ESOA response to Ofcom consultation "Mobile Data Strategy"

30 Jan 2014

1 General Comments

The European Satellite Operators Associations (ESOA) is pleased to provide its comments in response to the Ofcom consultation document "Mobile Data Strategy".

As a general comment, we find it strange that a strategy specific to mobile data is required. While it is apparent that mobile voice and data networks are very important to UK citizens and consumers, it is not at all clear why a strategy specifically for mobile data is required, and why a strategy for mobile data could not be taken into account in Ofcom's overall spectrum management strategy. A strategy for one specific application or service, risks giving undue weight to that application or service. Assuming however that Ofcom will continue to develop its mobile data strategy, Ofcom should consider also developing a strategy for satellite applications and other user groups.

A major thrust of the proposed mobile data strategy is to seek new bands to be made available for mobile data applications. All the bands suggested by Ofcom as potential future bands are currently occupied, by a variety of different services and applications. If any of these bands are to be identified for mobile data, the existing services will be constrained to some extent. Such constraints could range from operating in a band shared with mobile applications (leading to an increased risk of interference and constraints on the deployment of new stations), through to the removal of the existing services to make the band exclusively available for new mobile data systems. The consequences of the identification of new bands for mobile broadband, as proposed in this consultation document, are therefore very significant. If Ofcom's predictions are incorrect, the costs to existing services, applications and their users would be entirely wasted costs, causing unnecessary and perhaps irrevocable damage to the incumbent services.

ESOA asbl – 20th Floor, Bastion Tower
5, Place du Champ de Mars
B-1050 BRUSSELS – BELGIUM
URL : www.esoa.net

Tel : +32.2.550.3575
Fax : +32.2.550.3535
info@esoa.net

Secretary General
Ms. Aarti Holla-Maini
aholla@esoa.net

Association
Registration
N° 93652002

In general, we find that the demand for more spectrum for mobile data as presented by Ofcom in the consultation document is incorrect or is overstated. Therefore Ofcom should take a much more sceptical view towards the purported demands, and should provide much harder evidence of any spectrum needs before proceeding with identification of any new bands through this consultation. Our analysis of some of the spectrum demands recently developed shows significant errors in certain of the assumptions, meaning the results cannot be relied upon and should be revised.

We provide more detail in the comments below. For each of the main sections of the consultation document, we comment on some of the key issues discussed by Ofcom and provide answers to the specific questions.

2 Consultation Document Section 3 - The mobile data challenge

Paragraphs 3.2-3.5 refer to the data provided in the Ofcom "Infrastructure Report"[1]. As noted in the mobile data strategy consultation, monthly data traffic for the UK as a whole is around 29 PB[2]. It is interesting to note that the rate of growth declined, from 119% between March 2011 and June 2012, to 47% between June 2012 and June 2013. This would indicate that the annual rate of increase is in decline, leading to the conclusion that mobile data growth is more of an "S-curve" than a one of long-term exponential growth for the next 10 years or so, as is used by many of the forecasts. It is notable that in February 2013 Cisco significantly downgraded its estimates of future growth in mobile data traffic, with global cellular data traffic in December 2016 estimated at 7.4 EB/month compared to 10.8 EB/month in Cisco's February 2012 forecast.

It is also notable that according to the Infrastructure Report, the rate of growth in public Wi-Fi data (188%) is much higher than that for non-Wi-Fi mobile data (47%). Perhaps this also indicates a longer term trend, whereby most data growth is accommodated through Wi-Fi rather than the national mobile data networks. The principal reason for the decline in Cisco's February 2013 mobile data traffic forecasts compared to those issued the previous year was an increase in the share of traffic offloaded to Wi-Fi (from 22% in the February 2012 forecast to 46% in the February 2013 forecast).

This actual UK data and the recent data from Cisco underline the need to be very cautious about any growth predictions for mobile data.

Paragraph 3.19 mentions the possible use of wireless data services to provide an alternative to fixed broadband service. In this regard, we highlight the role of satellite broadband applications to provide service, beyond the reach of fixed broadband networks. Satellite networks are now able to provide broadband data access to the home, at costs similar to those of cable and terrestrial wireless systems. In any case, the spectrum requirements for areas of low population density, which are typically where cable broadband capabilities are poorest, are unlikely to have an impact on the overall spectrum demands, and so are a poor justification for the need for additional bands for mobile data.

[1] http://stakeholders.ofcom.org.uk/market-data-research/other/telecoms-research/broadband-speeds/infrastructure-report-2013/.

[2] Figure 2 of the consultation document erroneously states that demand is 30 GB per month.

Question 1: Have we correctly identified the future characteristics of mobile data demand?

There is considerable uncertainty about the size of the future demands for mobile data overall, and additional uncertainty about which new bands, if any, would be required to meet those demands. For example will future requirements be dominated by Wi-Fi and will increased use of small cells in the existing mobile bands accommodate future needs? Whatever the real data requirements, much of the capacity can be provided by technology improvements, such as moving to LTE and its evolutions, or increased use of small cells.

However, importantly, some of the recent analyses of the *spectrum requirements* to meet the mobile data demands have major errors, which lead to significant overestimation of these requirements. These errors are in ITU-R Report M.2290, recently developed by WP 5D, and similar errors are contained in the Real Wireless study[3], commissioned by Ofcom and referenced in the mobile data strategy. This is discussed further below.

Figure 40 of the Real Wireless report is entitled "Total potential demand for licensed mobile spectrum (before offload to Wi-Fi) for the low, medium and high market settings used in this study compared against forecasts from our UHF strategy for Ofcom" (noting that the title is incorrect as it is data traffic and not spectrum demand which is shown) and is reproduced below as Figure 1.

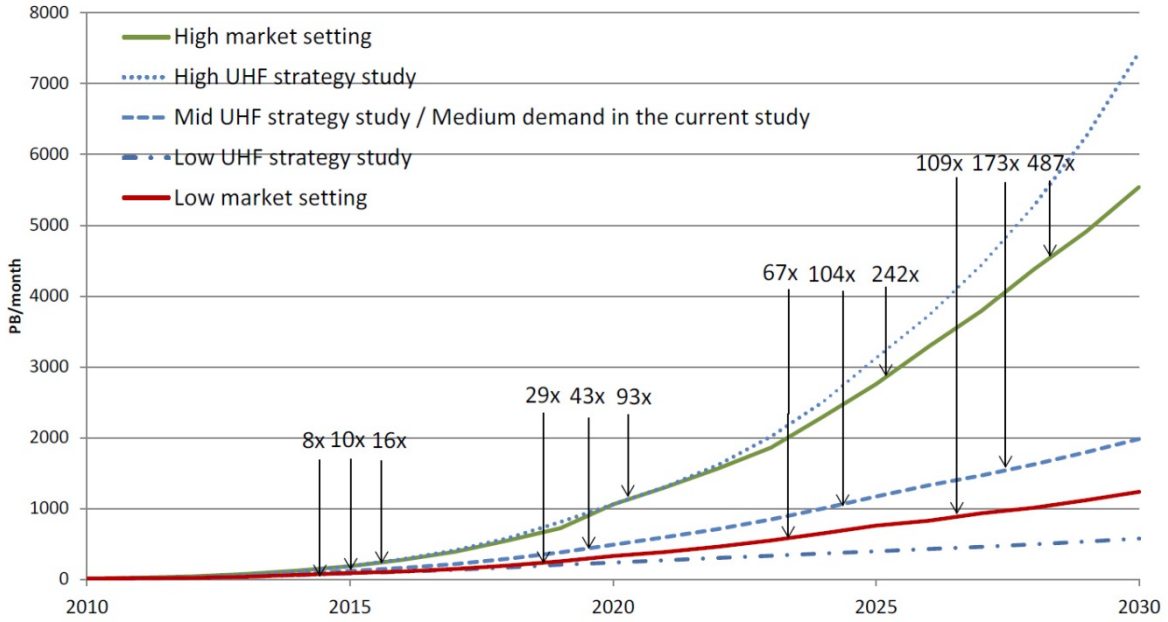

Figure 1 Real Wireless Mobile Data Traffic Forecasts for the UK as a whole

According to the Figure, by 2020, mobile data demand in the UK will be in the range of 300 to 1000 PB/month. This forecast range seems to be in line with many of the other market forecasts available (e.g. those produced by Cisco and Analysys Mason, which represent more optimistic and more conservative growth projections respectively). As indicated in the Infrastructure Report, monthly

[3] "Study on the future UK spectrum demand for terrestrial mobile broadband applications", version 3.0, 27 June 2013, http://stakeholders.ofcom.org.uk/consultations/cfi-mobile-bb/

data demand in June 2013 is around 29 PB/month (national mobile networks). Hence predictions of 300-1000 PB/month in 2020 represent a considerable increase on current data usage, but we accept them as working assumptions. As one benchmark of a relatively aggressive forecast, Cisco's February 2013 mobile data forecast projected that total UK mobile data traffic would reach 333 PB/month by the end of 2017.

The data demand for different topographical areas of the UK is shown in Figure 44 of the Real Wireless report, entitled "Comparison of demand densities in different teledensities for ITU demand from working party 5D against our UK specific medium demand estimates", and is reproduced below as Figure 2. Note the logarithmic scale.

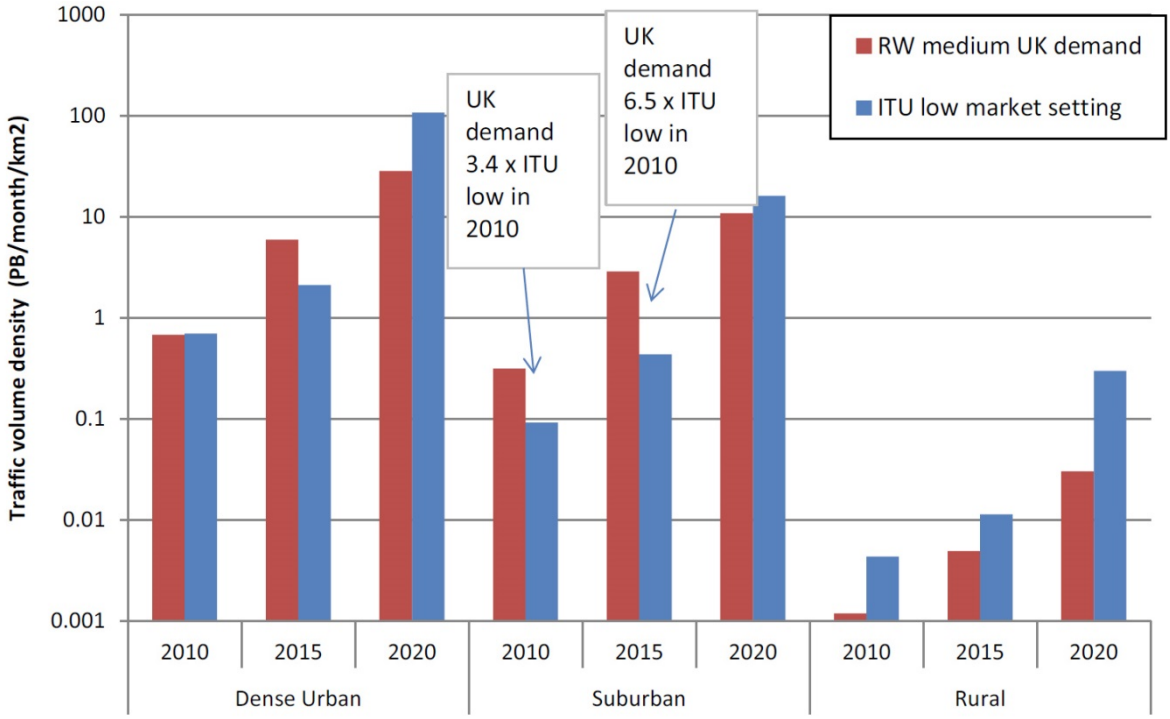

Figure 2 Real Wireless and ITU traffic demand densities

This figure shows demand in dense urban areas in 2020 as between 30 and 100 PB/month/sq km, demand in suburban areas between 10 and 20 PB/month/sq km and in rural areas of between 0.03 and 0.3 PB/month/sq km.

In order to convert these figures to monthly data demand for the whole of the UK, we have broken the UK down into areas representing high population density (over 10000 people per sq km), medium population density (over 4000 people per sq km) and lower population density. This yields the results below:

Type	Area (sq km)	Population	Population density (per sq km)
Urban	210	2345000	11167
Suburban	4190	17749000	4236
Rural	238600	42239000	177
Total	243000	62333000	256

If we apply the Real Wireless traffic volume densities for the year 2020 from Figure 2, the total volume of traffic for the UK is in the range 60000 – 224000 PB/month as shown in the table below.

Type	Area (sqkm)	Traffic density (PB/month/sq km)	Traffic (PB/month)
Urban	210	30 - 100	6300 - 21000
Suburban	4190	10 - 20	41900 - 83800
Rural	238600	0.03 – 0.3	7160 - 71600
Total	243024		55360 - 176400

These values vary from 55 to 590 times greater than the total traffic for the UK as indicated in Figure 1 (300 to 1000 PB/month) for the year 2020. Even the lowest of these traffic figures (urban) exceeds the total forecasts for the whole of the UK by a factor of between 6 and 70 depending on whether a low or high forecast is used. Similarly, even if urban and suburban traffic are ignored, the total rural traffic alone exceeds the forecasts by a factor of 7 or more. It is also noted that the ITU figures in Figure 2 are those from their 'low' user density model and as such the total traffic which would result from the application of their 'high' user density figures would exceed the total traffic forecasts for the UK by an even greater margin. Even if some of the traffic forecast in Figure 2 is offloaded onto Wi-Fi, vast differences remain.

These figures also reflect average monthly mobile data consumption by the UK population of between 890 and 2830 GB per month per person by 2020 which are wholly unrealistic figures. (As a comparison point, according to the Infrastructure Report, the average mobile data consumption per active SIM in the UK in June 2013 was 0.34 GB per month). It would appear that no cross-checking of the proposed data traffic volumes used in the model with the total forecast nationwide traffic has been done.

It is therefore evident that the model used by Real Wireless and the ITU in calculating spectrum requirements is fundamentally flawed in that it uses traffic densities which result in total traffic figures which are far, far in excess of the forecasts for the UK. The only way in which the Real Wireless modelling might be reconciled with their own estimate of total UK mobile data traffic is if the traffic volumes per square km are intended to represent only a very few hot spots, such as Canary Wharf, Waterloo station and Wembley stadium. For example, if the Real Wireless model were correct, the square mile of the City of London (almost 3 sq km) would account for as much as 30% of all the mobile data traffic in the UK. However, special measures can be taken to meet excessive peak hour demand in such confined locations, particularly through deployment of small cells and Wi-Fi offload. Allowing such locations to drive spectrum allocations across the whole of the

UK would be like widening every motorway in the UK, just because parts of the M25 are congested at rush hour.

The Real Wireless study estimated the total spectrum demands for the year 2020 to range from 775 to 2770 MHz. ESOA has not considered the effect on spectrum demands of reducing the traffic densities to more realistic levels, however replacing the traffic figures with realistic figures (and keeping other assumptions the same) it is clear that the demand for spectrum for IMT would be an order of magnitude less than the levels suggested by Real Wireless.

We propose that Ofcom review and revise its calculations of the spectrum requirements. Ofcom should not proceed with any proposals to identify new bands for mobile broadband applications, either nationally or at the ITU level on the basis of the figures provided in the models by Real Wireless or the ITU.

Question 2: Do you agree that there is a prospect of significant continuing growth in demand for mobile data services?

There may well be growth in mobile data demand. Much of that growth can be met by a number of approaches, including:

- the use of more up-to-date technology in the existing mobile bands (such as LTE), (as described by Ofcom in paragraph 3.23);
- the bringing into use of those bands currently available but not in use, or those bands planned to be available in the next few years, but are currently not used (such as the 700 MHz and 2.3 GHz bands);
- new network deployments, such as small cells (as described by Ofcom in paragraph 3.24);
- the increased use of Wi-Fi offloading (noting that the 5 GHz Wi-Fi band currently has very little use).

Ofcom's own analysis (Figure 11 of the consultation document) shows scope for a 30-fold increase in mobile data by 2030, without the need for any additional bands. Hence, at this time, ESOA would oppose moves to identify new bands for mobile broadband applications.

Paragraph 3.21 mentions the potential benefits arising from the growth in mobile services. One of the benefits mentioned is high-capacity services to rural areas. Studies such as the Real Wireless study and the ITU study have suggested that the demand for mobile spectrum in rural areas is significantly below that in suburban and urban areas. Hence the benefits of improved rural services, while clearly important, are not likely to justify making more spectrum available for mobile broadband. The analyses which predict significantly increased broadband data do so largely on the basis of very high data rates (around 1 Gbps) to users. The applications that might require such very high data rates, if they exist at all, are not clear. Further, as Ofcom acknowledges, most consumption of high speed data takes place indoors, where offload to fixed networks is viable and likely far more cost effective.

Naturally, any benefits arising from this increased use must be balanced against the benefits arising from alternative uses of the spectrum. Most current satellite systems operate in the C-band and Ku -

band. Due to increasing congestion in those bands however, there has been considerable growth in the number of Ka-band satellite systems being deployed for fixed satellite services. Satellites are uniquely capable of providing communications services over very wide geographical areas, instantly connecting large numbers of users over large, rural and suburban areas. Fixed satellite service (FSS) networks are currently being used to provide telecommunications services to end users at fixed locations, on aircraft, ships, trains and other vehicles to meet the need for increased transmission speeds, capacity and efficiency. The C-band spectrum used by satellite networks also guarantees interconnectivity with Africa & Eastern Europe for the delivery of video services or the backhaul of mobile networks from Europe to these regions.

Paragraph 3.24 addresses the increasing use of small cells in mobile networks, highlighting the challenges associated with the growth of small cells. This discussion seems to leave aside some positive developments in the deployment of small cells. For example BT[4] has plans to deploy small cells using its 2.5 GHz spectrum in the homes of its broadband customers and at external urban locations. BT has about 31% of the broadband/cable market in the UK. This will likely dramatically increase the number of small cells deployed in the UK (to millions of sites, not the tens of thousands of sites assumed in Ofcom's spectrum demand model), and could lead to a significant increase in overall mobile data capacity. Also, in the US, use of satellite dishes for siting small cells is reported to be part of DISH Network's plan for network build-out. There are many millions of satellite dishes that could be used in the UK via a partnership between a satellite TV provider and a mobile network operator.

Paragraph 3.25 suggests the need for an increase in spectrum for mobile broadband, based on the trends discussed in the consultation document. As discussed above, predictions based on high cumulative annual growth in mobile data demands for many years ahead must be considered as very uncertain. But even if those mobile data demand predictions are considered to be correct, there is no reliable evidence of a need to identify additional frequency bands to meet that demand.

Paragraph 3.26 and 3.27 discuss the implications of trying to make more spectrum available for mobile broadband. As has been mentioned above, there is currently no basis upon which to conclude that more spectrum will be required for mobile broadband in the foreseeable future.

Question 3: Have we identified all the challenges in realising future growth in citizen and consumer benefits from use of mobile data services and do you have any comments on the nature or the scale of the challenges we have identified?

ESOA broadly agrees that the major challenges have been identified. However, insufficient weight has been given to the opportunities to make better use of existing spectrum allocations. Thus, when it comes to issue of making more spectrum available for mobile broadband, ESOA considers that no additional spectrum is required, for the reasons described above.

[44] Also BT has already deployed over 5 million hotpots throughout the UK and Ireland to connect people online using Wi-Fi 2.4 GHz band with connection speed of up to 8Mbps.

Question 4: Have we correctly identified all the areas where Ofcom has a role in addressing the challenges of growing demand for mobile data services?

On the subject of competing demands for spectrum, Ofcom discusses the challenge in making additional bands available as being the amount of preparation required and the need for international agreements. This seems to take for granted that additional bands are required, which is not the case.

Question 5: Do you agree that the main additional area that our mobile data strategy needs to address is in relation to potential future spectrum options?

No, for the reasons above, we don't believe that new spectrum for mobile broadband is required.

Question 6: Is Ofcom doing all that it needs to do in other areas identified as being relevant to the mobile data challenge?

As indicated above Ofcom should review and revise the estimates for the UK spectrum requirements for mobile broadband.

Paragraph 3.42 refers to the need to prioritise potential additional bands for the long term – "perhaps as far as 2030". The growth in demand for mobile broadband in the next few years is very uncertain as shown by the numbers in the Ofcom Infrastructure Report, and situation for mobile broadband 16 years from now must be subject to such huge uncertainty that planning now for such a long period is unlikely to arrive at any valid conclusions. In many cases, "planning for the future" involves removing or constraining deployment of existing services, which cannot be justified based on the current evidence of the need for additional bands.

3 Consultation Document Section 4 - Spectrum management context

In paragraph 4.8, Ofcom states that "the optimal use of spectrum is most likely to be secured for society if spectrum is used efficiently, i.e. it is used to produce the maximum benefits (or value) for society. We consider the benefits from efficient use to include those enjoyed by providers and consumers of services as well as the wider social benefits, or the indirect benefits, of services provided using spectrum."

In the last fifty years, satellite communications has played a key role in the growth of the communications, media and technology industry in the UK, enabling breakthroughs like intercontinental telephony, live television from remote regions, the broadcasting of television channels to all citizens, global positioning, trunking for telecom operators and reliable data networks for private companies and off shore oil platforms in the North Sea.

The public values the availability of a multitude of open communications channels catering to and fulfilling the different needs of citizens. The ubiquitous nature of satellites – out of view from earth,

high in outer space, but in view of wide regions of the globe, make them unique platforms for flexible and robust communications within and outside of the UK. Satellite for instance can deliver 100% broadband connectivity (everyone, everywhere) with a service in all remote or rural areas (digital inclusion), as now fully recognised at EU level[5]. In the case of C-band (3400-4200 MHz), there are high social benefits from the use of certain C-band FSS applications, many of which are identified on page 21 of the draft RSPG Opinion on "Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband"[6] (i.e. used for the Galileo data system, the meteorological applications, emergency applications, diplomatic missions, and provision of safety services such as the GMDSS). Other high social value applications include distribution of TV and radio broadcasting (e.g. BBC World Service), essential connections with Africa and South America and provisions of niche TV programming for ethnic minorities. Services of high social value could be lost if C-band is used for terrestrial mobile broadband systems.

In paragraph 4.14, Ofcom acknowledges that, at least in principle, there might be higher value services than mobile broadband in the bands considered. In the case of the band 3800-4200 MHz, suggested by Ofcom as a potential band for mobile broadband, there are considerable benefits in the use of this band by the FSS. Satellite communications offer differentiating capabilities, which enable specific use cases and illustrate the role that satellites play in the overall communications ecosystem such as high data rates and efficient broadcasting. Given the large coverage and limited need for mobile infrastructure, satellites offer unique broadcasting capabilities. They are highly cost efficient for broadcasting, allowing distribution of data with limited cost and infrastructure requirements. Furthermore satellites offer high bandwidth with efficient spectrum usage enabled by new technologies such as multi spot beams, which make it possible to provide tailored content two-way to small areas. This further increases spectrum efficiency and reduces cost for applications targeting small areas, enabling very high data rates/bandwidth services irrespective of landmass.

Paragraph 4.28 of the consultation document makes reference to the Radio Spectrum Policy Programme and the obligation on member states to make at least 1200 MHz of spectrum available for wireless data traffic (including spectrum already in use). Wireless data traffic may be provided via either fixed, mobile or satellite platforms. From this definition, the draft RSPG Opinion on "Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband" determines that 1701.5 MHz is already available for wireless broadband, consisting of 990 MHz for "Terrestrial", 173 MHz for "Satellite" and 538.5 MHz for "Wi-Fi". Hence, it is apparent that the objective of making at least 1200 MHz available for wireless broadband by 2015 has already been fully achieved.

4 Consultation document Section 5 - Technology drivers of change and implications for spectrum

In paragraph 5.7, Ofcom states that macro cells are likely to remain the dominant model in less densely populated areas. But this ignores that most use is inside buildings where fixed networks will be available to almost everyone in the country. So offload is also a viable strategy in these areas. Note that Table 2 cites that "75% of data use is indoor today and may increase".

[5] See: www.broadbandforall.eu

[6] See RSPG document RSPG13-511 Rev 1.

In paragraph 5.11, Ofcom refers to the expectations of spectrum efficiency expected in the coming years. The numbers quoted might underestimate those actual gains, and do not fully address the benefits in moving from currently deployed 2G and 3G technologies to LTE Advanced networks. In the United States, Verizon is now carrying two thirds of its data traffic (and therefore 20% of all US data traffic) on an LTE network using only 20MHz of spectrum. Since according to the FCC over 600MHz of spectrum is already allocated, and over 100MHz more will be auctioned in 2014 and 2015 this suggests that the US already has the potentially for at least 6 times increase in the data carrying capacity of existing networks with no architectural changes (i.e. increased use of small cells or offload) even with the first generation of LTE (plus a move to VoLTE). More improvements are expected from LTE Advanced in the next 3-5 years.

In paragraph 5.13, Ofcom refers to the use of wider bandwidths to accommodate very high data rates, up to 1 Gbps. This is around 1000 times the data rate required for video streaming, which for most users is the most data intensive application. There are therefore significant doubts about the existence of applications that might require such a high data rate. The network backhaul capacity would also require significant increase, leading to high costs that would need to be passed on to the consumer.

In paragraphs 5.26 – 5.28 Ofcom discusses the limitations for mobile devices to support multiple frequency bands. In the case of the 3.5 GHz band, even though spectrum in this band has been licensed in many countries for a number of years, the number of LTE devices supporting this band is tiny. It is not clear whether the lack of support for the 3.5 GHz bands is due to technology issues, the poor propagation characteristics of these frequencies (making network roll-out more costly) or simply from the lack of demand for 3.5 GHz devices. In any case, the current situation indicates some doubt that the 3.5 GHz band (and similarly the band 3.8-4.2 GHz) would ever be used for mobile broadband, even if they were made available.

Question 7: Do you agree with our high-level assessment of likely technology and topology trends and their implications for future spectrum use? We are particularly interested in views on:

a) the potential demand for spectrum above 10 GHz;

b) the potential impact of integrating broadcast capability into mobile networks;

c) whether the technical and commercial challenges of supporting additional frequency bands in mobile devices drives interest towards bands close in frequency to existing bands;

d) the relative importance of large contiguous blocks of spectrum versus aggregation of smaller blocks

For the reasons explained above, we are extremely sceptical about claims for the need for any additional bands to support the mobile data demand, including bands above 10 GHz. We don't see the need for large contiguous blocks of spectrum, since the high data rates used to justify such large blocks are not necessary and are probably not affordable.

We note that in Ofcom's recently held "Spectrum Management Strategy" consultation, the 18-55 GHz band was identified as a "medium" priority with "Very long term potential for 5G use". We

point out that the higher frequency bands (18-50 GHz) are of the utmost importance and value for satellite communications.

This higher frequency range will involve the deployment of a large number of small, transmit-receive user terminals. Because of the sensitivity of satellite terminals to interference and the ubiquitous nature of these terminals, it is not possible for these high throughput satellite services to share the same spectrum over the same geographical area with other services especially mobile services.

Furthermore, UK-notified satellites have already been built and launched that will operate in that band for decades, and those UK satellite operators have invested billions already in space segment and associated ground segment. Migration of frequencies is not possible.

ESOA strongly opposes any consideration by Ofcom of the relocation or migration from the satellite allocations in this frequency range of commercial communications satellites or other space systems using, or already under construction to use.

Question 8: Are there any additional technology or topology trends that we need to consider that could have an effect on spectrum use?

Although not a technology or topology trend, one aspect which would have a significant effect on spectrum demand which is not discussed is the cost and willingness to pay. In recent years ARPU figures for the mobile operators in Europe have been quite flat. A report for the GSMA by A. T. Kearney predicts a fall in revenue per subscriber of 3.8% per annum over recent years, despite the growth in data usage. The opening of new frequency bands comes at a cost which must be passed on to the consumer. There is good reason to doubt that consumers are prepared to pay for these increased costs. This aspect should at least be considered in Ofcom's analysis.

Most of the points which are identified by Ofcom lead towards a reduced need for additional bands for mobile data. The only identified trend that would increase spectrum requirements is the support of very high datarates to the user (e.g. 1 Gbps). For the reasons described above, this trend does not seem to be justified. By making more aggressive (but still realistic) assumptions for the other trends, capacity estimates for the mobile data networks will increase, reducing the demand for additional frequency bands for mobile data and reducing or eliminating any impact of other spectrum users.

5 Consultation document Section 6 - Review and prioritisation of bands

5.1 Consideration of the 2 GHz MSS bands

In paragraphs 6.48 – 6.51, Ofcom discusses the possible use for the bands 1980–2010 MHz and 2170–2200 MHz, referred to as the "2 GHz MSS bands".

In May 2009 two operators, Inmarsat Ventures Limited (Inmarsat) and Solaris Mobile Limited (SML), were each awarded the rights to operate 30 MHz of paired S-Band spectrum in all 27 EU Member States for 18 years[7]. The spectrum bands awarded for use by Inmarsat are 1980 - 1995 MHz (Earth to space) and 2170 - 2185 MHz for space to Earth communications. For SML the spectrum awarded is 1995 - 2010 MHz (Earth to space) and 2185 – 2200 MHz for space to Earth communications. The spectrum awarded is for the provision of Mobile Satellite Services (MSS). Commission Decision 2007/98 of 14 February 2007, which designates these frequency bands for systems providing mobile satellite services, stipulates that any other use shall not cause harmful interference to and may not claim protection from mobile satellite services.

Since that date, both operators have been working with all EU Member States to firstly establish a common regulatory framework to enable provision of MSS in each Member State and also to ensure the availability of appropriate technology and ecosystems for commercial exploitation. After the original timetable for service availability lapsed, an EU co-ordinated process on the basis of Commission Decision 2011/667 was used to establish a roadmap with associated steps and time limits to bring the spectrum into use and have a launched satellite to provide MSS services by 1 December 2016. The first measure consists of the conclusion of a binding and signed satellite contract by 1st December 2013, of which both operators provided evidence.

Priority for the use of these bands remains with the two selected MSS operators in the EU. The services to be provided in the band may include the provision of mobile broadband services, which may be provided by the MSS system employing a complementary ground component (CGC). These bands cannot be considered as potential bands for terrestrial-only mobile broadband applications.

5.2 Consideration of C-band downlink spectrum

In paragraphs 6.57-6.65, Ofcom discusses the possible use of the bands 3.6–3.8 GHz and 3.8-4.2 GHz.

These bands are heavily used by the FSS throughout the world. Ofcom states that there are around 120 permanent earth stations (PESs) at 35 sites operating in these bands in the UK. There are likely to be additional earth stations in operation in the UK, since receive-only earth stations (used, for example, for reception of international TV broadcasts) do not require a licence[8].

The UK is among the European countries with the highest density of earth stations, as shown by the summary of the number of earth stations in the EU member states contained in Radio Spectrum Committee document RSCOM10-28.

To avoid harmful interference to FSS earth stations, geographic separation is required between FSS earth stations and mobile broadband base stations or user terminals. Studies have already been carried out, in particular in the run-up to WRC-07 (see in particular ECC Report 100, Report ITU-R M.2109 and Report ITU-R S.2199). Separation distances are typically 10s or 100s or km. Figure 3 shows an example exclusion area for a single FSS earth station, located at Brookmans Park. The

[7] Commission Decision of 13 May 2009 on the selection of operators of pan-European systems providing mobile satellite services (MSS) (2009/449/EC)

[8] For evidence of the use of C-band for TV reception, see http://www.satellites.co.uk/forums/c-band-reception-uk-and-europe.555/

yellow shaded areas show where the short term interference criterion would be exceeded. The red shaded areas show where the long-term interference criterion would be exceeded. The IMT base station characteristics are those proposed by ITU-R Working Party 5D for "macro suburban" base stations. Further information on the assumptions and methodology used to determine this protection zone can be found in ITU-R Joint Task Group 4-5-6-7 document 4-5-6-7/331.

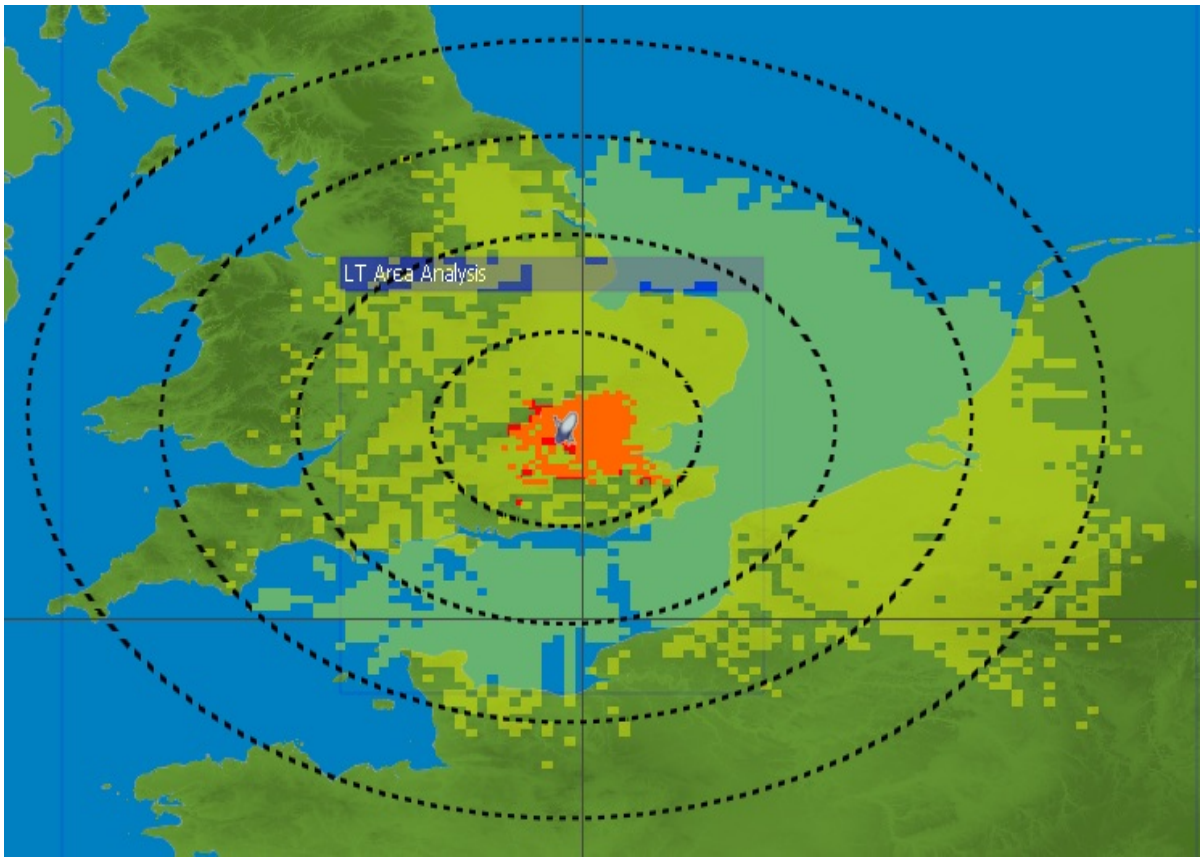

FIGURE 3 Protection zone for Brookmans Park earth station with respect to IMT base station.
Note – the black dotted circles are radius 100, 200, 300 and 400 km.

As can be seen, this one earth station alone leads to a protection zone for mobile broadband base stations that covers a large proportion of England. Although we do not have the locations of the 35 C-band earth station sites used in the UK, it is likely that the combined area for all stations will cover almost all of the UK. It should be noted that the protection zone for this earth station includes locations in France, Belgium and The Netherlands. This also means that FSS earth stations located in these countries, and in Ireland, might require protection from mobile broadband stations located in the UK, further constraining the scope to deploy mobile broadband systems.

Ofcom discusses two scenarios by which these bands might be made available for mobile broadband applications. In paragraph 6.62, Ofcom suggests that these bands might cease to be used by Permanent Earth Stations (PESs) in the UK. In paragraph 6.63, Ofcom suggests that PESs might be moved to less densely populated areas. Both approaches are wholly unacceptable for the reasons explained below.

Customers use the C-band due to the robustness of this spectrum (relative immunity from weather conditions), the size of the satellite beams (enabling broad connectivity over very large geographical areas (e.g., transcontinental services between the UK and the rest of the world) and the ability to rely on wide bandwidth (600 MHz down, 500 MHz up).

Many existing large earth station sites are already located in less densely populated areas. However even in these cases the protection distances cover several hundred km, and therefore cover rural, urban and suburban areas that might be considered for mobile broadband services. Some earth stations need to be placed at the customers' premises, which can of course be in suburban and urban areas.

Preferences for use of one frequency over another are determined by a variety of factors. In some cases, large coverage areas are required for long-distance or regional communications (e.g., backhaul, international links, point-to-multipoint broadcast distribution). C-band is ideally suited for this. ESOA members' UK customers use C-band to provide services into Asia, Africa and Latin America, particularly into equatorial regions. C-band also enables coverage of almost one third of the Earth with a single beam. A customer with sites all over Africa can use one broadcast outbound carrier to cover all sites, reducing costs of having to uplink onto multiple beams as may be required in the Ku and Ka-bands.

Weather may also play a determining factor in whether or not to choose a certain band. For example, customers serving areas of high rain or snow fall demand C-band as it is more resilient to interruptions due to precipitation than higher frequency bands such as the Ku and Ka-bands.

Several ESOA members' customers have PESs licensed with Ofcom and using C and Ku-band spectrum. SES for instance provided (confidential) data about their C-band customers to Ofcom in May 2012, in response to the Ofcom Spectrum Review consultation. ESOA anticipates that the use of the C-band by the FSS will continue for the foreseeable future.

Harmonisation of spectrum is another essential element. While international harmonisation of spectrum is beneficial for terrestrial mobile applications, it is vital for satellite applications. This is because satellite beams cover very large areas, in the case of C-band typically about one third of the earth surface. Therefore the frequency bands allocated for satellite services must be kept available in all countries. It is absolutely critical that the UK remain in line with other countries with regard to access to the frequency bands used by satellites.

5.3 Consideration of C-band uplink spectrum

In paragraphs 6.66 – 6.75, Ofcom discusses potential use of the bands 5350–5470 MHz and 5725–5925 MHz for mobile broadband. The band 5725-5925 MHz is allocated to the FSS and is used for uplinks.

There are two interference issues to be considered here: 1) interference from a transmitting FSS earth station to terrestrial mobile broadband or Wi-Fi receivers; and 2) interference from terrestrial mobile broadband or Wi-Fi stations transmitting to FSS satellite receivers.

We are not aware of any studies conducted by Ofcom addressing these sharing issues, but studies are ongoing within the ITU-R (JTG 4-5-6-7) and within the CEPT. The studies are at an early stage, but given that Wi-Fi systems are ubiquitously deployed, it is difficult to envisage that the deployment of such devices in this band would not constrain FSS earth station deployment. Unless satisfactory sharing conditions can be found to allow the use of this band by Wi-Fi systems within constraining FSS operations, ESOA would oppose the use of this band for Wi-Fi or other broadband mobile systems.

Question 9: Do you agree with the short list of bands we have identified for more detailed consideration?

For the reasons explained in more detail above, we do not believe that it is necessary to start work towards the identification of any new bands for mobile data. Due to existing and long-term use by satellite applications, we do not agree that the bands 1980-2010 MHz/2170-2200 MHz, 3600-3800 MHz, 3800-4200 MHz or 5725-5925 MHz should be listed as priority bands. These bands do not realistically have the potential to be used for terrestrial-only mobile data applications.

Question 10: Do you agree with our methodology for prioritising potential bands for mobile data use?

With regard to the 2 GHz MSS bands, the methodology recognises that availability depends on MSS use, but seems to assume that these bands may not be used by the MSS in the near future. This is now an incorrect assumption. With regard to the bands 3600-3800 MHz and 3800-4200 MHz, the methodology seems to assume that sharing is feasible, although also discusses the possibility of re-locating earth stations. We don't believe that sharing is practically feasible, or that relocation of earth stations to less densely populated areas would avoid the interference issues.

With regard to the band 5725-5925 MHz, the potential sharing situations with respect to the FSS are not mentioned, but this could be a "show-stopper" for potential use of this band for new Wi-Fi or other mobile broadband systems.

Question 11: Do you agree with our provisional assessment and the results of our band prioritisation

No. As explained above, ESOA believes that Ofcom should not identify any potential bands for future release at the current time since the case for additional bands has not been adequately made.

With regard to the 2 GHz MSS bands (1980 - 2010 / 2170 - 2200 MHz), these bands should be considered to be assigned to MSS operators for the foreseeable future.

With regard to the bands 3600-3800 MHz and 3800-4200 MHz, as indicated above, due to the large exclusion areas necessary to protect PESs, irrespective of whether PESs were to be moved to less densely populated areas, shared use of these bands seems practically unfeasible.

With regard to the band 5725-5925 MHz, practically speaking, we don't see that this band could be used for Wi-Fi applications without constraining current and future FSS operations. Therefore this band should not be identified at all.

6 Consultation document Section 7 - Spectrum scenarios

Question 12: Do you agree with the possible timelines we have identified in this section?

No, we don't agree that the 2 GHz MSS bands (1980-2010/2170-2200 MHz), the band 3600-3800 MHz, the band 3800-4200 MHz, or the band 5725-5925 MHz should be expected to be available at any time in the foreseeable future.

Question 13: Do you have any comments on the capacity implications outlined in this section?

On the basis that even with no additional spectrum, capacity is projected to increase to 30x the current capacity by 2030 (Figure 11 in the consultation document) and additional opportunities for increased spectrum re-use exist, it seems very likely that no additional spectrum will be required. If there are "hot spot" areas where demand exceeds the capacity of systems to deliver data, these can be addressed by solutions other than making additional spectrum available – e.g. use of Wi-Fi or small cells.

7 Consultation document Section 8 – Next Steps

Question 14: Do you agree with the next steps we have identified for further domestic work based on the proposed priorities?

For the 2 GHz MSS bands, we agree that Ofcom should continue to engage with the Commission and other member states, but with a view to the ongoing use of this band for MSS.

For the bands 3600-3800 and 3800-4200 MHz, due to the lack of practical feasibility of sharing with FSS usage of this band, and due to the importance of this band for the FSS both in the UK and internationally, Ofcom should support this band as a harmonised band for FSS applications and not as a harmonised band for mobile broadband applications.

For the band 5725-5925 MHz, we don't see how RLAN systems could operate without leading to constraints on deployment of FSS earth stations. Technical studies should be carried out, but it is probable that the regulatory implications of having a licence-exempt application such as Wi-Fi operating in a band shared with licensed FSS earth stations and satellite-borne receivers, would mean that this band is not feasible.

We oppose UK support of these bands as candidate bands for IMT or for mobile broadband at WRC-15.

Question 15: How do you think we should adjust our support for international harmonisation based on our proposed priorities?

Ofcom should oppose the international harmonisation for IMT in the bands 3600-3800 and 3800-4200 MHz and 5725-5925 MHz. Regarding 2 GHz MSS bands (1980-2010/2170-2200 MHz), Ofcom should support the continued harmonisation of this band for the MSS.

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