

Ofcom Call for Inputs on
Strategic Review of UHF Spectrum at 420-470 MHz
(UHF Bands 1 and 2)¹



Response from the Radio Society of Great Britain

February 2015

Introduction

This response to the above Ofcom Call for Input is from the Radio Society of Great Britain (RSGB, www.rsgb.org). The RSGB is the principal UK stakeholder representative body for Amateur Radio operators, with over 20,000 members, including many affiliated clubs and special interest groups. Whilst some of our members will have responded to the call individually, a number have indicated that they expect the Society to reply on their behalf

RSGB is also recognised as one of the leading organisations in the world in the field of amateur radio. It collaborates with 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. Consequently the RSGB take an active interest in spectrum allocations, coordination management and relevant technologies

The Society via its ETCC² organisation (at www.ukrepeaters.net) plays a key role assisting Ofcom in the management of numerous systems in the 430-440 MHz amateur service allocation, and our members also play leading roles in the amateur satellite service at 435-438 MHz.

It was disappointing to find that the Aegis report in particular did not consider amateur radio's own growth and technology trends in the UHF band. We have therefore taken the opportunity to supplement our response with an annex that includes usage, growth and technology statistics to illustrate the highly innovative technologies and demand that we are experiencing within the UHF amateur and amateur-satellite service allocations.

The Society welcomes further engagement with Ofcom on this admitted challenging topic. Permission is granted for a copy of this response to be placed in the public domain.

RSGB, February 2015

¹ As per the Ofcom document - UHF1 = 420-450 MHz, UHF2 = 450-470 MHz

² ETCC – Emerging Technologies Coordination Committee

Questions and Answers

Question 1: *Do you agree with Aegis's conclusions on congestion of current use of 420-470 MHz spectrum? Are there any other signs or areas of congestion that Aegis have not identified from their review?*

No - Aegis omitted to review the usage and congestion arising in 430-440MHz from amateur radio. We are already experiencing a shortage of available channels (compatible with the Primary User) in some areas due to the unprecedented demand for new digital voice systems. Unless there is a more permanent extension to the amateur 145MHz band (currently temporary at 146-147 MHz), we expect ongoing strong demand in 430-440MHz. Charts in the annex illustrate the growth in duplex repeater systems, digital voice gateways, satellites etc.

Although less critical, IARU amateur satellite frequency coordination can also struggle with peak usage/congestion from multiple satellite launches (where we expect more instances of 20-50 small satellites being released at a time)

Question 2: *Do you agree with Aegis's conclusions on the future demand and use of 420-470 MHz spectrum over the next ten years? Are there any other future uses or areas for future demand that Aegis have not identified from their review?*

No - Aegis did not consider the future demand in 430-440 MHz arising from increasing amateur use. Charts in the annex, derived largely from www.ukrepeater.net assignments and (thus in Ofcom records) shows that digital simplex and duplex systems are seeing substantial growth, as is international satellite use within 435-438 MHz (as recognised by WRC15 AI-9.1.8).

In the coming years we also expect amateur digital video usage to rise significantly as well. By default this would overlap the amateur satellite section, which would add to the current management challenge that RSGB and IARU Region-1 has recently been involved with. Another demand driver is that increasing loss of amateur spectrum in the microwave bands, such as we have recently experienced with the PSSR changes, will drive video/ATV usage down into UHF.

Question 3: *Do you agree with Aegis's conclusions that there is not yet any UK demand for wideband services in the 450-470 MHz band (which could for example, be used to improve rural mobile coverage)? Please provide any supporting evidence for your position.*

We agree that there is no proven demand - and there may be better alternatives. We acknowledge that LTE-450 may be beneficial for managed/integrated voice and some low data rate M2M, but it is far from clear that the limited bandwidth available in the UK would flexibly facilitate wideband services.

The only available LTE-450 standard is in Band-31 (10MHz duplex split for 452.5-457.5 paired with 462.5-467.50 MHz), which has limited vendor support compared to other LTE bands. The time and disruption required to reconfigure the existing UK UHF2 band for this is not an attractive prospect, and is of particular concern to ourselves, given the mention of amateur spectrum as a temporary 'parking space' to facilitate restructuring.

At technical level it is also debateable whether LTE-450 would perform better compared than say 700MHz, which will be far better supported. LTE-450 data rates are more restricted, antennas will have lower gain and there is minimal prospect of employing MIMO etc. A significant proportion of telemetry, SCADA and M2M is also characterised by low data rates for which other technologies may far more suitable and spectrally efficient.

Question 4: *Have you experienced degradation in your systems' performance which you consider to be caused by continental interference in the last 12 months? If yes, what approach did you take towards managing and minimising interference?*

Our East of England repeaters in particular often experience enhanced propagation conditions in the summer. This has been most problematic for the 1.6MHz-split analogue-FM systems on 433/434MHz which are co-channel with Europe. Over the years, measures such as CTCSS and coordinated (re)-assignments have reduced problems.

In contrast our narrowband-DX community look forward to such propagation conditions. The revamp of our UHF Beacon network (see annex) is intended to support its early warning and exploitation.

A future approach may be to exploit data from the UK/European beacon network as part of a more dynamic management tool.

Question 5: *Is there additional information relevant to the configuration of the 420-470 MHz band that we should consider in developing our approach to its future management? Please provide any evidence to support your views.*

In the Ofcom document Figure-2 on the UK band configuration of UHF-1 (420-450 MHz) only shows amateur as 'Single Frequency Operation'. This overlooks the three duplex blocks used for amateur repeaters on 1.6, 7.6 and 9MHz duplex splits, which are in Ofcom's database. It also omits special considerations that might need to apply in 435-438 MHz due to satellite usage.

Some of the examples of amateur technologies for digital voice, data, video and propagation measurement may be relevant or a 'source of inspiration'. For example, as demonstrated in both 437 MHz (and more recently at 147MHz), digital video channels need not consume the bandwidth that many commercial users often assume.

As coordinators, RSGB-ETCC and the Society Spectrum managers have remained 'technology-neutral', yet managed to accommodate a wide variety of new spectrally efficient technologies. Furthermore this has been achieved without a major disruptive reconfiguration to existing users and it has occurred within the Fylingdales constraints.

Within the Aegis report, the more significant reconfigurations raise the issue of temporary parking spaces and the potential use of amateur spectrum for this. This is where we have strong concerns. We would emphasise there is a huge difference between very short term local arrangements such as that for the Olympic Games and a much longer term and more disruptive exercise.

Question 6: *Do you agree with the potential solutions Aegis have proposed for managing the 420-470 MHz band to both meet the continued growth in congestion and demand from incumbent spectrum users, and to facilitate the deployment of wideband technologies? Are there any other solutions which you consider we should examine that Aegis have not identified from their review?*

No comment

Question 7: *Do you have any further comments relevant to how we might manage spectrum between 420-470 MHz?*

No comment

Question 8: *Do you have any comments on our proposed programme of work, the outcomes from which we will use to inform future decisions on how we manage the 420-470 MHz band? Are there any additional areas you consider we should explore?*

No specific comments, but as a key stakeholder in 430-440 MHz we would appreciate ongoing liaison with Ofcom.

Annexe: Amateur Radio UHF Infrastructure & Usage

1) UHF Amateur Repeaters

The 430-440MHz band is home to the vast majority of amateur radio voice repeaters. There are currently a total of 241 systems in the band and as the graph below shows this has grown by 54% since 2005 (156), driven almost entirely by the demand for digital voice systems and the lack of space in the amateur 145MHz band. D-Star was the first digital technology to be introduced and this has been followed more recently by DMR and Fusion.

Amateur repeaters use duplex pairs on 1.6, 7.6 or 9 MHz spacing and are limited to 25W erp (though users may use greater to access them). The narrower frequency pairs use high performance duplexers to enable much tighter spacing than their commercial equivalents and thus offer greater spectrum efficiency/flexibility in coordination with the available channels from the Primary User.

Analogue FM systems have also been subject to development with many using CTCSS and internet linking.



Figure 1: UHF Voice Repeater Locations

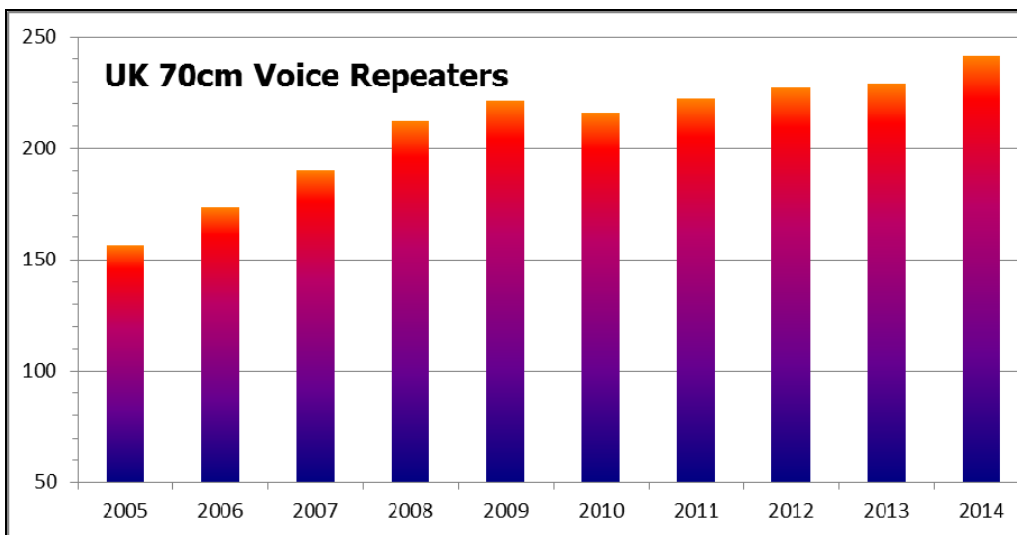


Figure 2: Growth in UHF Voice Repeater Numbers (Analogue and Digital)

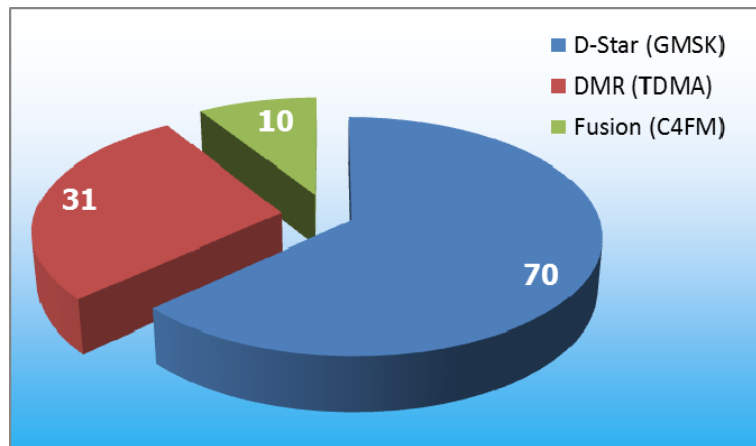


Figure 3: VHF/UHF Digital Voice Repeaters - by Technology

2) UHF Amateur Simplex Voice Gateways

The 430-440MHz band is currently home to 117 simplex voice gateways all of which are internet linked (out of a total of 271 in all amateur bands).

Growth in numbers has been driven entirely by digital voice nodes (aka access points or hot spots), despite being restricted by the lack of 24/7 unattended licensing due to Primary User considerations. We would welcome a dialogue with Ofcom in this latter regard.

Spectrum efficiency is assisted by tight ERP limits of just a few watts, and CTCSS being mandated on all analogue systems in line with IARU Region-1 recommendations.

The technology mix is somewhat different to duplex repeaters. As can be seen below, D-Star totally dominates the digital market, assisted by a wide choice of innovative developers who have implemented controllers with the required AMBE codec.



Figure 4: UHF Gateway Locations

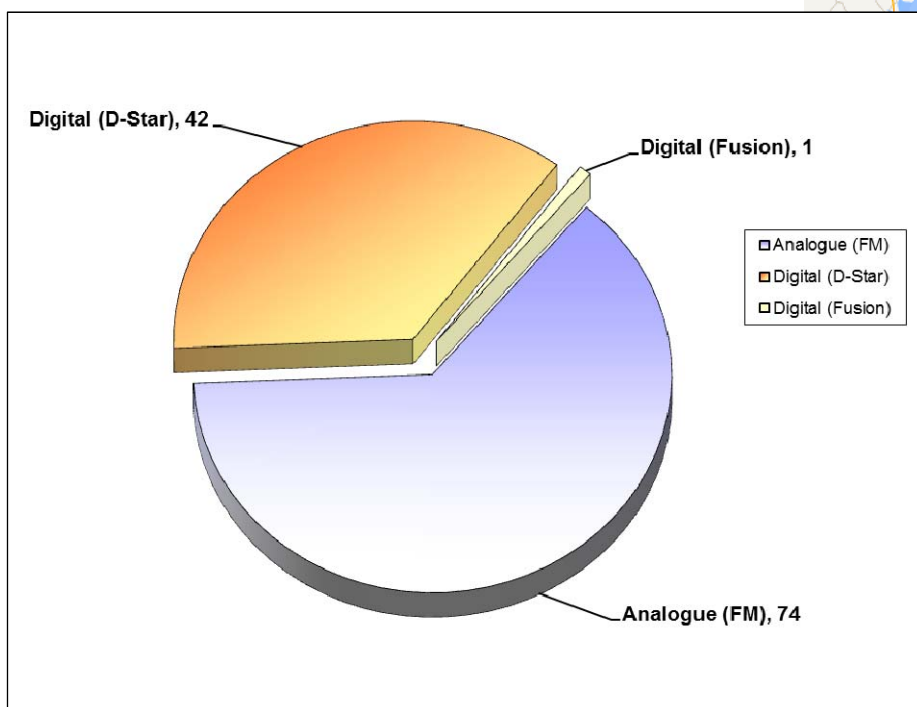


Figure 5: Amateur UHF Internet Gateways – by Technology

3) UHF Propagation Network

We note that Ofcom planning has to take into account continental protection. The demise of analogue television masks the uncertainties caused by changes in atmospheric conditions. Amateur narrowband and DX operators are of course particularly interested in such conditions.

Consequently following clearance via Ofcom and the Primary user, the RSGB 70cm Beacon Project is currently rolling out a new generation of UHF propagation beacons, which feature precision frequency sources and a combination of CW and Machine Generated Modes (MGM). The latter can facilitate automated monitoring of conditions.

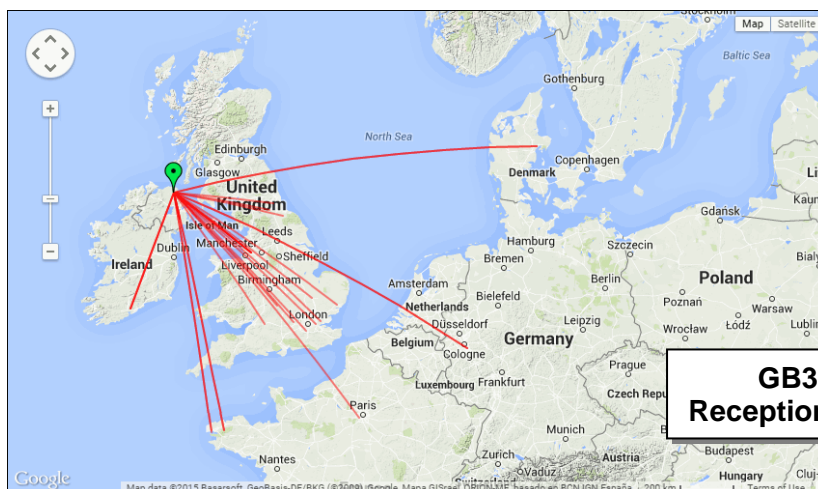
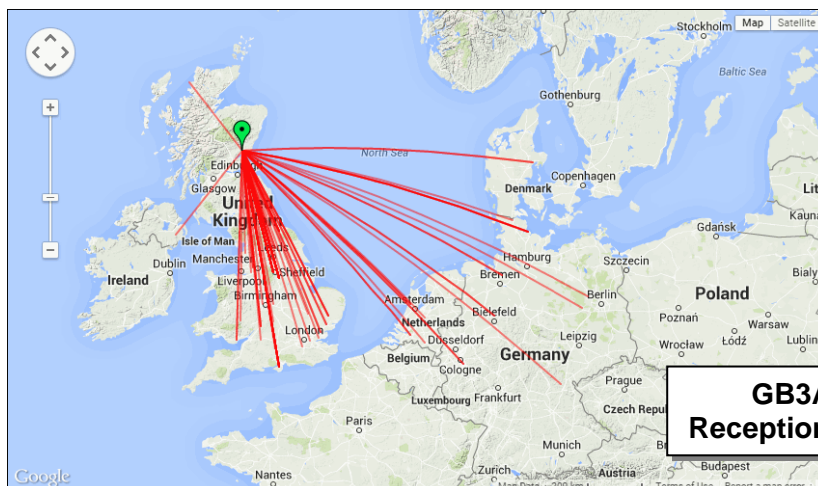
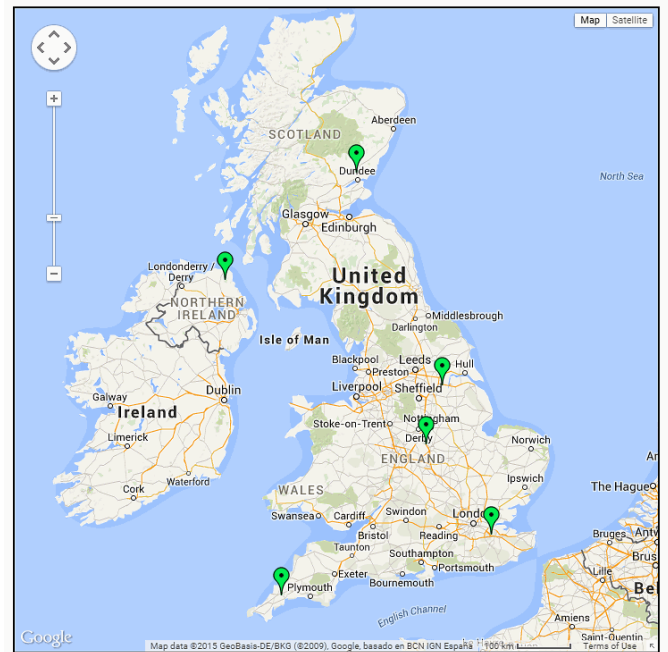
The two plots below are distance reports from GB3ANG (Angus) and GB3NGI (Country Antrim) on 432MHz from the www.Beaconsport.eu database

Ofcom or managed networks may wish to exploit these systems to pro-actively manage networks near international borders.

UK/RSGB 70cm BEACON PROJECT

The following uses Google Maps to show the locations of current/planned 70cms / 432MHz UHF Beacons in the UK-

System: [GB3ANG](#) [GB3MCR](#) [GB3LEU](#) [GB3NGI](#) [GB3UHF](#) [GB3FNY](#)
Options: [Reset](#) [Toggle-mapType](#)

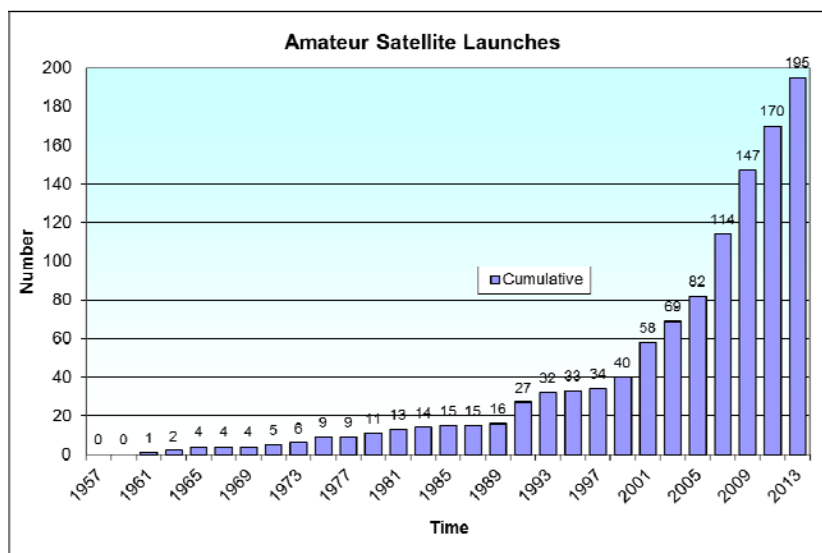
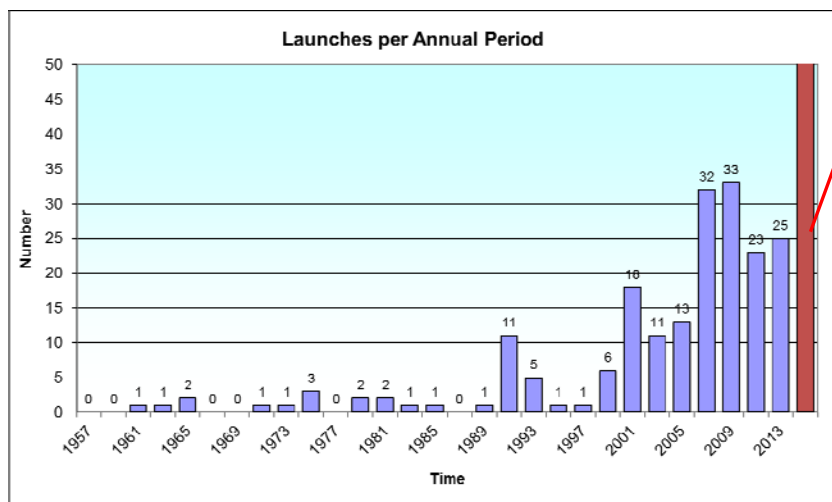


4) UHF Amateur Satellite and Television

The Amateur-Satellite service allocation at 435-438 MHz is subject to explosive growth from nano and picosats, most of which are frequency coordinated by IARU for the launch teams and ITU Bureau. The growth is such that WRC15 AI-9.1.8 is dedicated to managing this.

In practice most of the educational/technology missions are being coordinated to the top end of the allocation around 437MHz so they can be separated from higher priority amateur transponders lower in the segment. However the growth trend is such that an increase in the satellite allocation (potentially extending it up to 440MHz) may be required.

Below are copies of graphs created by IARU Region-1 for the 2013 EU Commission Technology Trends study (grouped into sequential 2-year periods). Since that study, growth has continued, with some rockets in 2014 releasing in excess of 30 satellites at a time (34 on Antares CRS-1 January and 37 on Dnepr in June), as well as increasing use of the International Space Station as a launching platform.



In addition in 2014 the IARU Region-1 Conference also approved detailed recommendations so that a resurgence in terrestrial usage of 435-438 MHz by innovative new reduced bandwidth Digital Amateur Television would be such that interference to the satellites would be minimal (typically by DVB-S QPSK and 2MHz maximum bandwidth). Usage is rapidly evolving from developers to operators, so we expect strong growth in this area in the next few years, partly driven by loss of spectrum in higher bands, as well as the drive to demonstrate innovation.