Crown Recognised Spectrum Access in 3400 to 3600 MHz: Consultation on spectrum policy and on terms of new grants and licenses

Intellect Response

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About Intellect

Intellect is the trade association for the UK technology industry. In 2007, the industries Intellect represents accounted for 8% of UK GDP, £92bn of Gross Added Value and employed 1.2m people.

Intellect provides a collective voice for its members and drives connections with government and business to create a commercial environment in which they can thrive. Intellect represents over 750 companies ranging from SMEs to multinationals. As the hub for this community, Intellect is able to draw upon a wealth of experience and expertise to ensure that its members are best placed to tackle challenges now and in the future.

Our members' products and services enable hundreds of millions of phone calls and emails every day, allow the 60 million people in the UK to watch television and listen to the radio, power London's world leading financial services industry, save thousands of lives through accurate blood matching and screening technology, have made possible the Oyster system, which Londoners use to make 28 million journeys every week, and are pushing Formula One drivers closer to their World Championship goal.

In the past 12 months 14,500 people have visited Intellect's offices to participate in over 550 meetings and 3,900 delegates have attended the external conferences and events we organise.

1) Do you agree that we should introduce RSA in the 3400 to 3600 MHz?

Intellect welcomes this consultation and broadly supports the thrust of the Ministry of Defences' (MoD's) proposals to reform UK Defence spectrum management and extend market principles to the MOD's use of spectrum. The release of these bands for commercial use has the potential to support a large amount of innovative wireless based services in the UK. As Ofcom states, the optimal use of this spectrum will promote the interests of both citizens and consumers. In our position paper, *Ministry of Defence Spectrum Divestment: The Intellect Perspective*, we outlined the challenges and believe the MoD recognises the complexity of this process and the balance that must be struck between technical, commercial and societal issues, UK and European legislation and treaty obligations towards bodies such as the International Telecommunication Union (ITU) and NATO.

The use of the RSA mechanism is the most appropriate way to facilitate access to these bands. There is a need to fully integrate three separate requirements in the course of the planned release. Firstly, to allow efficient release of spectrum to the market. Secondly, to afford possible retention of legal 'possession' of the bands to the MoD in the event that, for reasons of national security, it might need to leave open the possibility to make use of them again and thirdly, to incentivise public sector organisations, such as the MoD to trade spectrum directly with commercial stakeholders and receive the proceeds of such activity.

We believe that there are a range of additional factors that need to be taken into account in the course of introducing RSA rights in this and other bands that MoD has announced it will release over the course of the next two years and more. Some of these are for Ofcom to consider, others for the MoD. These factors are set out in detail in our paper *MoD Specturm Divestment: The Intellect Perspective,* which is submitted as an annex to this response.

In particular, it is conceivable (as the consultation document mentions) that Home office/security apps could operate in a different band, perhaps 3410-3440 MHz. This would

essentially create contiguous Government owned band, given the low prospect of release of spectrum below 3.4 GHz, where military use is likely to be more concentrated in future. Such a move has some logic to it, but Ofcom need to also take into account the current response assumptions about BEM/guards adjacent to the lower UK Broadband block or symmetric duplex channels. These are described in some detail below. In separate inputs to the MoD, in particular *MoD Spectrum Divestment: The Intellect Perspective*, Intellect have also advised that changes in allocation and terms of use could also be considered in the 2.69-2.7+ GHz radar band edge to encourage those users to 'move up' to higher frequencies . Similar changes to assumptions on BEM and other parameters would be need. In this response we haven't taken these potential changes into account as we are assuming these would form part of a separate consultation.

2) Do you agree that we should extend the relevant regulations to allow crown bodies to be granted and to trade RSA in the 3400-3480 MHz and 3500-3580 MHz blocks? If not, which frequency ranges do you think the RSA regulations should cover and why?

Intellect agrees that the regulations should be structured to allow Crown bodies to be granted and to trade RSA in the bands detailed in the question. Intellect would also agree with Ofcom and MOD that the spectrum occupied by UK Broadband for the purposes of mobile broadband (3480 – 3500 MHz and 3580 – 3600 MHz) should not be subject to RSA Regulations. In addition, whilst PMSE is a valuable application in this spectrum, we agree that the best way for the PMSE community to negotiate access to it is through the MOD and any existing user(s). Intellect is also a champion of the principle of technology neutrality, and accordingly, we believe that both of the abovementioned MOD bands should be made available in accordance with this principle. Excluding one or other bands would effectively prevent operators from deploying FDD systems. In this context, Ofcom should consider the possible restriction that the emergency service band will place on FDD service deployment. The base station Block Edge Mask in the EC decision 2008/411/EC was introduced in order to permit FDD and TDD systems to coexist. If FDD services are not accommodated, the benefits from adopting a stringent Block Edge Mask are very limited. Another intention of EC decision 2008/411/EC was to enable the coexistence of Mobile Broadband, or BWA, systems. Non BWA systems were not included in this decision.

Finally, it is important to note that any assessments (by potential commercial users) of the suitability of applications that might make use of the lower part of the band 3.4-3.6 GHz band when released under these proposals are to a great extent dependent on the applications to which the 3.1-3.4 GHz band is put when released "beyond 2012". As Ofcom will be aware, the applications to which a given band is put have a great deal of impact on the economic value that commercial interests will assign to it. The current lack of continuity in terms of the proposed timeframes for release of bands adjacent to 3.4-3.6 GHz will give rise to uncertainty over the applications that can be deployed in the band, which in turn could lessen the economic value of the spectrum in the eyes of commercial users. Careful consideration needs to be given to the timetable of spectrum release if the MoD (and, in future, other public bodies) is to realise the kind of revenue that it projects it might. In addition, the provision of as much information as possible on adjacent bands and any other clarifications that could reduce the uncertainty over the potential uses of them will be of great assistance to potential new service providers.

3) Do you agree that there should be no minimum trading unit for the RSA grant and the WT licenses arising from trade in the band?

Intellect disagrees with Ofcom in its approach to this issue. If no minimum trading unit is applied in these bands, there is a possibility that resulting allocations will become fragmented across the band.

As Ofcom will be aware, as technologies making use of wireless communications evolve, their demand for bandwidth increases. Industry needs access to stable, adjacent and holistic allocations of spectrum in order to launch services that can carry the level of traffic necessary to facilitate a return on investment for a given service in terms of the cost incurred to establish a given network and acquire rights to the spectrum in the first place. Band fragmentation, which is what would occur if Ofcom was to proceed with no minimum trading unit in terms of bandwidth, actively discourages the deployment of such high-value, wireless based services. This would suggest that a minimum unit of 5 MHz or 10 MHz should be considered instead.

To take one example, we anticipate any service provider looking to provide mobile broadband in this band would want access to a channel of at least 10 MHz and most likely 20 MHz in size. We believe that the greatest economic and social benefit can be afforded to the UK if a minimum trading block is introduced of this nature,

At the same time, we believe that there does need to be some flexibility in general on the issue of geographical trading areas. UK commercial interests are currently making substantial use of bands currently reserved for MoD use. Much of this usage is directly related to the development of innovative wireless technologies for both consumer and military use. Technological innovation of this kind makes a substantial contribution to the UK economy in the form of job creation and increased exports. Appropriate availability of spectrum in key locations is important to ensuring its continued success. We believe the MoD should facilitate continued use of bands currently and consistently used to test and develop new wireless technologies in the immediate geographical area of the relevant locations.

To be clear, we are not aware of specific uses of this nature in the 3.4-3.6 GHz band, but at same time do not believe that such use should be precluded. Small scale geographic protection, by means of a given interest acquiring rights to a band in a small area, would be facilitated by introducing a geographic trading unit, but also facilitating exemptions to it in certain situations where use was directly connected to innovation or Research and Development activity.

4) Are there specific conditions that you consider should be included in RSA Grants and WT licenses arising from trading in the band?

Intellect strongly supports provision for nationwide use of spectrum released in these bands, subject to our statement on geographic trading units in Question 3). We would emphasize that making this spectrum available on a localized and geographically constrained basis is likely to attract significantly less interest from commercial users than that which is released on a national basis. Due consideration should be given to releasing less actual spectrum but in cleared national blocks that are in, or adjacent to, the most commercially attractive bands. Such an approach would undoubtedly lead to greater economic value being attached to the spectrum that is released, lower equipment costs and complexity and, accordingly, greater interest from private sector users in acquiring the rights to make use of it, as well as greater certainty for ongoing MoD use in the remainder and higher levels of revenue for them in facilitating RSA use.

Irrespective of whether spectrum is released nationally or regionally, there will be a need for technical limits to protect other spectrum users. Ofcom proposes in-band power limits and boundary conditions for new users of the bands 3400 – 3480 MHz and 3500 – 3580 MHz. Whatever values are chosen for those limits, they would not be sufficient on their own to protect other spectrum users in some circumstances in two respects:

Firstly, the band above 3580 MHz is allocated to the fixed satellite service (FSS) and is used by FSS earth stations located in the UK. The unwanted emissions from new users in the 3500-3580 MHz band in particular might cause harmful interference to FSS earth stations. This can occur irrespective of the values chosen for the block edge mask. Studies conducted by ITU-R and CEPT (see, for example, ECC Report 100) show the need for coordination of BWA base stations under certain situations in respect of unwanted emissions.

The results in ECC Report 100 show, for example, in the case of BWA base station with an unwanted emissions EIRP density of -72 dBW/MHz (-42 dBm/MHz), the worst case separation distance to an FSS earth station is about 1 km. In the case of a BWA terminal station (TS1) with unwanted emissions EIRP density of -50 dBW/MHz (-20 dBm/MHz), the worst case separation distance to an FSS earth station is 13.7 km. The geographic separation of terminal stations from FSS earth stations can be assured through coordination of the earth station with an adequate coordination distance. The limits in the block edge mask proposed by Ofcom, assuming a minimum frequency separation of 20 MHz, are higher than the values assumed in Report 100, which would suggest the possible need for larger separation distances. It is noted that these distances should be considered coordination distances and in most case coordination would allow operation of BWA base stations and terminal stations closer to an FSS earth station.

Secondly, FSS earth stations are operated in the bands 3400 – 3480 MHz and 3500 – 3580 MHz in countries neighbouring the UK. The ITU places a requirement for coordination of terrestrial stations which would be located in the coordination area around FSS earth stations. The coordination areas for earth stations operating in neighbouring countries in some cases overlap with the UK. Just as we should expect our neighbours to ensure their terrestrial stations do not cause harmful interference to UK earth stations, UK must ensure that our terrestrial stations do not cause harmful interference to foreign earth stations.

These two issues lead to a requirement for coordination of terrestrial stations in some circumstances, firstly on the basis of their unwanted emissions with respect to UK licensed FSS earth stations, and secondly on the basis of their in-band emissions with respect to some FSS earth stations in other countries.

These two requirements are not likely to be major constraints on the use of the bands 3400 – 3480 MHz and 3500 – 3580 MHz but are important for the ongoing protection of other spectrum users . These requirements need to be ensured and therefore specific conditions should be considered for inclusion in RSA grants and subsequent WT licenses.

5) Do you agree with the proposed in block emissions limit for base stations in the 3500 – 3580 MHz block?

Intellect believes that a default in-block and out of block limits (Block Edge Mask) could be introduced that is derived from ECC REC (04)05, with the following provisions:

The default base station block edge limits should be based on ECC REC (04)05, with a 20 MHz block allocation and antenna gain of 16 dBi, with the emission limits in the ECC

recommendation, starting from the midpoint of adjacent restricted blocks[1]1. The use of the restricted band is either through synchronisation or limiting the maximum in band power permitted, similar to the European commission decision for the 2.6 GHz band- 2008/477/EC2. The base station Block Edge Mask limits between 0 and 2.5 MHz offset from the block edge, and should comply with ETSI EN 302 326 assuming a 20 MHz channel bandwidth and an in band EiRP of +53 dBm/MHz.

Proposed default BS BEM	
Offset from block edge {in MHz}	**Maximum mean EiRP**(in dBm/MHz}
0	+53
0 < Δf < 2.5	+22 - 4.8 * ΔF
2.5 < Δf < 6.5	+10 - 10.25 * (ΔF – 2.5)
6.5 < Δf < 9.5	-31 - 4 * (ΔF – 6.5)
≥ 9.5	-43
Note: 1) This BS BEM only applies; - when Base station EiRP is greater than 25 dBm/MHz or - the antenna height is above the roof line; or - in the absence of a bilateral agreement with the adjacent BWA operator. 2). The limits in this table are based on ECC REC (04)05 with the block edge at the centre of a 5 MHz external guard band or restricted blocks	

There may be other solutions

6) Do you agree with the proposed out of block emissions mask at the 3500 MHz and 3580 MHz boundaries for base stations?

Intellect believes that the blocks 3500 – 3505 MHz and 3575 – 3580 MHz should be restricted to synchronised TDD, essentially because the NATO Band at 3400 – 3410 MHz creates corresponding unpaired blocks at 3500 – 3510 MHz. Similarly, we expect the 3575 – 3580 MHz band to be restricted to synchronised TDD because the current guard band at 3475 - 3480 MHz creates a corresponding unpaired band at 3575 – 3580 MHz.

Above and beyond the creation of these unpaired blocks, it is important to note that adjacencies between spectrum blocks need to be accommodated. Commission Decision EC 2008/477/EC (related to the harmonization of the 2500 - 2690 MHz,) provides a a clear direction regarding adjacencies between licence holders as follows:

"To achieve compatibility a separation of 5 MHz is needed between the edges of spectrum blocks used for unrestricted TDD (time division duplex) and FDD operation (frequency division duplex) or in the case of two unsynchronized networks operating in TDD mode. Such separation should be achieved by either leaving these 5 MHz blocks unused as guard blocks; or through usage that complies with parameters of the restricted BEM when adjacent to an FDD (uplink) or between two TDD blocks; or through usage that complies with parameters of either restricted or unrestricted BEMs when adjacent to an FDD (downlink) block."

[1] ECC REC (04)05, Page 13: The reference frequency ΔF=0 of the mask should be understood as the central division line between adjacent frequency blocks. If the blocks are immediately adjacent, then the mask reference frequency is precisely the border between the two assigned blocks and respecting the mask limits may require operators to employ appropriate guard band inside the assigned blocks. However, if an administration decides to introduce between neighbouring blocks external guard band of ~25% of the assigned blocks (see Annex 1), then the reference frequency ΔF=0 of the mask should be understood to be at the centre of guard band between neighbouring blocks

7) Do you agree that less stringent technical parameters should be permitted if agreed between neighbouring operators?

Intellect believes that Ofcom should make reference to and implement relevant provisions of to ECC Decision 2008/411/EC, which looks broadly at the creation of a single market for services that use the band 3400-3800 MHz. The decision also specifies certain technical parameters which include limits for in-band emissions (i.e. EiRP radiated power levels) and limits for out-of block emissions (Block Edge Mask). The decision allows less stringent in-band and out-of-band emissions if there are bilateral or multilateral agreements between adjacent spectrum holders, using the following language.

"Less stringent technical parameters, if agreed among the operators of such networks, can also be used. Equipment operating in this band may also make use of e.i.r.p. limits other than those set out below provided that appropriate mitigation techniques are applied which comply with Directive 1999/5/EC and which offer at least an equivalent level of protection to that provided by these technical parameters".

8) Should we align UK Broadband licence conditions for base stations at 3500 MHz and 3580 MHz with those in the RSA grants if and when UK Broadband requests us to do so?

As a trade body representing 780 member companies, Intellect do not believe it is appropriate to comment on the content of one individual member companies license conditions outside the context of a dedicated consultation document relating to them. That said, specific views on base station limits are shown in our answer to Question 5 and we believe that they are applicable in context of this question.

9) Do you agree with the proposed in block emissions limits for terminal stations?

Intellect believes that the proposed in-block emission limits for terminal stations, as outlined by Ofcom, are acceptable.

10) Do you agree that the block edge mask should be based on the spectrum emissions mask from ETSI EN 302 623?

Intellect believes that fixed and nomadic terminals should be exempt from a Block Edge Mask as long as the terminal equipment complies with ETSI 302 326. The mobile terminal Block Edge Mask should be based on a 10 MHz channel complying with ETSI EN 302 623 without an offset from the block edge, thereby permitting two 10 MHz channel with no internal guard band

Mobile Terminal BEM	
Offset from block edge {in MHz}	Maximum mean EiRP {dBm/MHz}
0	+25
$0 < \Delta f < 2$	$+9.73 - 9.11 * \Delta f$
$2 < \Delta f < 10$	$-8.5 - 0.5 * (\Delta f - 2)$
$10 < \Delta f < 12$	$-12.5 - 5* (\Delta f-10)$
≥ 12	-22.5
Note: The above values are based on an in-band EIRP of 28 dBm and a carrier bandwidth of 10 MHz complying to ETSI EN 302 623	

11) Do you agree with our derivation of regulatory out of block limits for terminals and, if so, which of the proposed four alternative regulatory conditions do you think most appropriate?

Intellect has no strong preference but Option 3 for mobile terminals and option 4 for fixed and nomadic terminals offers a reasonable regulatory condition.

12) Should out of block limits for fixed, nomadic and mobile terminals be different?

Intellect believes that fixed and nomadic terminals should be treated differently from mobile terminals. Fixed and nomadic terminals should be exempt from a Block Edge Mask as long as the terminal equipment complies with ETSI 302 326.

13) Should we align UK Broadband licence conditions for terminal stations at 3500 MHz and 3580 MHz with those in the RSA grants if and when UK Broadband requests us to do so?

As a trade body representing 780 member companies, Intellect do not believe it is appropriate to comment on the content of one individual member companies license conditions outside the context of a dedicated consultation document relating to them

14) Do you agree that the technical limits at 3480 MHz should copy those at 3580 MHz when the use immediately below 3480 MHz is broadband wireless?

Intellect believes that the technical limits at 3580 MHz could be based on the presence of a restricted block between 3575 – 3580 MHz (i.e. the block edge is at 3577.5 MHz) and the technical limits at 3480 MHz could be based on the presence of a guard band between 3475 – 3480 MHz (i.e. the block edge is at 3477.5 MHz).

15) Do you agree with the proposed technical limits at 3480 MHz for the scenario where the upper edge of the emergency services block does not change from the current allocation at 3475 MHz?

Intellect believes these technical limits are sound and should be implemented.

16) Do you agree with the proposed technical limits at 3480 MHz for the scenario where the upper edge of the emergency services block is moved to 3480MHz?

Intellect does not believe that the guard band that is currently in place at the upper edge of the emergency service band should be moved. We also draw Ofcoms attention to the need determine future intentions, as mentioned in our response to Q1, and in the consultation document regarding whether Home Office applications may move down the band. This would clearly have an impact on conditions for the 3475-3480 MHz area of the band.

There are a number of reasons for this, but one key one relates to the possibility of interference being caused as a result of “airborne digital video/data links”, also known as “Helly-Telly” equipment operating in close proximity to a lower power mobile broadband device. The guard band between UK Broadband’s 3.4 GHz license and the emergency service band needs to be retained to prevent this occurring.

Intellect has also noted the inability of Ultra-Wideband (UWB) detect and avoid technology to protect broadcast services like digital video links ECC Decision (06)12 permits the use of UWB applications with a maximum peak EiRP of 0. This is higher than the out of band power that could be expected from a mobile broadband device that it operating in compliance with the ETSI standard EN 302 623. In outdoor environments, power control should further reduce any adverse effects on the operation of Heli-Telly.

In addition, we note the potential use of UWB applications installed in vehicles to improve road safety. Because of such use, users of digital video links will need to work alongside sources of interference greater than that produced from mobile broadband devices using the 3 GHz band. We have also followed the work of ETSI and other National Regulatory authorities, who are considering whether to permit UWB applications with transmit powers 20 dB greater than currently allowed by ECC (06)12. These will be used for location tracking of emergency service personnel working in dangerous environments such as burning buildings. Location Application for Emergency Services (LAES) is likely to result in harmful interference, in the Home office band if the use of UWB and airborne digital video links equipment is not effectively coordinated.

17) Do you agree that the technical conditions of the RSA grant at the 3500 MHz and 3580 MHz boundaries are the best option for the boundaries that will appear inside the 3500 – 3580 MHz block if the block is partitioned and traded into several smaller sub-blocks?

Intellect would suggest that networks operating in the 3500 - 3580 MHz range will also require restricted blocks between adjacent systems. The alternative is to a consistent policy for synchronization between different license holders based on that used in Commission Decision EC 2008/477/EC (related to the harmonization of the 2500 - 2690 MHz) and elaborated on in our answer to Question 6.

18) Do you think that the out of block limits for broadband wireless base stations in Figure 8.2 are sufficient to protect air-to-ground videolink receivers in an adjacent block?

Intellect believes that the limits shown in Figure 8.2 of the consultation document are sufficient.

19) What are your views on the requirements for protection of air-to-ground videolink receivers from interference from broadband wireless terminals?

Intellect believes that air to ground video links will be more prone to UWB interference, than interference from mobile broadband devices. As we state in our answer to question 16) UWB applications in vehicles will operate in close proximity to ground based receivers and UWB detect and avoid will not protect broadcast systems using the 3 GHz band.

A possible outcome is that video-links will be affected by Location Application for Emergency Services (LAES), especially if permitted a maximum peak EiRP of 20 dBm in 50 MHz. Furthermore, the 2012 games is very likely to need 3.4-3.6GHz spectrum for intense wireless camera use and this should be factored in.

Question 20) do you think that an out of block requirement for airborne videolink transmitters of -25 dBm/MHz EIRP is sufficient to protect broadband wireless receivers?

Intellect believes this limit is sufficient, but however it should be noted that emission limits designed into mobile broadband devices systems do not automatically apply others. Mobile Broadband co-existence studies have assumed a height of 30 metres; whereas Video-links used on police surveillance helicopters have line of sight to any nearby base station and an effective antenna height of several hundred metres.

_____END OF INTELLECT RESPONSE_____

DIVESTMENT OF MINISTRY OF DEFENCE SPECTRUM: THE INTELLECT PERSPECTIVE

ABOUT INTELLECT

Intellect is the UK Trade Association for the Technology industry. Our 750 member companies collectively account for 10% of UK GDP and 15% of overseas trade. Intellect incorporates the Intellect Wireless Council (IWC). The IWC formulates and communicates Intellect perspectives on wireless issues, including spectrum allocation policy and licensing to Government, Ofcom and associated executive agencies. Membership of the council is comprised of senior representatives from Intellect member companies with significant wireless related business in consumer, professional, civil and military markets. The council works to promote the use of wireless technologies for the benefit of Intellect members, industry and the UK and European economies.

SUMMARY

- As we noted in our response to the MoD Consultation *An Implementation Plan for Reform,* Intellect broadly supports the wide ranging approach which MoD is taking to reforming UK defence spectrum management. We believe that MoD recognises the complexity of this process and the balance that must be struck between technical, commercial and societal issues, UK and European legislation and treaty obligations towards bodies such as the International Telecommunication Union (ITU) and NATO.

- We believe that the MoD could benefit from access to the IWCs experience in these areas. The IWC is therefore keen to engage in a dialogue with MoD and, if appropriate, other Government Departments such as BIS and the Treasury, to support MoDs spectrum release and reform plans. Such engagement would help to maximize the economic and societal benefits of this process to the UK Government, its citizens and 'UK Plc'.

- The remainder of this paper sets out some of the complexities of this task in detail, outlines factors that we believe need to be considered in the course of the MoD divestment and reform programme, and highlights the challenge of applying the appropriate resources and skills needed to successfully realise it.

THE CHALLENGE OF MAXIMISING ECONOMIC & SOCIETAL VALUE

- It is inevitable that during the process of releasing spectrum there will be cases where 'temporary' band- edges arise between sections of spectrum which have been released and adjacent sections which will be released later. The release plan should try to minimize the effects of these, since they introduce a degree of uncertainty until all the release has actually occurred (or confirmed not to be). This uncertainty may reduce the economic, societal and technical value of the first sections to be released. For example, the band 3.1-3.6 GHz [*] is to be released in two separate sections, 3.4-3.6GHz* "By November 2010", and then 3.1-3.4 GHz* "Beyond 2012". Any assessments (by potential commercial users) of the suitability of applications that might make use of the lower part of the band 3.4-3.6 GHz* band when released "By November 2010" are to a great extent dependent on the applications to which the 3.1-3.4 GHz* band is put when released

[*] In citing these examples, Intellect acknowledges that the MoD plans to release "some spectrum" from within these bands, and not the entire range quoted.

"beyond 2012" (see below). The applications to which a given band is put has a great deal of impact on the economic value that commercial interests will assign to it. The current lack of continuity in terms of the proposed timeframes for release of adjacent bands will give rise to uncertainty over the applications that can be deployed in the band which in turn could lessen the economic value of the spectrum in the eyes of commercial users. Careful consideration needs to be given to geographic and spectrum packaging along with the timetable of spectrum release. In addition, the provision of as much information as possible on adjacent bands and any other clarifications that could reduce the uncertainty over the potential uses of them will be of great assistance to potential new service providers.

- Whilst we support and encourage the release of spectrum holdings that are held by MoD and its public sector partner organisations, we would emphasise that making such spectrum available on a localised and geographically constrained basis is likely to attract significantly less interest from commercial users than that which is released on a national basis. It follows that, in any review of the schedule for release of MoD Spectrum holdings, due consideration should be given to releasing less actual spectrum but in cleared national blocks that are in, or adjacent to, the most commercially attractive bands. Such an approach would undoubtedly lead to greater economic value being attached to the spectrum that is released, lower equipment costs and complexity and, accordingly, greater interest from private sector users in acquiring the rights to make use of it, as well as greater certainty for ongoing MoD use in the remainder.

- In relation to the above point, we believe that a number of specific bands on the current schedule cannot feasibly be released for commercial use on a nationwide basis. For example, the 3.1 GHz-3.4 GHz band is likely to be particularly difficult to release in this waybecause of powerful 'magnetron' radars and airborne and maritime use within it. Its commercial value will be significantly reduced as a result[1]. As we note below, Intellect understands the necessity of, in some cases, releasing military spectrum on a regional basis. This does however need to be clearly reflected in assessing its value. Greater clarity on the specific portions of these bands that will actually be available on a national basis would also be welcomed.

- Secondary trading, or 'sharing' of spectrum, can have unexpected consequences. It is fashionable to propose that users of a given band will consider instituting 'detect-and avoid strategies', or other 'interference avoidance' measures, when new users launch services in an adjacent band. These techniques are inherently complex and difficult to optimize and can thus seriously reduce the potential economic value of both the shared and adjacent spectrum bands. It is of key importance that MoD considers the difference in economic, societal and technical value between spectrum assigned/released on a primary basis and that released on a shared basis. For example, in the case of long range radars operating in 2.7-3.4GHz band the sharing criteria is likely to be more onerous than that encountered in other bands. Given this, and the fact that there is little prospect of international harmonization in this band, MoD could consider moving these radars into one part of the band to release more spectrum that is not subject to such difficult sharing conditions.

- We anticipate that allocations for some bands scheduled for release under RSA are harmonized with allocations for armed forces in allied NATO member states, and that their usage in allied

[1] In relation to this specific example, some members have noted that the 2.7-3.1 GHz band may be more commercially attractive for partial release (especially at its lower end due to its proximity to the harmonised 2.5-2.69GHz band). Whilst currently well used in comparison with the 3.1-3.4 GHz band, replanning and improvements to radar spectrum efficiency and spurii are more likely to facilitate some release nationwide. ie pushing the radars upwards within the 2.7-3.4 range may yield greater benefit than the reverse.

NATO states is broadly analogous with that in UK. If this were to be the case, a band that MoD judge to be suitable for commercial use might also be suitable for release by other NATO member states in Europe. The economic and societal value of spectrum generally increases when the geographical area over which it can be used increases. As such, Intellect believes that the encouragement of similar pan-European efforts would help to increase the economic value of the spectrum being released under RSA in the UK in the eyes of potential commercial users. We would suggest that the MoD explores how such efforts could be initiated.

- Despite the best intentions, it is very difficult to set technical parameters which are truly 'technology neutral'. When the specific technical parameters and conditions of use are published for this spectrum, the economic value of spectrum released by MoD will be directly impacted. Considerable knowledge and expertise is required to perform this complex function and MoD must address the challenge of how these skills are to be developed and retained.

- Technology that makes use of wireless communications links advances very rapidly. New devices, and the business models behind their deployment, are growing ever more complex. In this context, we believe those who acquire secondary rights for MoD spectrum will need the flexibility to upgrade their systems in order to take advantage of these new technical developments. This will require appropriate provision for some form of derived 'liberalisation' of technical parameters and conditions, and perhaps the actual allocation of bands concerned. Such provision adds a layer of complexity to this process. But if it could be accommodated by MoD, the economic value of the spectrum being released would be significantly increased.

- UK commercial interests are currently making substantial use of bands currently reserved for MoD use. Much of this usage is directly related to the development of innovative wireless technologies for both consumer and military use. Technological innovation of this kind makes a substantial contribution to the UK economy in the form of job creation and increased exports. Appropriate availability of spectrum in key locations is important to ensuring its continued success. We believe the MoD should facilitate continued use of bands currently and consistently used to test and develop new wireless technologies in the immediate geographical area of the relevant locations. One way to achieve this would be to ensure that certain geographical areas are 'ring fenced', in terms of facilitating continued use of released spectrum within such areas for test and development purposes.

THE INTELLECT VIEW: Commercial spectrum stakeholders will focus on the above considerations when determining whether to pursue relevant processes for gaining access to spectrum accorded RSA status under this process. We believe that any assessment of the economic value of MoD Spectrum released for needs to take full account of them. The amount of revenue gained by the MoD as a result of changing spectrum holdings to RSA status will be directly related to such factors. Similarly, the economic wealth indirectly generated via innovative use of some MoD spectrum needs to be considered when determining how any release is realized.

RELATIONSHIP CHALLENGES BETWEEN EXISTING REGULATORS & THE MoD

- Spectrum is assigned on a global basis through decisions made within the International Telecommunication Union (ITU). All commercial use of spectrum needs to be viewed through this paradigm. The likely commercial applications for any released spectrum will therefore cover a very wide range of applications and users. Many of these will have completely different needs and objectives. The processes and procedures through which the ITU allocates a given

band within national frequency allocation tables needs be given due consideration in the course of any release.

- Some of the frequency bands scheduled for secondary use under RSA are also subject to recommendations issued by the European Union. For example, the 3.4-3.6 GHz band is subject to Commission Decision 2008/411[2], which includes defined EIRP limits and an OOB[3] mask for central stations. The Commission Decision does allow for such limits and the masks to be relaxed but only under special arrangements and circumstances. There may be uncertainty as to whether incumbent users of these bands will be able to accommodate the deployment of any desired new service. These wider challenges need to be understood by MoD and their provisions clarified to the wider market.

- Effective management of spectrum released under the RSA process will also include involvement in the derivation of new international harmonization measures and cross border co-ordination to ensure that the commercial utility of these bands is not unduly constrained.

THE INTELLECT VIEW: The MoD should consider providing further clarification on how the need for compliance with European and International Telecommunications Union (ITU) regulation will be met.

CHALLENGES IN ENSURING EFFECTIVE & EFFICIENT SPECTRUM MANAGEMENT

- Changing the classification of numerous bands from 'crown immunity' to RSA status will fundamentally change the manner in which they are managed. Any future services used in them are likely to be more complex and subject to change than current ones. These future services are also likely to operate in a commercial context and, therefore, under commercial constraints. The technical, enforcement and administrative burden of managing these bands is likely to significantly increase as a result. The amount of spectrum involved, the relative complexity of the services and their deployment, and the possible associated legal considerations[4] highlights the challenge of ensuring appropriate resourcing for any spectrum management functions undertaken.

- Specifically, any new spectrum management regime will need to include an effective process for co-ordination between current users of the bands concerned and any new users of it. Although Ofcom have shown considerable ability at fulfilling this function over recent years, we believe that they might face a conflict of interest if they were to manage both public and military spectrum, as different priorities drive the process in the two cases. In addition, the MoD (or an associated party) would have a better understanding of how the spectrum it administers is used, as well as the associated drivers and constraints. They are also privy to information which only those with relevant security clearance can access, such as the specific technical characteristics of military applications that may be using bands adjacent to those being released. As we note elsewhere, such information is crucial if released spectrum is to be usable and tradable. In the light of these facts, we strongly believe that any spectrum management function relevant to this process should incorporate third party and MoD expertise and capability to optimize the commercial and security interests of the spectrum.

[2] COMMISSION DECISION of 21 May 2008 on the harmonisation of the 3 400-3 800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

[3] Out of Band

[4] For example, The Competition Act (1998) & The Enterprise Act (2002)

- Any assessment of the appropriate mechanism for managing spectrum released under RSA should be based on a detailed analysis of the costs and benefits of the various options that are available. Regardless of the mechanism, co-ordination of primary and secondary spectrum users takes a lot of time and effort. It is critical that appropriate resource is allocated to it. We would welcome further detail on how the appropriate level of resource for managing the reform process, including the release and subsequent management of the spectrum concerned, will be ensured.

- Spectrum management functions also encompass surveillance and radio interference investigation duties. Some of these duties could be performed by third parties. There is a need, however, to clarify the basis under which these duties would be fulfilled in context of the MoD Spectrum divestment process, as they often involve the police and other relevant law enforcement agencies. We foresee this to be an important activity for any organization appointed to fulfill a band management function, as it needs to be able to work closely with appropriate agencies already engaged in these tasks.

- Effective spectrum trading schemes include a function that facilitates an information sharing system that potential and actual traders can use to contact each other. Intellect would anticipate that such a system is already envisaged in this context. However, we have yet to see what form it will take, its mode of operation and whose responsibility it will be to ensure it is effective. Likewise, a given spectrum trading system also incorporates processes that ensure control over the spectrum concerned is maintained. We appreciate that the MoDs overriding priority is for Defence users to have access to the spectrum they require. As such, we feel that it is important that the information systems and processes that facilitate commercial engagement are compatible with those used to manage spectrum retained for exclusive Defence use. At the most fundamental level this would mean that, with due regard to security constraints, defence spectrum managers and any market engagement team (and their respective information systems) would draw on a common set of underlying data describing the totality of MoD spectrum holdings. Intellect believes that the resources and investment required to implement an information sharing system of this type are significant. Ofcom and equivalent independent frequency co-ordinators, e.g. JFMG, have proven adept at fulfilling this market liaison function since their formation. Furthermore, their processes / systems should be considered as a model for bands currently managed by MoD and subject to the divestment process.

- The amount of spectrum to be released is of itself sufficiently large that it implies a ‘full suite’ of spectrum management capabilities will be required. The staffing levels, and the skills which those staff possess, must be appropriate to the demands to be placed on them. The resource implications of ensuring that appropriately skilled staff are recruited and retained in sufficient numbers are likely to be significant. We would welcome any further information that can be provided on the current or future availability of these resources.

- Processes for mitigation of interference (a key role of a spectrum manager) almost always include a mechanism whereby current regulation or technical parameters can be modified in order to take account of practical experience by users. We believe it is very important that MoD makes provision for resolution of interference issues when bands are released under RSA. Appropriate resource, which should include staff with the appropriate skills, must again be put in place to perform this function.

THE INTELLECT VIEW: Any spectrum management function should be carried out by the MoD in

combination with a third party that has legal and actual competence (or access to competence) in dealing with civilian law enforcement agencies. This needs to be provided on a long-term basis rather than just for the period of the spectrum release process. Regardless of the organization responsible, appropriate resources and sufficiently skilled staff are crucial. These resources and staff need to be targeted at the provision of effective information sharing system as well as mitigation of interference issues (including enforcement). It is our firm belief that any additional funding necessary for providing these resources should be come from the revenue the MoD draws from those organizations it grants RSA rights to. The current fiscal climate, and the need to prioritize resources towards front line operations undertaken by UK Armed forces, would appear to necessitate this.

CONCLUSION

It should be emphasized that Intellect fully supports and welcomes the opening of MoD assigned bands to commercial interests through market mechanisms. We wish to ensure that the MoD derives maximum benefit from its initiative in launching this process. We believe that consideration of some of the factors outlined in this paper, and provision of some of the clarifications noted, will enable spectrum stakeholders to maximize the opportunities that this initiative presents to them. This will in turn enhance the economic value of the spectrum concerned and also the potential revenue to be gained by the MoD from this process.