Intelsat response to Ofcom consultation document on the application for a variation to Freedom4's '3.6 GHz licence'

We understand that Ofcom's initial view after analysing the Freedom4 application is that, as soon as possible, a variation in the licence should be made to

(a) Increase the central station maximum EIRP density from 14 to 23 dBW/MHz, but retain the requirement for the central stations to coordinate with co-frequency stations in other services (including satellite earth stations),

(b) Remove the central station EIRP limit of 22 dBW,

(c) Retain the maximum EIRP density of 25 dBm/MHz for the low-power terminals, but allow the use of such terminals to be mobile, and

(d) Remove the requirement for the low-power terminals to coordinate.

However we note that Ofcom will not reach a final decision in this matter until it has carefully considered the responses to the consultation. We note also Ofcom's request that responses should address the following question:

"Are there any reasonable grounds why Ofcom should not grant Freedom4's request to vary its licence as soon as practicable? If so, please explain your reasoning for this."

Intelsat believes there **are** reasonable grounds why the request should not be granted, and our reasoning is explained in the following points.

1. We strongly endorse the retention of the requirement for Freedom4's central stations to coordinate, but note that the proposed increase in central station EIRP density would increase the sizes of the coordination areas. As an example, in Annex I contours are plotted around a hypothetical FSS earth station in central England for the existing and proposed central station EIRP densities. Within each of these contours the long-term protection criterion used in the ITU-R studies for WRC-07 agenda item 1.4 would be exceeded at the earth station, unless some form of interference-mitigation technique was implemented (e.g. use by Freedom4 central stations of sector antennas with 'nulls' in the direction of the earth station). In this example the average coordination distance would increase from 40 to 45 km.

Note: substantially longer distances correspond to the short-term protection criterion used in the ITU-R studies for WRC-07 agenda item 1.4. This is as shown in Annex 2 for the same earth station, where the average distance to the contour exceeds 200 km.

As part of the coordination process, in many cases where reliance is to be placed on local 'clutter' to reduce interference, it will be necessary for measurements to be carried out to ensure that the agreed protection criteria will be met, before deployment of a central station.

2. Removing the Freedom4 central station absolute EIRP limit (22 dBW) may lead to overdrive of satellite earth station receivers in adjacent bands, depending on the bandwidth of the central station carrier. In principle it would allow a central station carrier using the whole of either of the Freedom4 bands (84 MHz wide) to have an EIRP of 42.24 dBW – an increase of 20 dB relative to the status quo. We therefore propose that, in addition to coordinating with FSS earth stations receiving carriers within these two bands, Freedom4 central stations should also be required to coordinate with all C-band FSS earth stations that are sufficiently close to suffer from receiver overload and/or unwanted out-of-band emissions. Example contours for such coordination are likely to have smaller mean radii than those in Annexes 1 and 2, but can be produced in a similar manner.

In Intelsat's opinion the current conditions attached to the licence variation do not guarantee that satellite earth stations operating in adjacent bands will be able to continue service safe from harmful performance degradation. We request that Ofcom revisit the current licence variation in this respect in close discussion with the satellite industry.

3. Comparing the "*Co-ordination*" requirements in the text of the proposed Freedom4 licence with those of the existing licence, Intelsat is concerned by the proposed removal of paragraphs (a) and (b):

> Existing licence, Annex 6, schedule 1, section 5
>
> *a) Without prejudice to the Site Clearance required in paragraph 4, the Licensee must obtain permission from Ofcom prior to establishing, installing and/or using the Radio Equipment at any geographic location covered by this Licence. Ofcom shall grant such permission where, following use of its co-ordination process, Ofcom considers that the Radio Equipment does not cause undue interference to existing authorised users of the band and adjacent band users.*
>
> *b) In granting approval Ofcom may specify restrictions on the use of Radio Equipment including restrictions, beyond those set out in the other terms of this Licence, on the maximum radiated spectral power density allowed on specific frequencies, the directions of transmissions and locations of Radio Equipment.*
>
> *c) The Licensee must also operate the Radio Equipment in accordance with any coordination procedure notified by Ofcom.*
>
> Draft new licence, Annex 7, schedule 1, section 5
>
> *The Licensee must operate the Radio Equipment in accordance with any coordination procedure notified by Ofcom.*

Intelsat is firmly of the view that paragraphs (a) and (b) should be retained, and further proposes that Ofcom's coordination procedure should be spelled out in the new licence. We look forward to working further with Ofcom on this issue to reach certainty that satellite earth stations will be sufficiently protected in the coordination process.

4. Although Freedom4's application does not request an increase in the maximum EIRP density of the low-power terminals, it should be noted that the existing limit of 25 dBm/MHz is **17.5 dB higher** than the figure used in the ITU-R preparatory studies for WRC-07 Item 1.4. Nevertheless, the map in Annex I includes a contour within which a low-power terminal would exceed the long-term protection criterion at the example earth station. The corresponding average coordination distance would be of the order of 26 km, i.e. 19 km less than the distance for a central station. The fact that this difference is much greater than the radius of a typical WiMAX cell (e.g. 5km) suggests that, provided the central stations are successfully coordinated, interference from the low-power terminals is unlikely to be significant. However, Intelsat cannot support the removal of the requirement for low power terminals to coordinate unless and until we are satisfied that the coordination of the central stations will guarantee protection for satellite earth stations from harmful interference. If the arrangements for coordination with the central station are inadequately defined the removal of the requirement to coordinate the low power terminals will compound the interference suffered by the satellite earth station and the quality of service available to its users.

It is also important to note that, should the Freedom4 system use FDD, the central station and mobile stations would operate on different frequencies. In this case it would be necessary to coordinate the central station as if it operates both on its own and on the mobile terminal transmit frequencies.

5. From the frequency-sharing viewpoint the most significant problem with Freedom4's application is the request for the low-power terminals to be mobile. In order to provide service throughout a given area this would require the central stations to be able to transmit in all horizontal directions. Although in principle each central station could protect satellite earth stations within that area by using antennas with nulls in the appropriate directions, the terrestrial system would then be unable to serve mobiles while they were in the vicinities of the satellite earth stations. In other words there would be substantial 'holes' in the Freedom4 coverage of that area. Of course this problem would not arise in an area in which there were no satellite earth stations, but it would severely limit the aim to provide mobile service throughout the UK. From Annex 1 it can be deduced that a typical size of area within

which a satellite earth station would need long-term protection from Freedom4 central stations would be of the order of 6500 Km^2.

These considerations suggest that, although coordination of Freedom4 central stations has been successful up to now, changing the licence to permit mobile use of low-power terminals would lead to increasing problems in coordinating additional central stations as further roll-out of the Freedom4 system occurs. Furthermore, opening up the Freedom4 system in this way would be likely to stimulate applications for similar licences by other operators, which if granted would exacerbate the problem.

And even assuming that all necessary coordinations were successfully carried out and the restrictions on Freedom4 coverage thereby accepted, the areas in which additional satellite earth stations could be deployed in the future would be reduced because of the need to coordinate with central stations of Freedom4 and other operators installed in the meantime.

In our view FSS operators and their customers in the UK have a legitimate expectation to be able to continue and also expand their use of the two bands of concern here, without undue constraints.

6. WRC-07 decided to open the band 3.4-3.6 GHz to IMT, which inter alia includes WiMAX-type services to mobiles, and for Europe Decision 2008/411/EC additionally opens the band 3.6-3.8 GHz to such services from 2012 onwards. Use for service to mobiles of the lower of the two bands in the Freedom4 licence (3605-3689 MHz) is thus covered by the EC Decision (although **not** by the ITU Radio Regulations), but such use of the upper band (3925-4009 MHz) would be in contravention of both ITU and EC regulations.

Furthermore we note that, in the spectrum embracing both Freedom4 bands, the mobile service is allocated on a secondary basis in the UK NFAP. Therefore we would expect mobile BWA systems to be secondary with respect to UK FSS operations – otherwise what is the point of the UK NFAP? Intelsat therefore questions Ofcom's ability to grant the licence variation at this time. If Ofcom plans to make the required changes to the NFAP, Intelsat believes that Ofcom should hold a consultation to allow stakeholders the opportunity to provide input on the issue.

However, we acknowledge that use of either or both bands for services to low-power terminals in fixed locations is within ITU, EC and UK regulations.

7. Owing to the fact that there is currently little use by satellite earth stations in Europe of the band 3600-3625 MHz, the problems in 4 and 5 above could be minimised by limiting mobile use of Freedom4 low-power terminals to the 20 MHz between 3605 and 3625 MHz.

8. Information in the consultation document indicates that, although the initial licence was granted in 1992, there was little commercial development of networks under it prior to 2004, and implementation since then has been limited to one company and so far has not included service to mobiles. Also, we believe that the only other licence variation of a similar nature in the UK to date was the one granted to UK Broadband Limited in 2008, but that involves frequencies within the band 3.4-3.6 GHz, which is not allocated to the FSS in the UK. Hence the fact that coordination has been successful to date and there have been no reports of interference to satellite earth stations is not surprising, but it cannot safely be used to deduce that extending this licence to include mobiles, further roll-out by Freedom4, and the award of similar licences to other operators, would not lead to problems in sharing frequency with the FSS. Intelsat considers that Ofcom should carry out more thorough tests on the impact a greatly increased deployment of mobile terminals by Freedom4 would have on satellite earth stations before going ahead with a licence variation.

9. If service to mobiles was permitted under the Freedom4 licence, we believe it would be necessary for the requirements of ITU Radio Regulation No. 5.AAA, for the protection of FSS earth stations in neighbouring countries in the band 3.4-3.6 GHz, including the pfd limit at the national border, to be incorporated into the Freedom4 licence for the bands 3605-3689 MHz and 3925-4009 MHz. This is because UK companies have interests in FSS earth stations abroad which would be vulnerable to interference from UK BWA systems, and also because we would expect other countries to do the

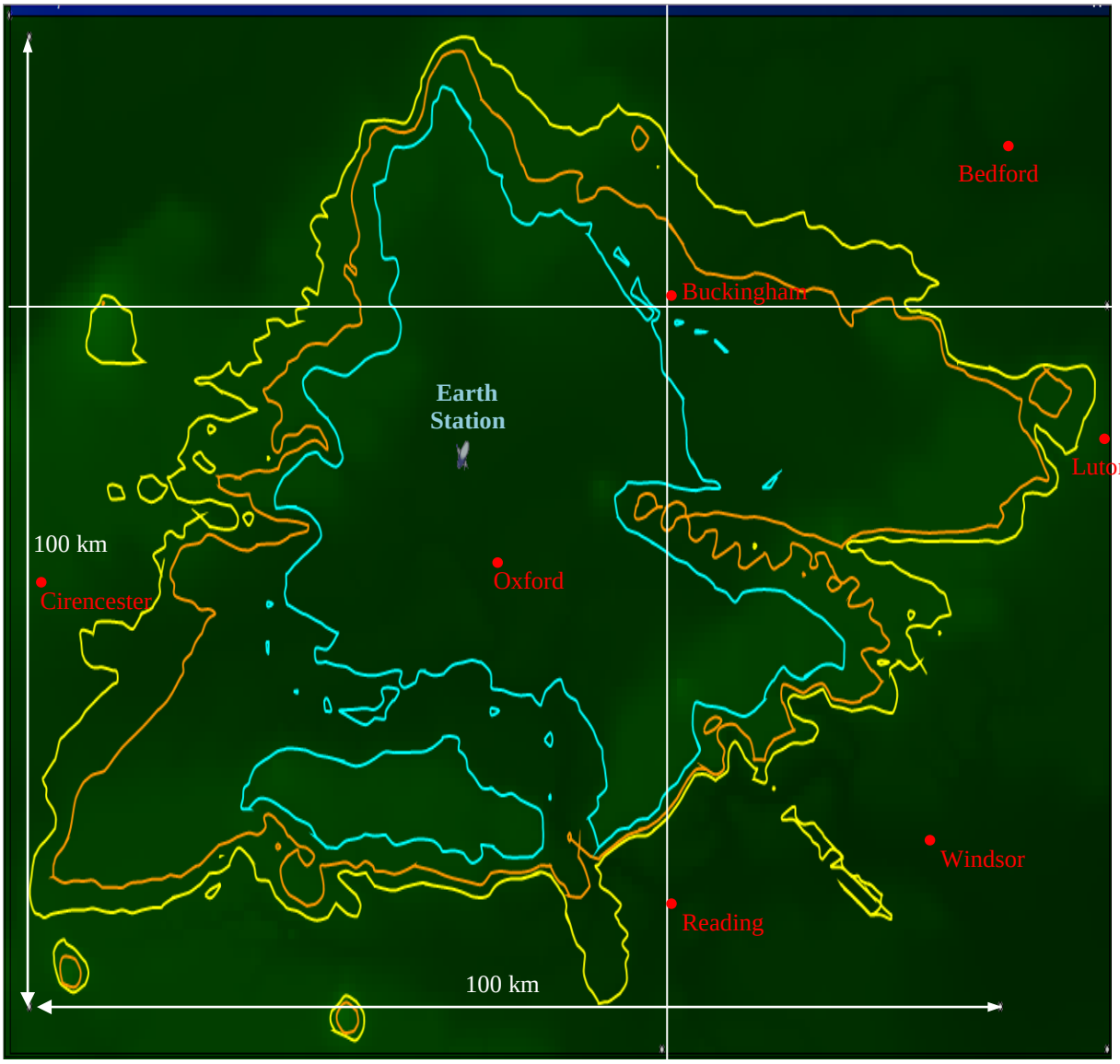
same to protect UK earth stations. Intelsat notes that the above requirements are not currently included in the proposed licence variation.

10. Intelsat believes that comments 1 to 9 above constitute reasonable grounds for Ofcom not to grant Freedom4's request in its current form, especially (but not only) as regards the band 3925-4009 MHz, and we would welcome the opportunity to meet with the appropriate Ofcom personnel to discuss the matter in detail.

{*See pages 6 & 7 for Annexes*}

ANNEX 1

Contours showing separation distances, between Freedom4 stations and example earth station in middle-England, required to prevent unacceptable interference, assuming no mitigation.



Contour within which interference from central station with 23 dBW/MHz EIRP density would exceed earth station's long-term protection criterion. Mean radius approximately 45 km, area enclosed of the order of 6500 km^2.

Contour within which interference from central station with 14 dBW/MHz EIRP density would exceed earth station's long-term protection criterion. Mean radius approximately 40 km, area enclosed of the order of 5000 km^2.

Contour within which interference from terminal station with 25 dBm/MHz EIRP density would exceed earth station's long-term protection criterion. Mean radius approximately 26 km, area enclosed of the order of 2200 km^2.

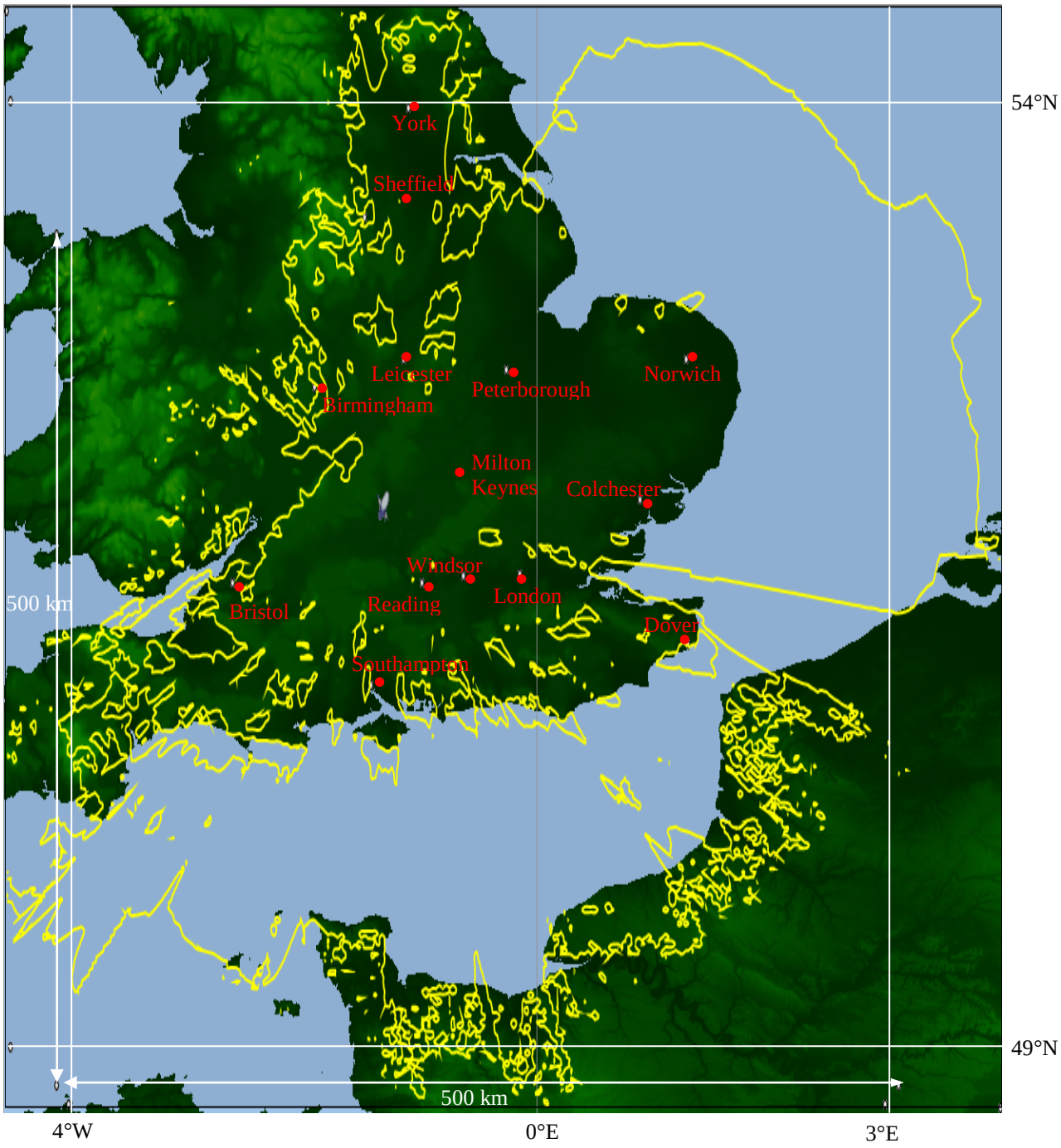
Earth station long-term criterion is that I/N should not exceed -10 dB for more than 20% of the time.

Earth station antenna diameter = 2.4 m; receive system noise temperature = 100K; receive carrier centre frequency = 3.65°; operating to satellite in GSO at 38.85°E longitude, i.e. 20° elevation angle.

Loss on interference paths calculated according to Rec. ITU-R P.452, using a terrain data-base with resolution about 1m vertically and about 1km horizontally and not including 'clutter'.

ANNEX 2

Contour showing separation distances, between Freedom4 stations and example earth station in middle-England, required to prevent unacceptable short-term interference, assuming no mitigation.



Contour within which interference from central station with 23 dBW/MHz EIRP density would exceed earth station's short-term protection criterion.
Mean radius approximately **205 km**, area enclosed of the order of **132000 km^2**.

Earth station short-term criterion is that I/N should not exceed -1.3 dB for more than 0.0017% of time.

Earth station antenna diameter = 2.4 m; receive system noise temperature = 100K; receive carrier centre frequency = 3.65°; operating to satellite in GSO at 38.85°E longitude, i.e. 20° elevation angle.