 of the UK's largest cities. Our smart metering service, connecting 10 million homes using long-range radio technology, will be one of the UK's largest machine-to-machine deployments.

Arqiva is a founder member and shareholder of Freeview. We broadcast all eight Freeview multiplexes, are the licensed operator of four of them. Arqiva is the licensed operator of both national commercial DAB digital radio multiplexes.

Arqiva is a major player in the UK's satellite industry, and is a major provider of permanent satellite services to both Freesat and Sky customers. Arqiva also provides global satellite based services to the security, oil & gas and exploration sectors.

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.

There is significant global activity in promoting the 28 GHz band for 5G

While we support the policy to promote the 26 GHz band for 5G, it is regrettable that Ofcom's consultation has entirely omitted reference to parallel ongoing UK and international developments in developing 5G in the 28 GHz band. We note, in that respect, that 3GPP are currently considering whether the 26 GHz band and 28 GHz band should be treated as one single band in Release 15.

While this does not prevent either us or other stakeholders from pursuing a 28 GHz 5G strategy, it does make it more difficult to align that strategy with 26 GHz developments at a regulatory level. It would be helpful, for example, if regulatory consideration was given to the best future approach for releasing large contiguous bandwidths in the wider millimetric spectrum. This could be achieved, for example, by adopting a TDD configuration as opposed to the FDD arrangement in the existing UK 28 GHz licences.

Ofcom's current approach of focussing solely on the 26 GHz band, therefore, risks undermining potential significant benefits of a joined up approach to making *both* bands available for future 5G services. Ofcom will be aware that the 28 GHz band is being developed across a number of markets. On the back of various industry players conducting trials in the 28 GHz band, regulatory steps are ongoing to promote this spectrum for 5G, such as:

- Japan's Ministry of Internal Affairs and Communications identifying the 27.5-29.5 GHz range as a 5G band in July 2017;
- The United States FFC Spectrum Frontiers proposal of July 2016 to, amongst other things, create a 5G band between 27.5 and 28.35 GHz. (There are advanced plans by Verizon to roll out fixed wireless services in this spectrum, expected in 2018);
- Canada's Ministry of Innovation, Science and Economic Development consulted on 5G spectrum in June 2017, identifying the 27.5-28.35 band;
- South Korea regulators are planning to release spectrum between 26.5 and 29.5 GHz in two waves starting in 2018; and
- Hong Kong's Communications Authority issued a 5G work plan in March 2017 identifying the band 24.25 to 28.35 for future 5G spectrum.

According to OECD figures, these five markets alone account for approximately one third of global GDP. This should, by necessity, figure in UK policy decisions on how best to exploit 5G spectrum opportunities in millimetric spectrum.

Elsewhere, there are signs of that the 28 GHz band is of growing interest to industry as a future 5G band, for example. For example, Australian operator, Telstra, has announced that it will be trialling 5G technology using 28 GHz at its Commonwealth games in 2018.

As a result of these developments, 5G fixed wireless services will be available in the 28 GHz band in a number of the above countries long before the ITU process has even confirmed the 26 GHz band for 5G identification in WRC-19. This raises a number of questions as to whether the existing WRC cycles are flexible enough to meet the needs of industry, especially as it evolves towards more advanced generations of wireless data provision. Linked to this, we would argue that the UK risks missing the bigger picture by focusing solely on the ITU regulatory process while disregarding actual market developments notably the work at 3GPP.

These market developments include, of course, Arqiva's own ambitions to provide 5G fixed wireless services using our national 28 GHz spectrum licence. Our ongoing trial with Samsung is the first of its type in Europe, revealing the potential of next generation connectivity which will include high data rates (~1Gbps), low latency and the ability to connect multiple devices. This will highlight the potential of using 5G FWA as an effective alternative to fibre connectivity in homes and businesses.

This should matter to Ofcom as we are the holder of the largest quantity of licensed 28 GHz spectrum in the UK and one of only two national licensees (the other being Three.) Indeed, we are grateful to Ofcom for its constructive engagement in supporting our ongoing 5G trial with Samsung.

We also note that, in response to all of these developments, Germany's Federal Network Agency (BNetzA) stated in July 2017 that it is "essential that Germany should seek an examination of this frequency range [the 28 GHz band] at European level". We believe that the UK should be taking the same open mind on this issue. In this, we are mindful of Ofcom's own statement of April 2015, *Laying the foundations for next generation mobile services: update on bands above 6 GHz,* where, in setting out its preferred options (including the 26 GHz band but excluding the 28 GHz band) for 5G services for consideration at the 2019 World Radiocommunications Conference (WRC-19) , it said the following:

> *Whilst we are aiming to develop a focused agenda item for WRC-19, we do not rule out consideration of other options, particularly if there is wide supported internationally. For example:*
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> *• Spectrum adjacent to the bands we have identified above may also be of interest[1].*

Given the well-established scale of international support for the 28 GHz band and its adjacency to the 26 GHz band, Ofcom should make clear its views on the possibilities and benefits to consumers and industry of the 28 GHz band in its ongoing considerations. This would ensure the most efficient use of both of the millimetric bands.

[1] Paragraph 1.15

Ofcom needs to take a broader view of the opportunities offered by the wider 24.25-29.5 GHz band

Ofcom asks in question 4.7 whether other bands can be used "as an alternative, or in preference to" the 26 GHz band. This appears to suggest a limited ambition to the possibilities in the case of the wider frequencies between 24.25 and 29.5 GHz. We consider that the 28 GHz band should be viewed as a *complement* to the 26 GHz band to the extent that it may be viewed as a single band (as being considered by 3GPP). We certainly do not see the two bands in any way as rivals. This would be consistent with the industry view, acknowledged by the 2016 *RSPG Opinion on spectrum related aspects for next-generation wireless systems (5G)* that one of the appeals of the 26 GHz band is the potential for a common tuning range across the 26 and 28 GHz bands[2].

This matters a great deal in relation to Ofcom's question 5.5:

> *Do you agree that the 26 GHz band should be released progressively? What risks do you envisage with such an approach and how best can these be best mitigated?*

We recognise some of the advantages, in principle, of releasing spectrum to the market as soon as possible, especially with the possible earlier availability of the top 1 GHz of the 26 GHz band (26.5-27.5 GHz). However, the experience with UHF spectrum (for example) between 694-960 MHz shows that phased spectrum releases for mobile services can lead to spectrum fragmentation and inefficiencies. The 700, 800 and 900 MHz bands will be operating in a sub-optimal way as guard bands, duplex gaps and synchronous duplexing arrangements prevent the most efficient spectrally efficient outcome. Moreover it is unclear that such fragmentation can then be resolved thereafter by the market alone.

Ofcom will be aware that the focus within 3GPP on millimetric 5G spectrum is very much on the wider 24.25-29.5 GHz band. We fully support that approach as it will lend itself to a more joined up and spectrally efficient outcome. The implications for this would likely be that greater bandwidths across both bands could be made available for future 5G services with greater data speeds offered for businesses and consumers. To further the interests of UK consumers Ofcom should be working with 3GPP to ensure that the 5G standards across the entire 24.25-29.5 GHz spectrum suit the needs of the UK.

The risk of Ofcom's proposed approach to releasing spectrum piecemeal is, therefore, that this might constrain the ability to approach the wider 24.25-29.5 GHz band in the most efficient way. We are specifically concerned that an early spectrum release of the 26.5-27.5 GHz band could lead to inefficient outcomes for the spectrum below and above this smaller band. We would urge caution on this proposal and that the UK should wait until there is a clearer view from the standards bodies as to the future 5G potential of both the 26 and 28 GHz bands. At that time, the 26 GHz band could be packaged in a way that maximises efficiencies for future spectrum holders, potentially aligning with existing spectrum use in the 28 GHz band and offering large contiguous blocks to individual licensees.

[2] See page 5 of the Opinion

For similar reasons we believe that the other question which Ofcom raises with regards to options for authorising spectrum in the 26 GHz band (questions 5.1-5.4) are best informed by the work of the 3GPP and the interaction between the 26 GHz band and the 28 GHz band. This is particularly the case in the UK as Ofcom already has licensees in the 28 GHz band, including Arqiva, who are seeking to develop their own 5G fixed wireless access solutions.

Fixed wireless access in the 28 GHz band is compatible with existing use of the 26 GHz band

We understand that the principal reason behind the UK and RSPG's original rejection of the 28 GHz band for 5G identification at WRC-19 is that it perceives a significant risk of harmful interference from 5G services into existing satellite services currently using the same band.

One of the regrettable consequences of keeping the 28 GHz band off of the agenda for WRC-19 is that no formal sharing studies under the auspice of the ITU can be undertaken to explore the compatibility of 5G fixed wireless access and satellite services. However, the FCC has conducted its own compatibility studies[3] in 2016 that demonstrated that effective coordination between the two services was possible.

This is consistent with the terms of Arqiva's own 28 GHz licence, which allows for both terrestrial and satellite use. Before determining the conditions for this licences, Ofcom carried out work to consider what conditions were appropriate in order to avoid harmful interference and have put those conditions into the licences. Consistent with those licence conditions, we are clear from our own internal technical analysis that both fixed wireless access and satellite services can co-exist successfully with some prior coordination. As a result of this, we are pursuing a twin strategy of developing a 5G fixed wireless access broadband solution at the same time as developing a satellite broadband service *using the same band*.

Clearly, this could represent a highly desirable outcome in spectrum management terms. There is a possible scenario in which spectrum sharing provisions are put in place in the 28 GHz band whereby valuable fixed 5G services competing with traditional fixed broadband providers co-exist with satellite broadband operators.

We agree with Ofcom's proposed usage cases for millimetric spectrum

Section 4 of Ofcom's consultation sets out a number of proposed usage cases and business models which could be underpinned by the 26 GHz band. Our view is that the evolving developments in the 28 GHz band can be used as a guide for the direction Ofcom should be taking with the 26 GHz band. Additionally, given the adjacency between the two bands, we would argue that decisions on the 26 GHz band should be taken with a view to ensuring alignment with those future developments in the 28 GHz band.

[3] Document FCC 16-89

However, we broadly agree with Ofcom's assessment of potential usage cases in millimetric spectrum. In particular, we endorse its views that:

- Services could be deployed to meet high traffic demand or "hot spots";
- Neutral hosts may emerge to meet the challenge of identifying suitable sites for the installation and operation of small cells. While it is not certain to take place, we agree with Ofcom that it is possible that these hosts would secure access to their own spectrum;
- Services will seek to take advantage of new 5G standards which offer low latency, high reliability and offer the additional advantages provided by network slicing; and
- Fixed wireless access services will be deployed – as we set out above this is now a reality in the 28 GHz band.

Ofcom points to the possibilities of using 26 GHz for backhaul services. Again, while this may be possible, our own view in this area is that the UK needs to vigorously pursue its ongoing policies to enable fibre backhaul for 5G services. In particular:

- Confirmation of the UK Government's policy of zero rates for new fibre deployment for the next 5 years; and
- Enhancing access to both ducts and poles and to dark fibre through the ongoing Wholesale Local Access and Business Conductivity Market Review processes.

Clearly, the trials that we are currently undertaking with Samsung can be used as something of a pointer to the possibilities of future 5G services in the millimetric bands. Our ambition is to act as a neutral host provider in the guise very much envisaged by Ofcom. The service we are proposing is a fixed wireless access one and our trial will be able to demonstrate the potential for this technology to offer an alternative to fibre to the home. This aligns itself with one of Ofcom's overarching ambitions in its *Digital Communications Review* that network competition is the favoured approach to driving innovation and future communications service provision.

<u>Ofcom analytical model is broadly correct but its conclusions are incomplete</u>

While we believe that 28 GHz (as it refers to the Fixed Service at least) should be part of the WRC-19 agenda item 1.13 discussion, we also recognise the reality that there is limited appetite for changing the regulatory course which has been put into train by European policy makers.

Paragraph 7.9 sets out the criteria which guides Ofcom's "roadmap" for prioritising bands for this agenda item. In its criteria Ofcom has not looked at the bands that are being prioritised for 5G standardisation at 3GPP. Ofcom should be looking to support the market where, as in this case it is fully consistent with its statutory duties. Ofcom should considering where the industry is putting its own efforts when deciding where to focus its attention.

Nonetheless we thought it worth making the point in this submission that every criteria outlined by Ofcom leads to a favourable view of 28 GHz fixed wireless access.

We set this out below:

Ofcom Criteria for favourable 5G bands	Assessment of 28 GHz band for FWA
Is there scope to share with 5G?	**Yes** FCC sharing study Actual sharing in UK by Arqiva
Is there sufficient international support to create scale?	**Yes** USA, Japan, UK, South Korea, Canada, Hong Kong
Is equipment likely to be available?	**Yes** Verizon planning on services in US by 2018
Unconstrained by adjacent bands?	**Yes**
Can an existing eco-system support deployment?	**Yes** In this case the future adjacent 26 GHz band
Is it consistent with needs of other users?	**Yes** It can co-exist with identified future satellite broadband demand
Does it have an existing ITU mobile allocation?	**Yes** Although for FWA, it needs a Fixed Allocation, which it also has

As a result, we continue to be unclear as to why this band is conspicuously absent from any meaningful (or otherwise) discussion to be a candidate band for 5G within the ITU Radio Regulations. While this does not prevent either us or other stakeholders from pursuing a 28 GHz 5G strategy, it does make it more difficult to align that strategy with 26 GHz developments at a regulatory level.

Steps can be taken to realise the combined benefits of both 26 GHz *and* 28 GHz

In the continued absence of the 28 GHz band from preparations for Agenda item 1.13 at WRC-19, we still consider that the UK should seek to formally assess, at a regulatory level, the possibilities of a combined 26 and 28 GHz FWA approach to 5G in the millimetric bands. These assessments should be done with the full backing of the satellite sector (of which Arqiva is a member) so that they are aware of the spectrum sharing potential between satellite services and 5G fixed wireless access. We are, of course, conscious of the concerns of the sector over possible interference issues but believe that this is not an issue as it relates to 5G fixed wireless access,

Some possible ways of addressing this issue could include:

- An RSPG work item which looks at the policy implications, challenges and opportunities of of a wider 26 and 28 GHz FWA band;
- Technical work within CEPT to formally assess the viability of spectrum sharing within the 28 GHz band; and/or
- Consideration whether this could be set as an agenda item for WRC-23.

As the holder of the largest amount of licensed 28 GHz spectrum in the UK and as a satellite and telecoms infrastructure provider, we are happy to engage further with Ofcom on this issue to make progress on this issue.