Response from UKSA to Ofcom consultation on WRC15 AI 1.1

This document has been prepared by the UK Space Agency (UKSA) and includes contributions from members of the UK satellite sector.

General points

We understand that AI1.1 is concerned with additional capacity for broadband IMT and that the new allocations are requested on a PRIMARY basis. This implies the deployment of devices within the new allocations will be essentially be on the same basis as current 3G and 4G systems. That is, devices may be deployed anywhere globally without restriction and there is no scope for protection of existing services through exclusion zones or through limitations on their numbers. The conclusion based on experience from GSM, 3G and 4G is that in Europe, spectrum identified at WRC-15 will be awarded to IMT exclusively and it is unlikely any sharing with other services will be possible.

Satellite systems are also evolving and we expect at least a fourfold growth in the sector over the next 20 years. This will require spectrum. As with IMT, satellite services use spectrum based on the fundamental characteristics of propagation technology. Telecommunications applications include fixed, transportable and mobile terminals and to a large extent, the optimum bands for satellite mobile will be similar to those needed for IMT handsets. High bandwidth fixed services and active remote sensing systems must use frequencies in the 3-30GHz range. This is constrained at the lower end by bandwidth and antenna size and at the higher end by propagation impairments. Passive satellite based remote sensing applications need to access specific spectral lines associated with molecular resonances and are extremely sensitive to interference.

Currently, sharing between permanent earth stations and the fixed service has been found to be an efficient method to make the best use of limited spectrum. This compatibility is mainly due to the narrow antenna beamwidths and the relatively low density of links which has enabled sharing through careful band planning. Sharing between small and mobile satellite terminals and the fixed service has been much more difficult. It is very difficult to imagine how IMT could share bands with the fixed satellite or the mobile satellite services due to mutual interference. Further, the cumulative interference from unwanted emissions arising from large numbers of consumer class IMT terminals operating in adjacent bands is of real concern, especially to the remote sensing service.

These difficulties in sharing bands between satellite and mobile services has already been demonstrated in many studies carried out by the ITU-R in preparation for previous WRCs.

Question 1: *How much do you expect UK mobile data demand to change in the period 2015-2030? Please provide evidence for the trend and, where possible, please indicate how demand might vary across the device categories listed in paragraph 4.7. How should we account for factors (including pricing) that would constrain demand?*

Whilst M2M may grow the device numbers for people will approaching saturation in the time frame considered and so the main issues is more likely to be data-needs per person per timeslot. Mobile spectrum demand will be constrained by much greater use of wifi-offload, and frequency/geography re-use by pico/femto cells which according to recent studies by Ofcom will be increasingly converged with fixed/fibre super-fast broadband.

The extended capacity proposed for video has not been demonstrated by success in the market and the terrestrial broadcast service is likely to remain the most spectrally efficient delivery mechanism for video.

Question 2: *What evidence do you think is relevant to assessing the extent of consumer benefits associated with meeting the increase in demand for mobile data?*

No comment

Question 3: *What proportion of mobile data traffic do you expect to be carried over (a) Wi-Fi and similar systems in licence-exempt spectrum and (b) mobile networks in licensed spectrum? How do you expect this to change over the period 2015-2030 and how do you expect total data demand for Wi-Fi and similar systems in licence-exempt spectrum to change over the same period? How might this vary by location, environment etc.?*

No comment

Question 4: *What factors will act to change the spectral efficiency of mobile technologies in the future? What spectral efficiency values are appropriate for consideration in our study for the period 2015-2030?*

No comment

Question 5: *What service bit rate values are appropriate for consideration in our study for the period 2015-2030? What evidence do you have of changing needs for service bit rates?*

No comment

Question 6: *What proportion of traffic do you consider should be assumed to be carried on each cell types for the period 2015-2030? How will this vary with service environment i.e. between home, office, public areas, rural, suburban and urban? What evidence do you have of the factors affecting the uptake of small cells in licensed spectrum in the future?*

No comment

Question 7: *Given the current mix of services on cellular networks what is the ratio of downlink to uplink capacity currently dimensioned for and how would you expect this to change over time by 2015, 2020, 2025 and 2030? How do you expect the ratio of downlink to uplink demand to vary for the service categories given in Table A5.4 of Annex 5, and what factors might affect this? How does this ratio of downlink to uplink capacity change (if at all) with network radio access technology and offload to licence-exempt systems?*

No comment

Question 8: *What are your views about the pros and cons of the frequency ranges in Table A6.1 in Annex 6 for mobile broadband and for existing applications using this spectrum? Do you have views on other bands that are not in Table A6.1?*

<u>General points</u>

The current ITU frequency allocations to satellite services are very heavily used by satellite operators. Previous studies have shown that due to global mobility required for IMT and high sensitivity of satellite receivers, in general, fair sharing between satellite and mobile services is not possible.

Bands that are adjacent to passive bands, e.g. those covered by footnote 5.340, need to be treated with extra care. Broadband mobile equipment is likely to be low cost. It is difficult to see how the unwanted emissions from such equipment, in large deployments, could be prevented from causing unacceptable interference in the adjacent passive bands.

The bands given in Table A6.1 do not correspond with all the bands under consideration by JTG-4-5-6-7. It is assumed that Ofcom already has enough evidence and <u>Ofcom will not support IMT use in the bands not covered by Table A6.1</u>. These bands include many important satellite bands. If this is not the case, it will be necessary to re-consult the stakeholders.

<u>Specific points on the bands presented in Table A6.1</u>

1300-1400 MHz and 1427-1527 MHz

We note these bands are adjacent to the 1400-1427 MHz passive band. We support studies but doubt that low cost equipment will be able to meet the emission limits given in RA769. Satellite applications looking down will receive the cumulative interference from potentially millions of these devices and this will put extreme constraints on the out of band emissions that may be uneconomic and the due to the mass deployment, the potential for a faulty device to cause interference becomes high.

1452-1492 was originally the DAB-L and DVB-H band and should be brought into use along with the unpaired 2GHz bands. This is dormant yet harmonised mobile spectrum

1518-1559 MHz, 1626.5-1660.5 MHz and 1668-1675 MHz

These bands are extensively used for MSS worldwide, including safety of life services and also cover the 1670-1675 MHz Metsat allocation. Inmarsat and ESA, both with significant UK public and private sector investment, actively use these bands and have recently collaborated in developing the Alphasat satellite, an 800M€ investment due for launch in 2013. We agree with the ITU position that previous studies have demonstrated that sharing in this band is unrealistic and the band should not be considered for allocation under AI1.1.

1695-1700 MHz

This is an important band for meteorological satellites and is covered by RSA. This RSA is based on sharing with fixed links, it is difficult to see how sharing with the mobile service could be achieved. The UK has invested heavily in the Metsat service through the EU EUMETSAT and ESA programmes. This downlink band is an essential input into Met Office forecasting. Future satellites may be able to migrate to x-band spectrum but we estimate the current satellites using this band have a remaining lifetime of at least 20 years. We agree sharing studies should be undertaken and that the band should only be allocated to the mobile service if these studies demonstrate that the existing services can be protected.

2025-2110 MHz and 2200-2290 MHz

These are an import space operations, earth exploration and space research service bands. Footnote 5.391 to the radio regulations specifically forbids the deployment of high density mobile systems in these bands. We agree with the proposal not to make further studies in these bands and that the band should not be considered for allocation under AI1.1

3400-3600 MHz

This is the lower c-band which is heavily used by the fixed satellite service. Footnote 5.430A was added at WRC-07 permitting limited use for IMT in some countries, but not the UK. There is no official allocation to the fixed satellite service in the UK but the band is used by many other administrations, including several in Europe. It is also used by EUMETCAST to distribute meteorological data within Europe. Globally this band should remain as a fixed satellite service band to protect services in those regions where the high rainfall rates experienced prevent a migration to higher bands. The band is also important for BBC monitoring in the UK and existing monitoring stations should be protected. Agenda item 1.1 is considering a worldwide allocation, we agree that based on existing studies and Report ITU-R M.2109, that this band is not suitable for further study. It is already designated for IMT in many countries and for general mobile/FWA use above 3410MHz in CEPT.

3600-4200 MHz

This is the main c-band which is heavily used by the fixed satellite service and for broadcasting. The band is important and well used in the UK by broadcast monitoring stations and these should be protected. We consider that based on existing studies, neither segment of this band is suitable for sharing with mobile services.

4500-4800 MHz

We are not aware of any current or planned UK civil space sector use of this band. However, Appendix 30B of the Radio Regulations identifies this band in the fixed satellite service plan. Previous sharing studies in reports ITU-R M.2109 and M.2119 show that sharing is not possible. If this band is allocated to mobile it would prevent future satellite deployments in the plan which could impact the growth in the fixed satellite sector.

5350-5470 MHz

This band is allocated to Earth exploration satellite and space research services. The UK space agency and its predecessors and the Met Office have invested heavily in spacecraft that use this region of spectrum. We support studies but the band should only be allocated to mobile services is successful sharing can be demonstrated. This applies to existing Earth stations and also to new Earth stations. If this band is allocated to Mobile, a mechanism will be required enable the introduction of new earth stations as and when required by the Earth exploration and space research services.

5850-6425MHz

This is c-band, a primary allocation to the fixed satellite service extensively used for Earth to space links. We support the revisiting of existing studies and new studies. The band should only be allocated if these studies show sharing is possible without

constraining the fixed satellite service. It would not be acceptable to the satellite sector to deploy IMT in this band based around protecting IMT from existing satellite uplink facilities as this would inhibit future growth.

13.4-14GHz

The inclusion of this band is surprising.

The lower part of the band is extensively used by the Earth exploration and space research services and the upper part of the band is used by the fixed satellite service ku-band uplinks. While we support studies it is difficult to see how a mobile deployment could not cause unacceptable interference to the sensitive altimetry receivers. The UK have significant investments through ESA, e.g. in the RA2 instruments used for Radar Altimetry and very important inputs to weather forecasting.

Sharing may be possible with the fixed satellite service uplinks and we support studies. However, a deployment should not constrain existing and new deployments of fixed or temporary satellite ground terminals.

18.1 – 18.6 GHz

The inclusion of this band is also surprising as it is part of the satellite Ka-band downlink spectrum. The lower part of this band (18.1-18.4) is extensively used for broadcast satellite service feeds, reducing congestion at lower frequencies and is also used for distribution of meteorological data. The upper part of the band is used for many applications including passive earth exploration satellites and satellite broadband. It has been proposed for services to satellite earth stations on mobile platforms (ESOMPs). As above, limited sharing may be possible and we support studies. However, a deployment should not constrain existing and new deployments of fixed or mobile satellite receivers and should not increase interference to earth observation.

27 – 29.5 GHz

This is the Ka-band uplink and fixed service earth stations may be deployed in any part of the band 27.5-29.5 GHz. The band above 28GHz is used for Earth exploration satellite downlinks. With the roll out of Ka-band satellite services being a primary area for growth for the fixed satellite service, it is expected that there will soon be a high density of small satellite terminals actively using the band for uplinks. Previous studies have shown sharing was not feasible in similar situations at lower frequencies and clearly sharing with terrestrial mobile would be impractical. This band should not be considered for IMT.

38 – 39.5 GHz

While this band is allocated, technology still needs to develop to enable its use by the satellite service. Propagation impairments are the principle barrier to use for satellite links and the Inmarsat/ESA Alphasat satellite will carry an experimental payload to demonstrate use of this band as well as a propagation monitoring package. It is noted that several satellite networks now have filings in the Master Frequency Register. We support studies but it is probably too early to conclude if sharing is feasible.

Question 9: *Are there any other bands that are not in Table A6.1 for which you think we should be considering their pros and cons for mobile broadband and for existing applications using this spectrum?*

The UK Space agency can not comment on additional suitable bands, though we note there are several options to make better use of existing IMT allocations, e.g. pairing the unpaired 2 GHz bands and the 1452-1492 MHz band, which appears to be currently unused.

Question 10: *What are your views on bands which should be a priority for consideration for mobile broadband?*

We consider that with the new allocations made at WRC12 there is now already sufficient spectrum allocated to mobile broadband. Before new allocations are made better use should be made of the existing IMT spectrum, e.g. smaller cells, inter-provider capacity sharing and through alternative bands, for example greater use of WiFi offloading.