Award of Spectrum in the 10GHz, 28GHz, 32GHz and 40GHz Bands

Joint response from the Radio Society of Great Britain, UK Microwave Group, Amsat-UK and BATC.

September 7th 2006

Introduction

This response is a joint one to the above Ofcom consultation from the Radio Society of Great Britain (RSGB, www.rsgb.org.uk) and its affiliates UK Microwave Group (UKuG, www.microwavers.org), Amsat-UK (www.uk.amsat.org) and the British Amateur Television club (BATC, www.batc.org.uk) who are all stakeholders in 10GHz amateur activities. In addition we acknowledge contributions on Amateur Satellite data from international Amsat Societies as part of a broad team effort.

RSGB is recognised as one of the leading organisations in the world in the field of amateur radio. It collaborates within its fellow national societies via the International Amateur Radio Union (IARU) through IARU Region-1 (www.iaru-r1.org).

Amateur radio is a science based technical hobby enjoyed by over three million people worldwide. From a statutory point of view it is fully recognised by the International Telecommunication Union (ITU) as a Service and is listed in the ITU Radio Regulations as the Amateur Service and the Amateur-Satellite Service. Furthermore the frequencies and system affected by this consultation involve some of the most professional and cutting edge activities by any standard.

We thank Ofcom for this opportunity to comment, but stress that direct engagement prior to this particular consultation, which had been offered, would have been beneficial to all stakeholders. We are grateful for additional contacts since then and look forward to this being the norm in future consultations where Amateur Services allocations are involved.

We would be pleased to provide any additional information on request or participate in any future discussions.

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RSGB, UKuG Amsat-UK, & BATC September 2006

Enclosed:-

- *Summary responses to the four consultation questions*
- *A more detailed critique*
- *Regulatory comments*
- *Mask Comments*
- *Comments on the Impact Assessment*
- *Technical parameters of 10G systems*
- *Queries re MoD 10GHz Restrictions*
- *Background Information on 10GHz Satellites*

Consultation Question and Answers

Question 1
Do stakeholders agree with the proposals for the award of licences in the 10GHz, 28GHz
and 32GHz bands in 2007?

Answer 1:

In respect of the 10GHz band we profoundly disagree with the approach. We were deeply disappointed by the level of background research and liaison that had been undertaken before the publication of this particular consultation as his highlighted in this response. We urge that more 'friendly' spectrum and antenna parameters are adopted prior to any award to mitigate its worst effects, particularly on the international Amateur Satellite Service which uses the 10GHz band for its most ambitious missions, including the highly important Mars Orbiter/Lander mission. Ofcom needs to visibly demonstrate that it is complying with EU17/23.

Also in regard to 10GHz we nominally prefer the spectrum on offer to be offered in smaller chunks (eg 50MHz blocks) as that would offer great technical flexibility.

Far more information on both potential users/systems, award spectrum rights and MoD restrictions are also needed.

More detailed comments and background information is given in the rest of this submission

In respect of the 28/32GHz bands, we note Ofcom's dismissal of perfectly valid suggestions for an innovative narrow Amateur/Beacon sub-band as these frequencies that are close to the 30GHz 'moisture minimum'. In both cases allocations as narrow as 10MHz total bandwidth (compatible with guardbands perhaps) would suffice.

Ofcom say:
"Ofcom considers that the current Amateur spectrum allocations are sufficient to support innovative use."

We would highlight that Amateurs are present vacating or offering to vacate others areas of Secondary microwave spectrum where there are Primary alternatives (at 24.048 and 75.976GHz). Its is not the quantity of spectrum that interests us per se – it is its quality and the opportunity for new innovation and realtime propagation data. Furthermore the proposal embraces ideas from the Cave Audit and previous Ofcom-SES research on band sharing and spectrum efficiency. We see a need to fill a gap between our (moisture-prone) 24GHz band and the much higher 47GHz allocation, whilst also offering opportunities for dynamically managing longer range links and sharing by professionals in the bulk of these allocations

Question 2
Do stakeholders agree with the proposal to include in the award of the 32GHz band that portion of the band that has been open since 2003 for point-to-point applications?

Answer 2:

Our Answer in Question-1 above would offer benefits to such applications and it would be a pity for such an opportunity to be lost.

Question 3
Do stakeholders agree with the proposal to defer the release of the 40GHz band and reviewthe position in two years' time?

Answer 3:
Within this huge 3GHz chunk of idle spectrum an opportunity must surely exist for a long-term easy-access experimental slot (or park?) for both Amateur and other T&D users that would aid technology development
- a slot that would not disappear when the bulk of the band becomes commercially exploitable.

Question 4
Do stakeholders have any other comments on the contents of this document?

Answer 4:

We note the Impact Assessment is largely concerned with auction packaging and competition issues. As such, it does not address identification of stakeholders and 'victims'. This seems to be wholly out of step with Ofcom's 'Better Policy Making' process.

In our opinion, all auction packaging seems to have been arranged to favour large rich bidders. This may inadvertently block innovation from smaller more nimble organisations including some of our affiliates to experiment and innovate.

These awards in total represent a huge spectrum/bandwidth resource, certainly one of the largest in Ofcom's auction programme. We would be saddened to see UK and International interests compromised by a far from thorough approach which has had little regard for existing stakeholders, ITU/CEPT guidance etc.

Finally, we remain profoundly disappointed with the nature, tone, and thoroughness of this particular consultation document and the research preceding it.

10GHz Proposal Critique

Under Ofcom's own Guide on 'Better Policy Making' it is incumbent on Ofcom and its Agents to accurately identify interests and engage with stakeholders. In this case previous inputs to the SFR-IP had clearly identified multiple interests in these bands by the Amateur Services, some of which were enquired of in the intervening period without any answer prior to the publication of this consultation. Despite this no requests for information were received and the consultation document clearly suffers in a significant number of places from subjective, inadequate or incorrect as detailed by just a few selected examples below. In addition the reader is also referred to later section on MoD coordination zones etc which were omitted in the consultation document.

Para. 2.13 it is stated that the long-standing Amateur Satellite Service allocation 10.45-10.5GHz is designated as "Space to Earth" only.

Comment: This is incorrect, as the allocation has no restriction in the ITU Tables and can be (and will be) used for both "Space to Earth" and "Earth to Space" communications in coming Amateur satellite projects, although for the imminent P3E/P5A Missions it will be S-E. Under the Ofcom proposals, this could mean commercial terrestrial stations running in excess of +55dBW eirp in the 10.45-10.5GHz Amateur Satellite segment, may obliterate the Amateur Services' ability to receive extremely weak signal flux signals as prioritised by EU Allocation Footnote 23.

Page 80 of the consultation document references the AMSAT-NA web site and uses this to claim that the Amateur Satellite Service does not utilise this allocation.

Comment: Had the AMSAT-NA website and other (national) AMSAT websites been examined more carefully, it would have been evident that the allocation has been and will be used by very ambitious missions:-

- Oscar-40 (is in orbit but currently inoperative) had a 10.451/2 downlink
- Phase-3E (an Earth Orbiter) by Amsat-DL due for launch in 2007
- Phase-5A (A Mars Orbiter) due for launch in 2009
  . – including a German Mars Society Balloon/Lander backed by ESA, DLR et al

Thus the proposal ignores the forthcoming ambitious technical and scientifically important internationally supported and financed missions.

A6.30 *"Publicly available information on the Amateur Satellite use shows that this band is earmarked as a space to earth band. It also appears that currently there are no Amateur Satellites operating in this band. No information on the parameters for this Amateur Satellite use is available and therefore their impact has been considered as minimal and highly unlikely. Amateur Satellite systems can be developed and launched by other administrations/countries and these systems may have coverage over the UK. In these cases, the UK would be not be in a position to question their authority as the operation would be within the international allocations".*

Comments: If “the UK would not be in a position to question their authority as the operation would be within the international allocations”, how can national operation be any different to international operation?

“No information on the parameters for this Amateur Satellite use is available and therefore their impact has been considered as minimal and highly unlikely”. Ofcom neither looked very hard and never asked!! The Amsat-DL websites had frequency plans orbits etc

We would highlight that much of this was compiled into a succinct backgrounder for other stakeholders, published on UK websites and supplied to Ofcom ahead of the Stakeholders event on July 28th but not directly mentioned or published on the Ofcom website at the time. As with uncertainties in MoD usage data mentioned elsewhere this undermines confidence the original Ofcom document.

A6.31 *“As use is on a secondary basis a future spectrum access licensee will not be obliged to protect the national Amateur use. Use by the Amateur Service on a national basis would only be permitted where the Amateur licensee could be confident of not causing interference to the spectrum access licensee”.*

Comment: Even though the Amateur Services have allocations on a secondary basis, the above is not necessarily the case. In the overlap band the Amateur Satellite allocation has global status. The consultation document does not explicitly state the Spectrum Rights associated with the award (which in any case would be national only). Thus the above may not hold true in all circumstances, particularly if the award was on a secondary basis, with MoD retaining Primary status. In that instance the new licensee would be on an equal (or conceivably less than equal) non-interference basis to the Amateur services.

Even if the award is a national co-Primary one, CEPT EU17/23 still requests administrations to make all possible effort to maintain the designated Amateur sub-bands for weak signal reception. In addition as we highlight elsewhere 10GHz is a low-loss long-range band. A unilateral UK allocation would need to ensure it does not cause harmful interference to our European neighbours, which include a Primary amateur allocation in France in the 10.45-10.50GHz range.

This appears to represent a significant (and unjustifiable) downgrading of the Amateur Services status in this band and, in this respect, is deplored by the Amateur Services. We would stress though that we have no evidence of amateur operation in the 10GHz band having caused interference problems to the current Primary User (UK-MoD).

A6.44 *“At present there is no Memorandum of Understanding (MOU) between the UK and other countries where international coordination would be deemed appropriate for the three frequency bands. For the time being, operators in these bands should apply the following;*

Limit: spectrum flux density (PFD) not exceeding -115 dBW/(MHz$_x$m^2) at the geographical border of another country (where a sea path exists between UK and the other country, the low tide coastline should be used).

Calculation: based on the ITU-R P.452-12 based on the free space propagation and an atmospheric attenuation of 0.015 dB / km for 10 GHz….etc.”

Comment: As is well known from low-power (<0dBW – 10dBW) Amateur propagation experiments over many years, it is common for 10GHz signals to propagate over distances of typically 400 to 600km under fairly "normal" band conditions. UK Amateur contacts into Europe (Denmark, Sweden, Germany, The Netherlands, France etc.) are regularly made under such conditions. Occasionally under enhanced tropospheric conditions (eg. by rain-scatter and ducting) contacts in excess of 1000km are achieved. For example, the current terrestrial amateur UK communications distance record in the 10GHz band was recently extended to 1347km (from Farnham to Sweden) on 15th July 2006, using just 2 Watts transmitter power and a 43cm dish.

It is, therefore, probable that interference across national boundaries will occur at these frequencies with the proposed commercial emitted power levels. It is difficult to see how, with the close proximity of France (and other EU countries) to the East Coast of the UK, over a sea path, how interference from new 55dBW systems can be avoided

Regulatory Issues and EU Footnotes

The consultation document virtually ignores the spectrum rights of the Amateur Services. Be it noted that Amateur access rights to the 10GHz band were granted in 1947 (Atlantic City) and have not been rescinded since. Other ITU regulations also seem to have been 'missed'.

Ofcom makes reference to ITU-R Article-21 'Terrestrial and space services sharing frequency bands above 1GHz' to justify 55dBW eirp in all bands with no other antenna parameters specified based on RR-21.3. However a table lower on the samepage strongly suggests that 45dBW is the normal maximum above 10GHz

We would also highlight that Ofcom has ignored

RR-21.5 The power delivered by a transmitter to the antenna of a station in the fixed or mobile services shall not exceed +13 dBW in frequency bands between 1GHz and 10GHz, or +10 dBW in frequency bands above 10GHz

Additonal sections also highlight the protected nature of 28GHz satellite services

Ofcom has ignored or selectively interpreted requirements from previous sharing studies notably by CEPT/ERC resulting in well established spectrum parameters being ignored

Violation of CEPT Common European Frequency Allocation Table footnotes

Amateur Service

EU17: In the sub-bands 3400-3410MHz, 5660-5670MHz, 10.36-10.37GHz, 10.45-10.46GHz the amateur service operates on a secondary basis. In making assignments to other services, CEPT administrations are requested wherever possible to maintain these sub-bands in such a way as to facilitate the reception of amateur emissions with minimal power flux densities.

Amateur Satellite Service

EU23: In the sub-bands 5660-5670MHz (earth to space), 5830-5850 MHz (space to earth) and 10.45 -10.50GHz the amateur-satellite service additionally operates on a secondary and non-interference basis to other services. In making assignments to other services, CEPT administrations are requested wherever possible to maintain these allocations in such a way as to facilitate the reception of amateur emissions with minimal power flux densities.

The last sentences of EU17 and 23 require Ofcom to make an earnest and demonstrable effort to accommodate weak signal flux services (regardless of their secondary status).
We look forward to this being done!

Impact on Amateur and Amateur Satellite Services

Interference Levels

Ofcom envisages that future commercial users would emit up to +55dBW eirp in this band. This appears to be contrary to ITU RR Article 21, which states that it should ”normally be +45dBW eirp”. Furthermore, Clause 21.5, specifies a 10Watt transmitter power limit, with up to +35dB (antenna) gain. Such transmissions could completely wipe out “weak signal flux” terrestrial and satellite signals received by Amateurs especially in the Satellite band

In-Band Compatibility

We wonder if consideration been given to the probability that interference to Satellite TVRO systems may occur, especially in urban situations, principally by direct “swamping” of sensitive LNB “front ends” by +55dBW signals? (Be it noted that many microwave systems, similar to those proposed, may be installed in urban areas where this type of interference is most likely)

LNB “front ends”, as the Amateur Services are well aware, are inherently wideband and are used for high performance Amateur purposes anywhere between 9 and 13GHz with little or no modification. Therefore both amateur and potentially domestic receivers are almost certainly be subject to “swamping”.

A comment received from an engineer working for a well known UK manufacturer of domestic SATV equipment) quoted verbatim, as received: “Anything that hits the LNB directly will cause a “de-sense” or severe degradation of the noise floor due to RM effects. The LNB LOs are not all that good generally, and the dynamic range of a typical LNB is not excellent”.

Out of Band Compatibility

We have plotted overleaf the Ofcom mask in reasonable detail to illustrate their full widths including some out-of-band emissions, which start to impinging on both Amateur TV Repeater operations as well as terrestrial narrowband weak signal activity centres.

The noise floor of a good amateur receiver is about -140dBm so that about 92dB of path loss is needed to reduce the spurious signal to equal the noise floor.

If an amateur station is using a 60cm dish with 66% efficiency, then its capture area is about 0.2 square metres. A 92dB path loss equates to a LOS distance of 5km, and that is with the dish beaming at the interference source.

With 30dB of sidelobe suppression, the distance comes down to 160m or so, if the amateur antenna is not pointing at the interference source.

The peak spurious EIRP will generally be expected to be in the main beam of the source antenna, so there will be further attenuation if it is not “aimed” at the receiving station.

General Mask Comments

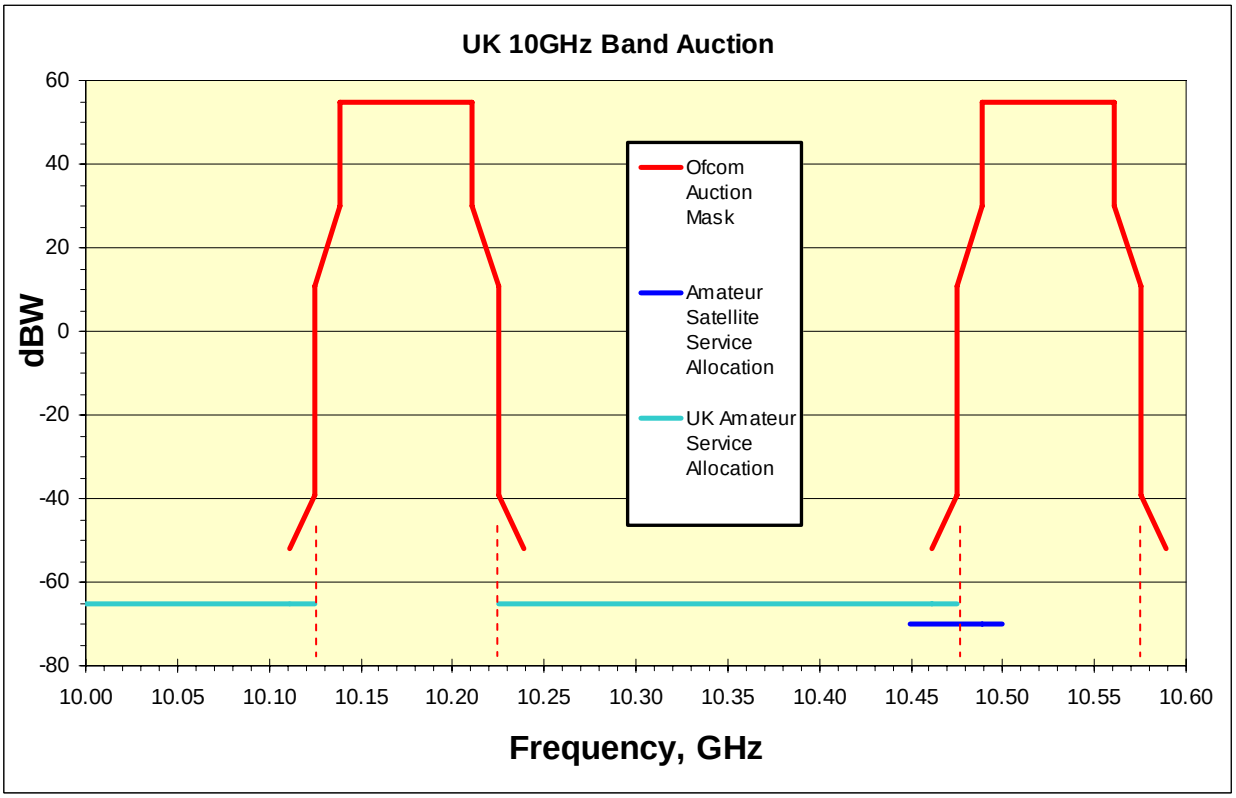
By choosing the 55dBW ceiling, Ofcom has ignored a number of previous careful CEPT sharing studies on peak levels, masks, channelling etc. In addition out-of-band emission outside of the 14MHz ‘tails’ are not specified at all

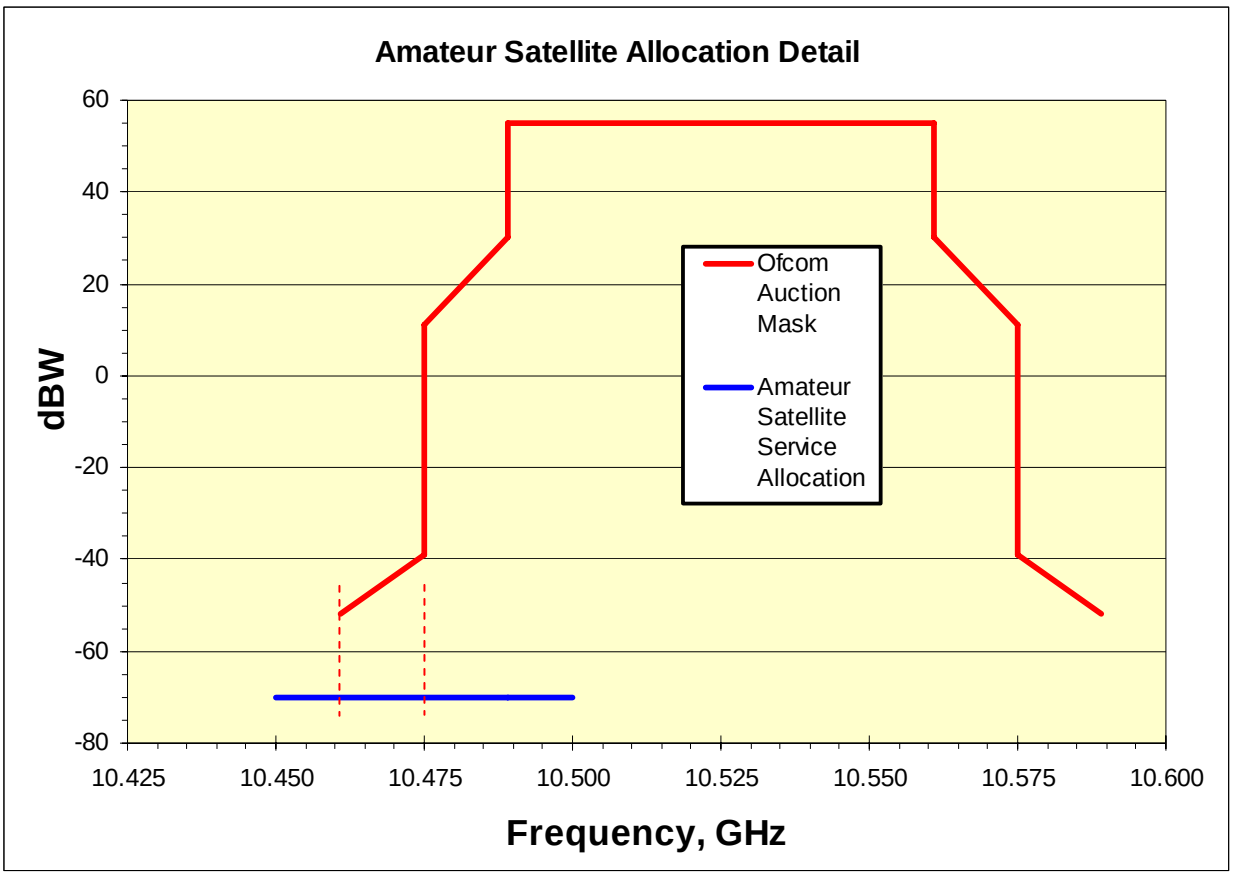
Elsewhere in CEPT it is typically accepted that –70 to –85dBm/MHz is the default eirp to protect other services (eg as specified for UWB) and we would like to see similar parameters introduced, along with explicit transmitter power limits as per the radio regulations. Quite simply Ofcom has ignored all well established means of technical coordination and sharing studies as practised by CEPT et al

Interference to future Satellite Service Uplinks

At present insufficient information is available in the Ofcom document to assess this, but it is a serious concern

Spectrum Masks/Allocations





Typical Parameters for Planned/Under-Test Amateur Satellites

In addition to the data already available from Amsat-DL and appended to this submission, Michael, OH2AUE, Amsat-OH Director, and Amsat-OH P3E Module E5 Project Manager, has submitted extra information, via email, for the forthcoming Amsat Satellites P3E and P5A, planned and under active construction. This is quoted verbatim here, as received. Whilst we add the caveat that the project continues to evolve, it is clear that the low power densities on Earth could be come victims to the new +55dBW awards with the proposed mask and unspecified antenna pattern:

"I made some 'rough' received power level calculations (TX power + antenna gain - path loss) to get some idea of what we might be looking at, give or take some dB's:"

"For P3E in coherent mode at apogee:
Pout = 0 dBm = -30 dBW
Antenna gain = 2 dBi gain ~omni
EIRP = -28 dBW
Path loss (@ 42 000 km) = -205 dB
Power level on Earth => -203 dBm = -233 dBW

"For P5A in coherent mode at apogee: (3-axis stabilized:)
Pout = + 50 dBm = 20 dBW
Antenna Gain = 44 dBi (high gain antenna)
EIRP = 64 dBW
Path loss (@ 378 000 000 km apogee) = -284 dB
Power level on Earth => -190 dBm = -220 dBW

Tumbling mode:
Pout = + 50 dBm = 20 dBW
Antenna Gain = 2 dBi gain ~omni
EIRP = +22 dBW
Path loss (@ 378 000 000 km apogee) = -284 dB
Power level on Earth => -232 dBm = -262 dBW

"I took the apogee to get the worst case numbers emphasised. Also the dish gain is based on a 2m dish with 50 % aperture efficiency. I would expect us to be able to do better with the gain and also the range is not near apogee for us..."

"For P5A and the P3E evaluation transponder the emission bandwidths for modulation are about 3.9 kHz at minimum and 2 MHz + at maximum (for the ranging and coherent mode). For data modulation, the modulation data rates range from about 3 bit/s (BPSK) to 200 or 400 bit/s (BPSK)."

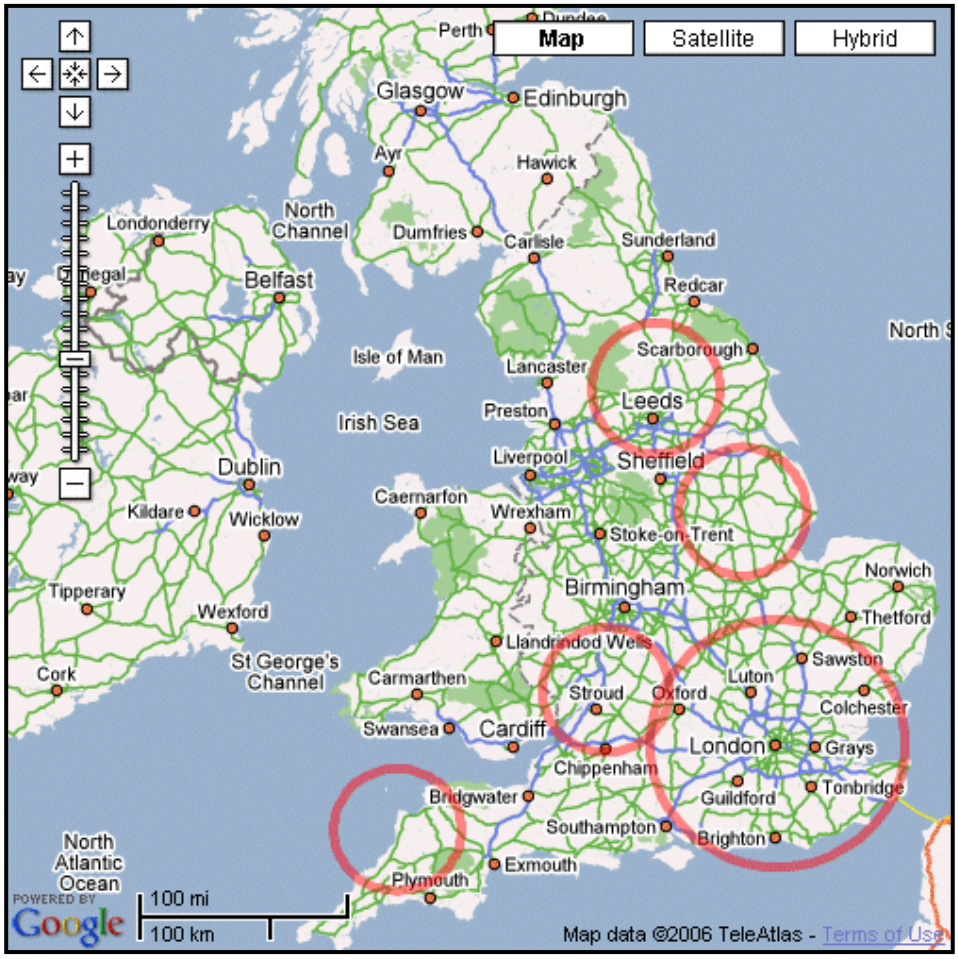
"We are looking for signals really close to the noise floor, mostly below it (our coherent transponder has demonstrated locking at some 20 dB below noise)."

RSGB et al has indicated its willingness to continue the dialogue that has recently opened up with Ofcom on these systems

Primary User Restriction Zones

Whilst mention of MoD airborne assets is mentioned in the 10GHz band, the consultation omits to mention existing restrictions on terrestrial services. In the Amateur Licence (BR68 and its imminent successor – on the Ofcom website) and in the 10.3GHz PMSE Licenses available from JFMG (downloadable from www.jfmg.co.uk) there are zones around parts of the country which either exclude or severely restrict 10GHz users in order to protect the Primary User.

The Amateur licence lists 50km coordination radii around Menwith Hill, Waddington, Cheltenham and Bude.
In addition we experience a 100km radius centred on Charing Cross – as illustrated in the Google map below. Similarly JFMG list frequencies around 10.3GHz as not being available in Northern Ireland and parts of Wiltshire, Surrey, Berkshire, Dorset, Somerset and Avon.



It is far from clear if these restrictions will apply to the new awards in the 10GHz band.

Our Questions are…

a) **Do these radii apply and restrict the new awards ?**

b) **If not and MoD can now accept new +55dBW licensees, then can Ofcom be 'Service-Neutral' and moderate these long-standing restrictions?**