

Ofcom Consultation:

UK preparations for the World Radiocommunication Conference 2019

RSGB Joint Response

12th September 2018

Introduction

This response is a joint one to the above Ofcom consultation document from the Radio Society of Great Britain (RSGB, www.rsgb.org.uk) and its national affiliates who have a wide range of spectrum interests from LF/HF/VHF through to microwaves and beyond; and collaborate via the RSGB Spectrum Forum

RSGB is 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.

We have limited our response to largely those questions that affect amateur allocations and interests.

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Contents:-

- Selected Consultation Questions and Answers
- Annex-1A and 1B regarding Amateur Radio Innovation and Research in the 50 MHz Band
- Annex-2 regarding Amateur Radio Innovation at frequencies >275 GHz

Questions & Responses for selected Agenda Items (AIs)

Question 1: *Do you agree with the prioritisation of the agenda items, as shown in Annex 5, and if not why?*

We note that Ofcom has set a 'Low Priority' for AI-1.1 (50 MHz, aka the 6-metre band) and also note the definition for 'Low' is in para-3.6 as being straightforward etc.

In practice Ofcom has also adopted a 'neutral position' and RSGB is led to believe lacks internal resource for the item. Unfortunately this combination has prohibited inputs and on occasions left wider UK policy/interests exposed. On the other hand RSGB volunteers have been pleased that they are able to participate in the Ofcom/UK-delegation to CEPT preparatory meetings which also include AI-9.1.6 on Wireless Power.

Whilst recognising that Ofcom is often resource limited, nonetheless we suggest this is now reviewed and look forward to either a higher Ofcom priority and/or a more positive approach for AI-1.1.

Question 2: *Ofcom is supporting the following three priority bands for IMT identification in the RRs: 24.25 – 27.5 GHz 40.5-43.5 GHz (as part of a wider global 37-43.5 GHz tuning range) 66 – 71 GHz. If you don't agree with any of these bands, or think we should be promoting other bands, please provide justification for your views.*

The RSGB supports the IARU position that any IMT identification in the frequency range 24.25-27.5 GHz shall include full consideration and protection for the amateur and amateur-satellite service's primary allocation at 24-24.05 GHz.

The RSGB is against the allocation of new bands in the mobile service to satisfy the IMT identification requirements. In particular and in relation to the priority bands identified by Ofcom, the RSGB does not support the allocation of the range 24.25 – 25.25 GHz to the mobile service in Region 1 and its subsequent identification for IMT. The amateur and amateur-satellite services have a global primary allocation in 24 – 24.05 GHz and the out of band emissions from a mass deployment of mobile broadband systems operating in very wide channels in adjacent frequencies will appear as interfering noise in the primary amateur allocation. An identification that starts at 25.25 GHz could mitigate this difficulty.

The RSGB also supports the view that in relation to other bands within the scope of AI 1.13 a "No Change" position should be taken. In particular we fully support Method G1 NOC in the draft CPM Report for the band 47 – 47.2 GHz [Ref: R15-TG5.1-C-0478!N02!MSW-E].

Question 3: *What are your views on the suitability of the currently identified bands for HAPs and do you think there is a requirement for additional spectrum? Recognising that we support 26 GHz as a global band for IMT under agenda item 1.13, what are your views on the bands currently under study for HAPs, both globally and in ITU-R Regions?*

Our concerns are similar to our response to Q2/AI-1.1.3. We would not wish to see adjacent out-of-band emissions causing interference to our primary amateur and amateur-satellite service allocations at 24.0-24.05 and 47.0-47.2GHz

Question 4: *What are your views on the bands within scope of Agenda Item 1.16 and their suitability for Wi-Fi and Wi-Fi like services? Do you agree that Ofcom should support the CEPT position of No Change? If not, please provide evidence to support your view.*

The frequency band 5650-5850 MHz is allocated to the amateur service on a secondary basis in Region 1 but in the UK, access is restricted to the three sub-bands only: 5650-5680 MHz, 5755-5765 MHz and 5820-5850 MHz. The ranges 5650-5670 and 5830-5850 MHz are also allocated to the amateur satellite service. Therefore the RSGB has a specific interest only in the band 5725-5850 MHz from those identified in Resolution 239.

Already indoor and outdoor Wi-Fi systems are possible across the first lowermost band; and the two uppermost bands are covered by indoor and outdoor BFWA systems as well as indoor Wi-Fi in the UK. All these systems occupy broad channel widths of up to 40MHz and therefore have the potential to completely occupy any of the amateur sub-bands. This causes problems for amateur reception of low flux density signals and reduces the utility of the spectrum for amateur applications.

Therefore the RSGB supports the CEPT position for NOC especially in 5725-5850 MHz band. Moreover the RSGB strongly urges that any subsequent wider Region-1 release for Wi-Fi systems is regulated by the same technical conditions already defined for the UK and for indoor operation only.

The RSGB is also encouraged to see the new work item in CEPT that will consider further spectrum for Wi-Fi in the range above 5925 MHz.

We take this opportunity to repeat our 2016 position that any liberalisation of Wi-Fi undermines the *raison-d'etre* for past spectrum restrictions on the UK amateur service and that Ofcom must consider complementary liberalisation measures for incumbents.

Question 20: *What are your views on Agenda Item 1.11, and do you agree that no specific identification for rail communications is required in the Radio Regulations?*

We agree with Ofcom that no specific identification or change is required in the Radio Regulations. Furthermore we support satisfying the spectrum needs for railway radiocommunication systems between train and trackside within existing mobile service allocations that are not also allocated to the amateur service.

Question 23: *What are your views on Agenda Item 1.1, recognising that licensed amateur operators in the UK already have access to parts of the 50 – 54 MHz band?*

Firstly:-

- We strongly agree with Para-7.2 that with TV Broadcast in decline in VHF that change is long overdue.
- With respect to the last part of 7.3 however, this seriously underestimates UK amateur interest and benefits from wider geographical activity and the innovations associated with emerging digital developments that are being supported by Ofcom in adjacent 71 MHz experimental spectrum

Agenda item 1.1 regarding 50 MHz is a high priority topic for amateur radio and Ofcom is encouraged to increase its priority, be more supportive on behalf of a very active UK stakeholder community – or at least enable volunteers on the UK Delegation to take a more positive position. The agenda item was originally a CEPT-supported when instigated at WRC-15.

The 50 MHz (6-metre) band is a key one for amateur radio throughout the UK, Region-1 and beyond. Although access in the UK was granted in the 1980s it has never been a formal ITU Region-1 allocation, causing some ongoing restrictions, geographical gaps in activity and long term uncertainty. Presently, the band remains allocated by ITU as Broadcasting Primary in Region-1, despite the significant decline in VHF TV broadcasting.

We believe it is important it is now made a formal amateur allocation at ITU level and with the capacity to fully accommodate both current and future amateur applications. Harmonising it across the region is important in helping to raise activity and support UK-led innovation. In principle we would prefer a 50-54 MHz solution that would achieve maximum harmonisation, but in practice do recognise the CEPT position, as well as the distinct usage patterns present.

We also consider some of the compatibility studies submitted by other administrations to CEPT/ITU to be overly conservative compared to the real-world experience from over 40 years of amateur usage to date.

We therefore ask Ofcom to support the following:-

- a) **A Primary amateur segment** (similar to the existing UK national one at 50-51 MHz). The priority for such a segment is at 50.0-50.5 MHz, encompassing the existing international weak-signal and propagation beacon/research range. This range was recognised in the original CEPT proposal for this agenda item and has also been recognised in CEPT/ITU considerations.

In the 1980s the UK and Ofcom predecessors led the way with 50 MHz permits, leading to a vibrant UK 6m amateur community (including UKSMG – the UK Six Metre Group). Supporting this band again should be part of the UK position. A modest size Primary allocation (even if shared) would also provide long term regulatory certainty for all concerned

- b) **An ITU allocation in at least the rest of the 50-52 MHz range.** Whilst we acknowledge that sharing is required, this has successfully occurred for over 40 years in practice. Amateur systems such as FM and Digital systems (including simplex-gateways and duplex-repeaters) are typically lower power than the 50.0-50.5 segment, and many are coordinated, assisting such sharing
- c) **A formal option at ITU level, perhaps by means of footnote, that would enable part or all of 52-54 MHz to also be made available to the amateur service on a shared non-interference basis where national conditions permit.** Parts of this range often have very low utilisation by others. We maintain there would be greater benefits from enabling it for novel amateur developments and usage (or an 'opportunity cost' from not doing so). National licensing conditions and coordination etc. could easily accommodate the need for specific sharing, or rare occasions of civil contingency use that have been of concern for some other administrations.
- d) **Consideration of an option for amateur-satellite service uplinks within the 50-52 range.** Originally the amateur-satellite service was considered in early proposals, but this was dropped from the final draft of Resolution 658 (WRC-15). Nonetheless there are significant opportunities:-
 - i) Really low Doppler in LEO compared to higher bands (give or take atmospheric fluctuations)
 - ii) There is no other service present – The AI-1.1 studies has indicated that nothing else is in orbit
 - iii) It would offer better recognition for small satellites flying propagation-mapping/profiling SDRs wrt to the terrestrial amateur beacon network (Much of which has been upgraded with GPS-locked and specialist digital weak signal modulation schemes)
 - iv) Any uplink powers would thus in practice be small compared to existing individual usage for contests and 50 MHz Earth-Moon-Earth (which uses upward pointing steerable antennas)
 - v) It would support innovative pioneering research on tropo- and ionospheric phenomena

In further regard of 52-54 MHz – the extra frequency range would provide a major boost to the highly innovative digital data and video modes currently being pioneered in other experimental VHF bands. This has been led by BATC members in the new Ofcom 'sponsored' 71MHz experimental range and is the topic of regular updates to Ofcom's BRIG forum. UK amateurs have been instrumental in these developments and it would be unfortunate not to support such ground-breaking UK innovations and 'export' that expertise more widely via a harmonised frequency range, or at least a footnote that enables provision for such use in a far clearer manner than the uncertain nature of Radio Regulation 4.4. RSGB is aware of current UK assignments (not all of which are active) in 52-53 MHz. This still leaves 53-54 free - and in the medium- longer term 52-53 could also be shared/migrated.

In summary the key messages with respect to AI-1.1 are:

- Global harmonization of the frequency band 50–54 MHz is highly desirable.
- There has been over 40 years of amateur usage with no harmful interference.
- Given sufficient spectrum, the band could also accommodate highly innovative data and video developments by amateurs – which is an opportunity that could have wider benefits for other ‘fallow’ VHF spectrum
- Sharing studies have shown 50-54 MHz can be successfully shared by the amateur service and remaining analogue television broadcasting
- Compatibility studies submitted by other administrations to CEPT/ITU are overly conservative compared to the real-world experience from over 40 years of amateur usage.
- ITU/CEPT studies have indicated no demand whatsoever from commercial mobile or fixed systems. Likewise there are very few Wind Profiler radars (which can easily protected by specific coordination zones)
- Whilst co-channel sharing with governmental/military mobile may in principle be difficult, in practice this has proven feasible (helped by the 30-88MHz band they have available and amateur licence conditions)
- Ofcom should move from its neutral position and support the IARU ‘50 MHz Compromise’ in CEPT with a 50.0-50.5 MHz primary band and 50.5-52.0 MHz secondary band.
- Ofcom support is also requested for additional consideration for access to part or all of 52-54 MHz – perhaps by ITU footnote
- Consideration should also be given to the benefits that would arise from a secondary amateur satellite uplink provision (preferably in 50-51 MHz - overlapping the propagation beacon and FM/digital segments)

Question 26: What are your views on Agenda Item 1.7 considering spectrum needs for short duration satellites, noting also the potential linkages to Agenda Item 1.2?

The increasing number of such satellites and UK strategy for growing its space sector suggest a positive solution should be found – and one that is practical to implement on small satellite platforms where duplex filtering is difficult to implement, whereas separate VHF/UHF up/downlink frequencies may be more practical.

The RSGB (in line with the IARU position) supports satisfying the spectrum requirements for non-GSO satellites with short duration missions within the existing allocations for the space operation service or the frequency ranges identified in *invites ITU-R 3 of Resolution 659 (WRC-15)*, unless the satellites are amateur satellites as defined in RR Nos. 1.56 and 1.57.

Question 27: What are your views on Agenda Item 1.15, particularly on the protection needs of passive services?

The RSGB is interested in the use of this range (and up to 3000 GHz) by active services which are mentioned in the current RR footnote 5.565, but has no position on the specific frequencies proposed between 275 GHz and 450 GHz for Fixed and Land Mobile Services.

Active services include the Amateur and Amateur Satellite services and access to this frequency range facilitates the development, exploration and characterisation of radio propagation in this region. To this end Ofcom has enabled a NoV to the amateur licence to allow operation and experimentation in this region. There are already active experiments with amateur equipment operating at 288 GHz for example (See Annex-2). In our opinion this represents ground-breaking development in the true spirit of the amateur service and is building bridges between amateurs and the UK research community¹.

¹ “Exploiting terahertz frequencies - why 450 GHz?”, IET Colloquium on Millimetre-Wave and Terahertz Engineering & Technology 2016

Therefore the RSGB supports the IARU position on this agenda item and in particular requests support from the UK to ensure that any WRC action maintains the flexibility in any footnote (or other regulatory action) for other active services to retain access to the entire frequency range (subject to the existing and continuing protection to passive services).

Question 28: What are your views on Agenda Item 9.1.6, particularly on the categorisation of WPT and whether WRC action is required?

In general, RSGB supports the Ofcom view that WPT should be viewed as a radio application. We believe it is viable to find operating frequencies for WPT which will not cause difficulties to other radio services.

RSGB does not, however, support the view that WPT(EV) is a necessary enabling technology for domestic electric vehicles – it is expected to be costly compared to “plug-in”, inefficient in its use of energy and brings with it issues of safety (from high levels of radio frequency energy modelled as being in excess of the ICNIRP reference levels) and harmful interference to radiocommunications services

IARU strongly supports the position that high power WPT(EV) should be limited to the proposed 20 kHz spectrum, in view of the potential for high levels of spurious and harmonic emissions from high power installations. However, IARU notes that these installations are more likely to be distanced from residential areas, and so the potential impact on residential radio services could be somewhat reduced.

In terms of the proposed 79-90 kHz systems for domestic vehicles, the emission footprint modelling which IARU has done, and presented to both CEPT and ITU, shows very clearly the potential for high levels of harmful interference to any radio service operating in the domestic environment, be this amateur, broadcast or other.

Reports from Asia of coexistence of WPT(EV) with radiocommunications services should be viewed with caution, in view of the much higher assumed field strength of broadcast signals in that region compared to Europe.

Data from a WPT(EV) development system and provided by its manufacturer to CEPT show emissions in excess of CISPR 11 or ITU-R SM.329-12 limits. These limits of themselves are some 30-40 dB higher than those necessary to protect radiocommunications services.

The necessary improvement in spurious emission limits could be relaxed somewhat if all WPT(EV) systems adopt a single tightly controlled operating frequency, to prevent the scattering of upper-order harmonic emissions across the whole radio spectrum. Without such frequency control, the entire LF and HF radio spectrum will be affected by the harmonics of nearby WPT systems, which modelling shows could extend to a distance of 1 km from each WPT(EV) installation.

We urge particular attention to the fact that compared to the fundamental charging frequency the higher harmonic frequencies are capable of radiating in the far-field more efficiently and such complexities should be accounted for in regulatory and standards bodies, test procedures etc

Other factors that require consideration is that higher power transfer may involve more than one transducer per vehicle (Ofcom reports document up to four for an electric bus). Another ambiguity is the basic definition of an ‘Electric Vehicle’ vs the broader CEPT definition of ‘Transport’

It is therefore clear there can be a number of ambiguities involved with this very high power application.

Given the projected density of deployment of WPT(EV) installations and their spurious emissions footprint, RSGB believes that as an integral part of authorising WPT as a technology for deployment, appropriate spurious emission limits should be defined. Doing this after the products have been released into the market will, put simply, be too late.

Ofcom should therefore support and press for the relevant CEPT / ITU-R reports and recommendations to be available in good time, ensure they are clear on scope/definitions etc and that thoroughly cover unwanted/spurious emissions. Likewise we would be concerned if CISPR & ETSI measures are inadequate.

Question 29: Do you have any comments concerning the Standing Agenda Items, where not covered elsewhere in this document?

With respect to **Agenda Item 8 concerning Footnotes**

There are a number of country footnotes that apply to amateur service allocations, some of which appear to be obsolete. We seek UK support to review/remove the following:

- **1.8-2 MHz: 5.97 (Loran) 5.98, 5.99, 5.102**
- **3.5-4 MHz: 5.119, and 5.122**

In addition we seek a change to **5.96** to amend/remove the overly restrictive clause that limits the power of amateur stations to 10 Watts.

Question 32: What changes to the Radio Regulations have you identified that would benefit from action at a WRC and why? Do you have any proposals regarding UK positions for future WRC agenda items or suggestions for other agenda items, needing changes to the Radio Regulations that you would wish to see addressed by a future WRC?

With respect to AI-10 regarding future agenda items: We support the IARU Position that does not foresee any specific amateur items below 275 GHz required for WRC-23 or WRC-27.

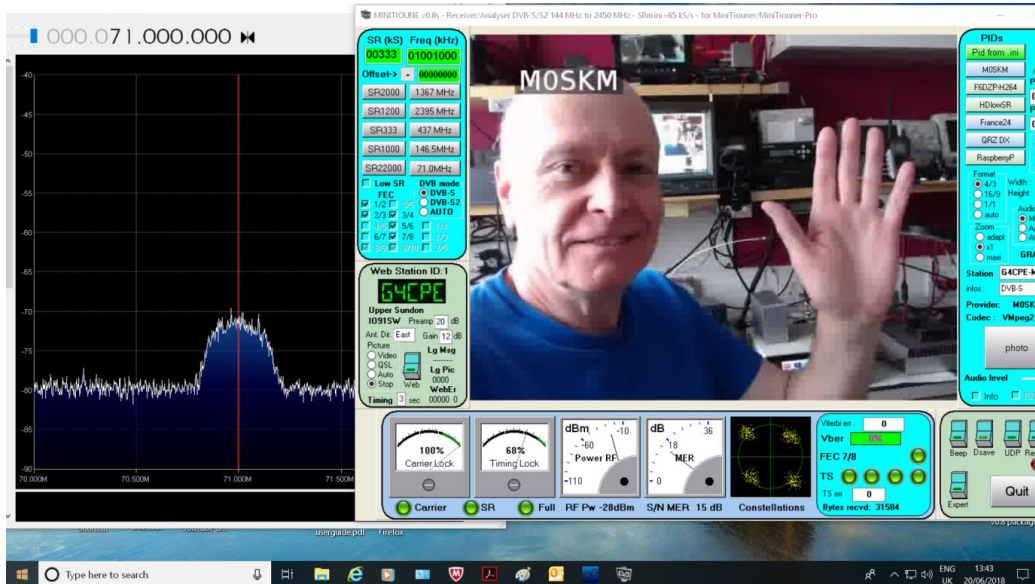
However we are concerned by some (prospective) proposals:-

- Wideband space-borne radar in 40-50 MHz which may cause harmful out-of-band emissions to weak signal amateur service activities at 50MHz. We are also not convinced this need be a WRC-23 item and cause four extra years of studies/effort
- Space weather sensors – which may include wideband HF profilers and other sensors that overlap or intrude into) amateur allocations.
- Additional mobile spectrum in the 6-24GHz range – This is simply not justified and we would be concerned with our 10 and 24 GHz allocations
- Proposals concerning GNSS

Some of these topics will only become apparent in detail after the current consultation deadline. Therefore we urge Ofcom to have an open-access IFPG assessment process and potentially a separate consultation as such proposals become clearer (and before WRC-19 itself).

Annex-1A: Amateur Innovation in VHF

With respect to AI-1.1, UK amateurs and in particular members of BATC have been spectrally-efficient pioneering low-rate video developments. The example below is 333kb/s realtime video within a 500kHz channel bandwidth. This is being trialled in UK amateur experimental spectrum at 71 MHz courtesy of a Ofcom licence variation (NoV) but is precisely one of the innovations that form part of the amateur spectrum requirement associated with 52-54 MHz access. Such developments have wider value to the UK and Ofcom in demonstrating that largely fallow low-VHF spectrum can be put to better use than at present. There is literally an ‘opportunity cost’ by not enabling and fostering this. (Regular updates are presented by RSGB to Ofcom’s BRIG organisation)



Note the above is supported by a collaboration between UK amateur transmit hardware developments and French amateur SDR hardware/software for receive.

Annex-1B Amateur Research at VHF

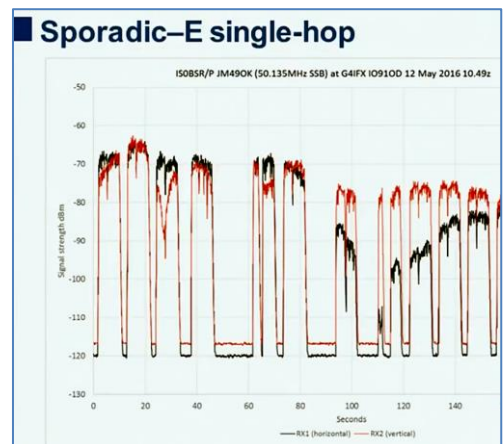
Weak signal modes and Propagation Research are a key ongoing feature of the 50 MHz band which can exhibit both HF and VHF characteristics and can also feature ‘Sporadic-E’. Recent work has include assessments of Faraday-polarisation rotation within Sporadic-E events as well as forecasting their meteorological drivers

Polarisation of 50MHz signals

Chris Deacon G4IFX

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From RSGB Convention video: <https://www.youtube.com/watch?v=13Cs4nB1TjI>

Annex-2: Amateur Innovation at Frequencies >275 GHz

With respect to AI-1.1.5, Resolution-767 (which had significant UK/RSGB input when first drafted) explicitly recognises ongoing developments by amateur and radiolocation services

Below is a recent example of work that this has enabled at 288GHz, featured in the June-2018 edition of RSGB RadCom magazine. A notable feature of this work is its class-leading frequency stability and phase noise that enables traditional amateur narrowband CW/SSB of a few kHz bandwidth to be clearly received at these elevated frequencies. It builds on similar work in the amateur 122, 134 and 241 GHz bands.

Regulars

GHz Bands

Martlesham 2018

The annual Round Table and UKuG AGM was held at Adastral Park, Martlesham over the weekend of 14 and 15 April. People who attended both days were treated to a trip in glorious Spring weather to the nearby Bawdsey Radar Museum. A fascinating visit and a look into the work of Robert Watson-Watt and his colleagues on wartime radar development. As well as the AGM, the Sunday featured plenty of traders and a selection of talks ranging from SDR using Gnu Radio by Heather, MOHMO to Aircraft Scatter by John, G3XDY. The construction competition, judged by G4DDK, G3XDY and myself was very well supported, with plenty of microwave electronics, plus several Raspberry Pi projects through to a beautifully engineered 3.4GHz SM6FHZ Septum dish feed built by John, PA7JB. The final winner, going through to the final of the UKuG's G3VVB trophy competition, was Mike, G8CUL's multi-range RF power meter.

The UK's first 288GHz system

On display at Martlesham and operating under the RSGB's 'Above 275GHz' NoV [1] was a 288GHz transmitter and receiver built by Roger, G8CUB. The transmitter (**Photo 1**) produces -22dBm of CW at 288GHz by multiplying up from an 8GHz 'ZLPLL 14G' synthesiser by ZL2BKC [2] in three stages via 96GHz to a Terratech passive tripler feeding a 20dB horn antenna. The receiver (**Photo 2**) uses an ultra-low noise 100MHz Wenzel reference with another ZLPLL 14G at 4.8GHz multiplied up to 19.2GHz as LO, feeding a 15th-harmonic 140-220GHz TeK mixer with a 45dB Quasi Optical horn antenna. The mixer has a conversion loss of almost 60dB at 288GHz (!), so receiver sensitivity is quite low. I'll leave you to do the sums, but the transmitter could be clearly heard across the room at about 3 metres range. Roger is hoping for a QSO partner soon, but this sort of equipment is very hard to find at 'reasonable' amateur prices!



PHOTO 1: G8CUB's 288GHz transmitter. Photo courtesy G4BAO.

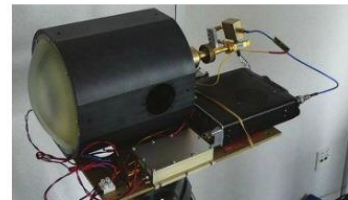


PHOTO 2: G8CUB's 288GHz receiver. Photo courtesy G4BAO.

Websearch

- [1] UK 'above 275GHz' NoV: <https://bit.ly/2H6dqZF>
 [2] ZLPLL 14G: <https://zl2bkc.com/store/>