UK MICROWAVE GROUP

Input to Quotient Associates Study - May 2006

Dear Chris,

Many thanks indeed for contacting me regarding our amateur radio microwave activities on the bands above 30GHz. I'm very pleased that you have taken the trouble to get in touch with the UK Microwave Group as we represent all the radio amateurs in the UK who use these frequencies.

We are represented on the RSGB Spectrum Forum by Mike Dixon and myself, together with one of our committee members, Murray Niman. Both my colleagues have considerable expertise and experience in negotiations with organisations such as Ofcom. They are aware of, and have indeed contributed to, what follows herewith.

On behalf of the UK Microwave Group I would like to make the following submission to your study:

General Overview

As amateur microwave radio enthusiasts, we have many reservations about allowing yet more licence-exempt operations in areas of spectrum for which we are licensed by the ITU and Ofcom and, indeed have been licensed worldwide since around 1947, at the Atlantic City World Radio Conference. I am pleased to see that you are already aware of our submissions to Ofcom re 24GHz and 79GHz.

We are seeing a massive influx of licence free systems (many of them "domestic" and therefore in very large numbers) on our lower microwave frequencies, particularly in the region 2GHz to 10GHz. To now have to face a similar influx on the bands from 30GHz upwards fills us with dismay. It is these bands into which we are moving in ever increasing numbers, partly to escape the problems lower in frequency but, more importantly, to extend our technical horizons and explore the potential of the higher bands.

Amateur microwavers in the UK and throughout the world are highly skilled, very technically competent people who explore the microwave frequencies in a manner quite different to the "run of the mill" radio amateur you might find on the lower VHF and Short Wave bands. Indeed the term "amateur" is really a misnomer.

Many of our members are professionally engaged in microwave and/or communications engineering and thus have access to facilities and information that can help them in their leisure time microwave pursuits. We use the very latest techniques, devices and components and are very much in touch with what is going on in the commercial microwave field. It is an ongoing concern of both myself and our group that the general public and organisations such as Ofcom are not fully aware of the technical expertise and the high level of experimentation achieved by our members. We are also conscious that the UK education system is not producing skilled RF/Microwave engineers and feel that amateur microwave activities are one of the few that foster skills which are in considerable scarcity in the UK.

For the amateur bands below 1GHz, the great majority of radio amateurs now buy their equipment ready made (mainly of Japanese origin) and spend much of their time communicating rather than learning by experimentation. This fits the widely held picture that the man in the street has of what he may call "the radio ham". A casual listen across the short wave amateur bands will show a high level of usage. This is in sharp contrast to the microwave bands where the amateur enthusiast spends much of his time designing, building and then, and only then, using his equipment - not only for point-to-point communication but also for some very sophisticated scientific studies. To a casual listener on any of our microwave amateur bands this would give the impression that activity is low. In addition, much of our on-air activity tends to be at weekends when our members are not at work. Thus listening on a weekday may also give a false impression of the levels of activity. This is far from the case!

UK Amateur Microwave Activities

At this moment in time in the UK, we have microwavers designing equipment for use in terrestrial, satellite and Earth-Moon-Earth (EME – 'Moonbounce') communications. The activity range is staggering - beacons, troposcatter, rain and aircraft scatter, Software Defined Radio (SDR), digital communications, tropospheric ducting research, radio astronomy, remote control, amateur analogue and digital TV, as well as the more usual terrestrial links that occur every day of the year. There are many examples of sophisticated communications software designed for extremely weak signal and "below the noise floor" reception that have been written and are being used by radio amateurs working in most of the allocated microwave bands. GPS and DDS techniques are being widely adopted to give 1Hz accuracies on transmitter sources, as well as SDRs leading the way to cheaper receivers.

For your interest and information, I have attached some slides in Power Point format that includes maps and other data showing some of the quite remarkable distances that we have achieved on the microwave bands up to the 142GHz region. You will note the distances on the bands above 24GHz. These are possibly well in excess of what commercial organisations (apart from space comms) would expect to achieve. All of this has been done with the use of low power output levels (one to two watts RF at the most and often a few tens of milliwatts) to highly directional dish antennas. The ranges shown on the map and in the list vividly illustrate the leading edge narrow bandwidth receiver and frequency accuracies in use for the modest transmit powers used.

Our receivers are as state-of-the-art as possible since we operate at very low noise floors and, in some cases, comparable to those used in the Radio Astronomy Service. Many of the links, especially the EME ones, produce just a few decibels of signal to noise ratio. Licence-free devices, especially wideband and frequency agile types, pose a very real threat to our kind of operations, as they do to the RAS, mentioned above. The Amateur Services (that is, the Amateur Service and Amateur Satellite Service, both recognised by the ITU) are not, of course confined to the UK. You may be unaware of the existence of the International Amateur Radio Union (IARU) which coordinates – or tries to coordinate - amateur activities worldwide, including the use of amateur satellites.

Satellites

Since the launch of Oscar-1 in 1961 there have been over fifty amateur satellites successfully launched, mainly in the VHF-lower microwave bands. Amateur satellites use most of the bands up to and including 47GHz, as well as the 29, 144 and 432MHz bands for both uplinks and downlinks. AMSAT-UK hosts the IARU Amateur Satellite Frequency Coordination web pages that can be seen at

http://www.amsat.org.uk/iaru/default.asp
This lists all amateur satellites currently undergoing frequency co-ordination.

You ask the question "and if there are any amateur satellite operations at these frequencies". The answer is a very positive "Yes"! One of the most successful was Oscar-40, which carried a popular 24.048GHz downlink. Its successor, 'Phase-3E', is being prepared for launch in 2007 by our German colleagues in Amsat-DL. Details are:

Target orbit:	*30,000km apogee - 2,000km perigee 60 deg inclination.*
Uplinks:	*29MHz, 435MHz, 1260/68MHz and 5668MHz*
Downlinks	*145MHz, 2400MHz, 24.048GHz and 47.088GHz.*

It is also intending to carry an experimental coherent transponder with 2447MHz uplink and 10450MHz downlink. As you can see the 2.4 and 5GHz transponders will also have to contend with Licence-exempt systems

From the above you will surely see that amateur microwave enthusiasts are indeed professional both in outlook and in their actions!

Beacons

You may also be unaware of the network of microwave beacons that has been set up by the radio amateurs all over Europe. While the majority of them are on frequencies at 10GHz and below, we also have beacons on 24GHz and 47GHz and it is expected that their numbers will grow as amateur activity also grows on the higher bands. Indeed, the access to a beacon is often a major factor in local amateurs building equipment for a particular band. Our beacon network is not only vital to our members but is also

of value to other organisations (sometimes professional!) who need a propagation indicator and/or frequency marker. We see the increased allocation of licence-free devices to these bands as a very serious problem to the beacon network in that signals from them could completely mask the beacon signals or cause interference to them.

The beacon network has not been done on the cheap. Individuals or a local group often carries the considerable cost. Our Group website, http://www.microwavers.org/, has a beacon section which may interest you.

Ideal Licence Exempt Frequencies

We would also like to point out that Automotive and other Short Range Devices already have large amounts of licence exempt allocations at 58 and 63GHz, just either side of the 60GHz Oxygen absorption peak, which is ideal for frequency re-use and so far barely used. Given our experience of longer range working, this is why we feel that coordinated /licensed spectrum, rather than licence-free, is still needed for assured quality for both commercial and amateur applications. Further up the spectrum though beyond 94GHz, we ourselves see little point to strict ITU allocations and that contrasts to the possibilities of bands even above 275GHz being regulated at WRC-2007.

Other mmWave Bands

The UK Microwave Group, through the RSGB Spectrum committee, has asked for a number of small frequency allocations within the range 30 to 40GHz based on bands identified by Ofcom's SFR-IP. This is with a view to propagation research (especially anomalous propagation) in an area of the millimetre bands where the effects of water and oxygen absorption show a marked reduction and would complement other Ofcom research on Beacon assisted band-sharing. Our 24GHz band is very much affected by water in the atmosphere and this has limited even the impressive distances over which UK amateurs have made two-way contacts at that frequency. At 47GHz we have a similar problem with increasing attenuation. To have narrow frequency allocations between 30 and 40GHz in the 'moisture-minimum' would be of special interest to us, as we feel sure some of our members could make significant contributions to scientific studies and propagation models in this field.

Spectrum

Finally, we have no wish to portray ourselves as a hoarder of spectrum. Indeed, we have policy of harmonisation with other countries, especially in Europe. Overseas contacts at microwave frequencies are quite commonplace and are becoming increasingly so on 24GHz and above. Common international frequency allocations are therefore essential if further progress is to be made. We are migrating out of secondary spectrum at 24.192MHz and parts of 79/80GHz to concentrate activity within our Primary allocations. In recent submissions to Ofcom and the EU we have indicated our willingness to share/relinquish wider (especially Secondary) allocations in exchange for narrower better protected, ideally Primary-Exclusive, allocations. This would, though, need to be agreed and harmonised at CEPT/ITU level.

On behalf of our members I thank you very much for liasing with us in this matter and would earnestly ask you to seriously take our concerns into account when reporting back to Ofcom. As a group, we also know that other non-amateur organisations that use these bands have significant concerns over the spread of licence free users across the higher microwave spectrum.

Very sincerely,

Peter Day,
Amateur Radio G3PHO,
Chairman UK Microwave Group.
www.microwavers.org