An Amateur Radio publication for the Microwave Enthusiast

UKuG

scatterpoint

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Barry G8AGN & Bob G4APV World 30THz record


New Antenna arrangement for G4BAO

UK Microwave Group

Subscription Information

The following subscription rates apply.

UK £6.00 US $12.00 Europe €10.00

This basic sum is for **UKuG membership**. For this you receive Scatterpoint for **FREE** by electronic means (now internet only) via

https://groups.io/g/Scatterpoint and/or Dropbox. Also, **free access to the Chip Bank**.

Please make sure that you pay the stated amounts when you renew your subs next time. If the amount is not correct your subs will be allocated on a pro-rata basis and you could miss out on a newsletter or two!

You will have to make a quick check with the membership secretary if you have forgotten the renewal date. Please try to renew in good time so that continuity of newsletter issues is maintained. Put a **renewal date reminder** somewhere prominent in your shack.

Please also note the payment methods and be meticulous with PayPal and cheque details.

PLEASE QUOTE YOUR CALLSIGN!

Payment can be made by: PayPal to

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or a cheque (drawn on a UK bank) payable to 'UK Microwave Group' and sent to the membership secretary (or, as a last resort, by cash sent to the Treasurer!)

Articles for Scatterpoint

News, views and articles for this newsletter are always welcome.

Please send them to

editor@microwavers.org

The CLOSING date is

the FIRST day of the month

if you want your material to be published in the next issue.

Please submit your articles in any of the following formats:

Text: txt, rtf, rtfd, doc, docx, odt, Pages

Spreadsheets: Excel, OpenOffice, Numbers

Images: tiff, png, jpg

Schematics: sch (Eagle preferred)

Please send pictures and tables separately, as they can be a bit of a problem.

Thank you for you co-operation.

Roger G8CUB

Reproducing articles from Scatterpoint

If you plan to reproduce an article exactly as in Scatterpoint then please contact the Editor – otherwise you need to seek permission from the original source/author.

UKμG Project support

The UK Microwave Group is pleased to encourage and support microwave projects such as Beacons, Synthesiser development, etc. Collectively UKuG has a considerable pool of knowledge and experience available, and now we can financially support worthy projects to a modest degree.

Note that this is essentially a small scale grant scheme, based on 'cash-on-results'. We are unable to provide ongoing financial support for running costs – it is important that such issues are understood at the early stages along with site clearances/licensing, etc.

The application form has a number of guidance tips on it – or just ask us if in doubt! In summary:-

- Please apply in advance of your project
- We effectively reimburse costs - cash on results (e.g. Beacon on air)
- We regret we are unable to support running costs

Application forms below should be submitted to the UKuG Secretary, after which they are reviewed/ agreed by the committee

www.microwavers.org/proj-support.htm

UKμG Technical support

One of the great things about our hobby is the idea that we give our time freely to help and encourage others, and within the UKuG there are a number of people who are prepared to (within sensible limits!) share their knowledge and, what is more important, test equipment. Our friends in America refer to such amateurs as “Elmers” but that term tends to remind me too much of that rather bumbling nemesis of Bugs Bunny, Elmer Fudd, so let’s call them Tech Support volunteers.

While this is described as a “service to members” it is not a “right of membership!”

Please understand that you, as a user of this service, must expect to fit in with the timetable and lives of the volunteers. Without a doubt, the best way to make people withdraw the service is to hassle them and complain if they cannot fit in with YOUR timetable!

Please remember that a service like our support people can provide would cost lots of money per hour professionally and it’s costing you nothing and will probably include tea and biscuits!

If anyone would like to step forward and volunteer, especially in the regions where we have no representative, please contact the committee.

The current list is available at

www.microwavers.org/tech-support.htm

UKμG Chip Bank – A free service for members

By Mike Scott, G3LYP

Non-members can join the UKμG by following the non-members link on the same page and members will be able to email Mike with requests for components. All will be subject to availability, and a listing of components on the site will not be a guarantee of availability of that component.

The service is run as a free benefit to all members of the UK Microwave Group. The service may be withdrawn at the discretion of the committee if abused. Such as reselling of components.

There is an order form on the website with an address label which will make processing the orders slightly easier.

Minimum quantity of small components is 10.

These will be sent out in a small jiffy back using a second class large letter stamp. The group is currently covering this cost.

As many components are from unknown sources. It is suggested values are checked before they are used in construction. The UKμG can have no responsibility in this respect.

The catalogue is on the UKμG web site at www. microwavers.org/chipbank.htm

UK Microwave Group Contact Information

Chairman: Neil Underwood G4LDR	General Secretary: John Quarmby G3XDY	Membership Secretary: Bryan Harber G8DKK
email: chairman@microwavers.org	secretary@microwavers.org	membership@microwavers.org
located: Wiltshire IO91EC	located: Suffolk JO02OB	located: Hertfordshire IO91VX
Tel: 01980 862886	Tel: 01473 717830	
Treasurer: David Millard M0GHZ	Scatterpoint Editor: Roger Ray G8CUB	Beacon Coordinator: Denis Stanton G0OLX
email: treasurer@microwavers.org	editor@microwavers.org	beacons@microwavers.org
	located: Essex JO01DP	located: Surrey
	Tel: 01277 214406	

Scatterpoint Activity news: John G4BAO scatterpoint@microwavers.org
Contests & Awards Manager: G3XDY as above g3xdy@btinternet.com

Assistants

Murray Niman	Webmaster	G6JYB	g6jyb@microwavers.org
Kent Britain	USA	WA5VJB/G8EMY	wa5vjb@flash.net
Mike & Ann Stevens	Trophies	G8CUL/G8NVI	trophies@microwavers.org
Noel Matthews	ATV	G8GTZ	noel@noelandsally.net
Robin Lucas	Beaconspot	G8APZ	admin@beaconspot.uk
Chris Whitmarsh	mmWaves	G0FDZ	chris@g0fdz.com
Mike Scott	Chip Bank	G3LYP	g3lyp@btinternet.com
Paul Nickalls	Digital	G8AQA	g8aqa@microwavers.org
Heather Lomond	SDR	M0HNO	m0hno@microwavers.org
Neil Smith	Tech Support	G4DBN	neil@g4dbn.uk
Barry Lewis	RSGB uWave Manager	G4SJH	barryplewis@btinternet.com

UK Regional Reps

Martin Hall	Scotland	GM8IEM	martinhall@gorrell.co.uk
Gordon Curry	Northern Ireland	GI6ATZ	gi6atz@qsl.net
Peter Harston	Wales	GW4JQP	pharston@gmail.com

International

Kent Britain	USA	WA5VJB/G8EMY	wa5vjb@flash.net

Loan Equipment

Don't forget, UKuG has loan kit in the form of portable transceivers available to members for use on the following bands: **Contact Neil G4DBN for more information**

5.7GHz 10GHz 24GHz 47GHz 76GHz

30THz World Record

Today, 22 May 2021, Barry G8AGN/P and Bob G4APV/P set a new world record of 65m on the 30THz band. Reports both ways were 599 and the equipment used was the same as for previous shorter contacts.

The contact took place in the grounds of the Finningley Amateur Radio Society (FARS) and special thanks are due to Kevin G3AAF who acted as our host, kept us supplied with coffee and acted as the contact adjudicator. Several other club members were also present during parts of the 6 hour long operating session which included time involved in measuring out the path length and waiting for the rain to stop!

The weather was mixed, mainly overcast with variable light wind and the occasional light rain shower (typical for a late May Bank Holiday weekend!). Propagation conditions were very variable with periods of no wind and 100% copy; at other times, light winds seemed to churn up the atmosphere and increase path attenuation and/or induce deep signal fades/scintillation?

Editors Comments

To state the obvious again. Scatterpoint is only as good as the content received. It is the articles that make the magazine interesting. Plus the activity reports, and what you have been doing this month. So please get writing and send in your articles to the Editor, and your activity reports to G4BAO scatterpoint@microwavers.org .
Very many thanks to the contributors, and those who sent in reports. Well done Barry on your 30THz World record.

A Review of the WB SG 1 Opt15G Signal Generator

Roger Ray G8CUB

The lack of a signal generator at home working below 2GHz, led me to consider the Chinese WB-SG1 opt15G

It was reputed to operate from 1Hz to 15GHz, in two bands. 1Hz – 200MHz, on a BNC output. 10MHz – 15GHz on SMA.

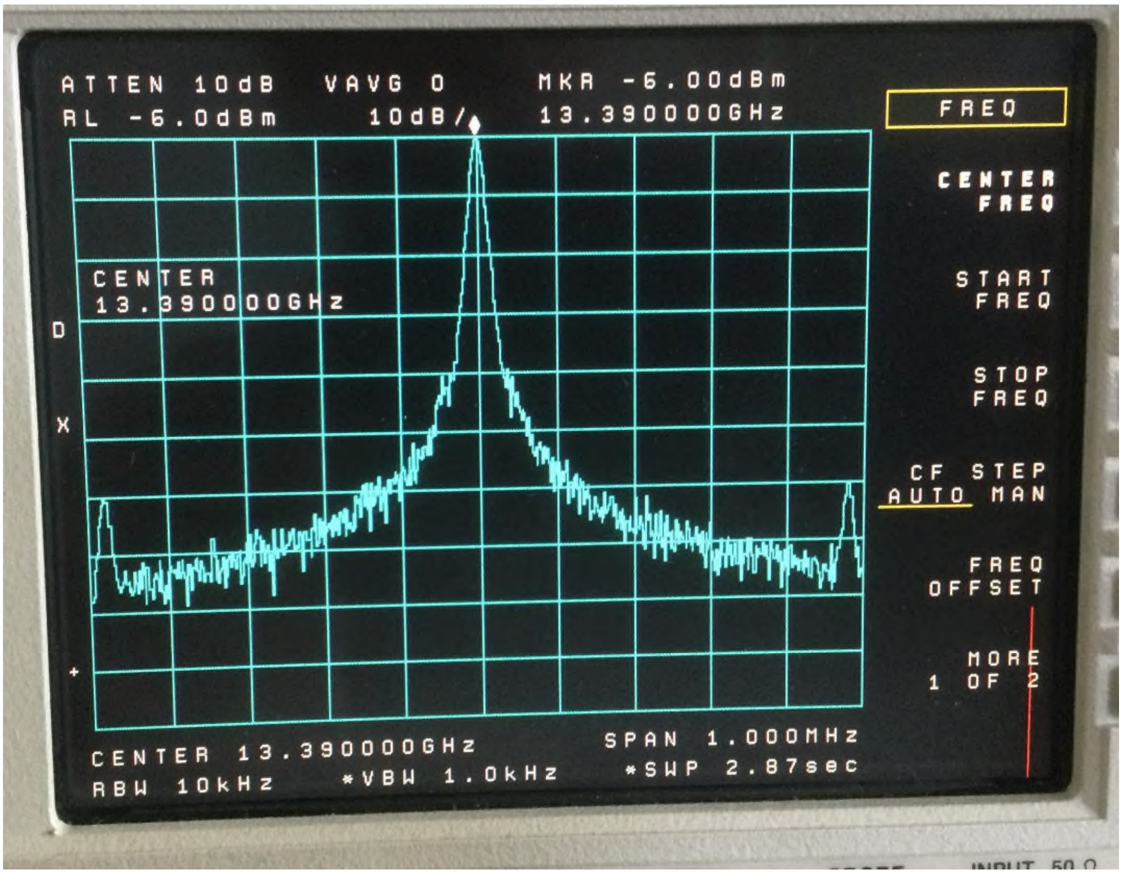
I was unsure whether this was going to be another awful synthesiser, with an LCD display. Firstly it is not just a pcb, but a boxed unit with pcb front panel, containing the display, and up/down, left/right buttons.

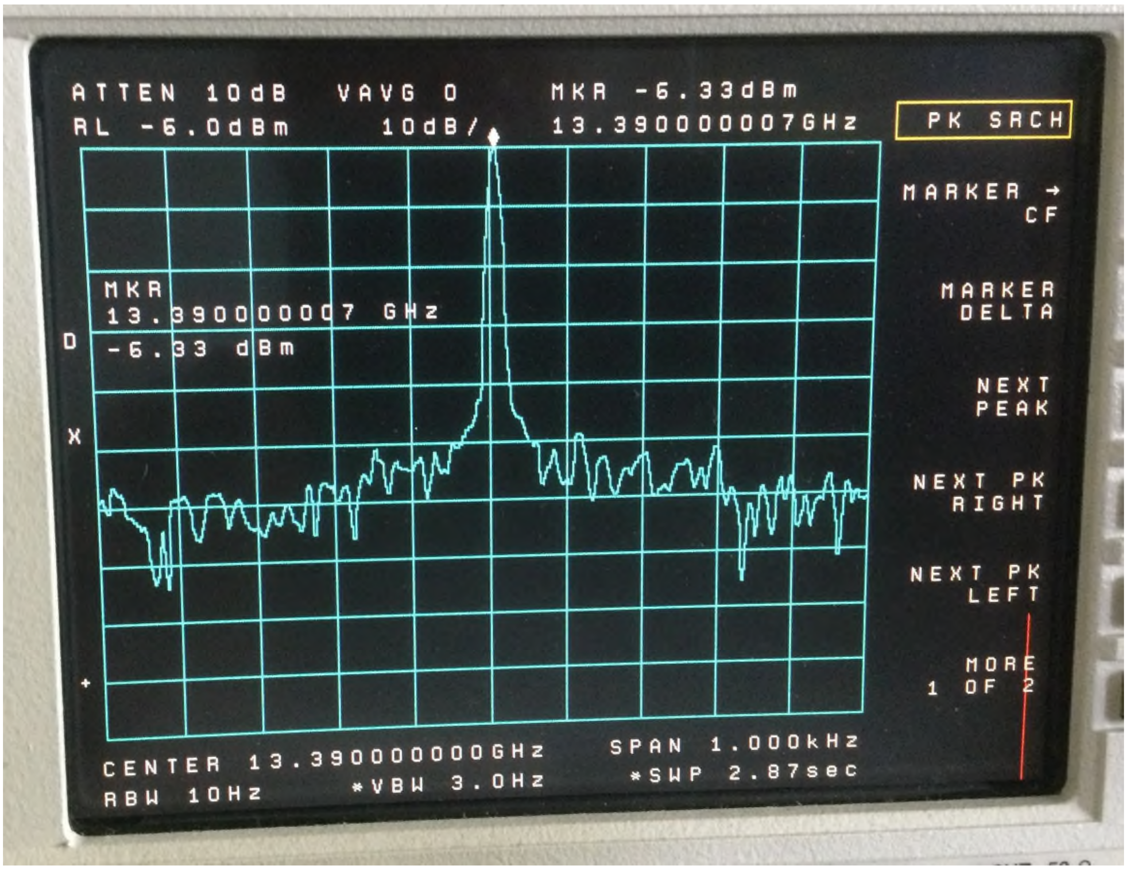
It uses a 10MHz internal reference, and has an external input. The first assumption was that the internal reference was likely to be way off frequency. It was a pleasant surprise to find the error at 15GHz was only 25Hz low!

My next assumption was also proved wrong. When operating in the upper half of its frequency range, the F/2 product was well down. -50dB at 15GHz.

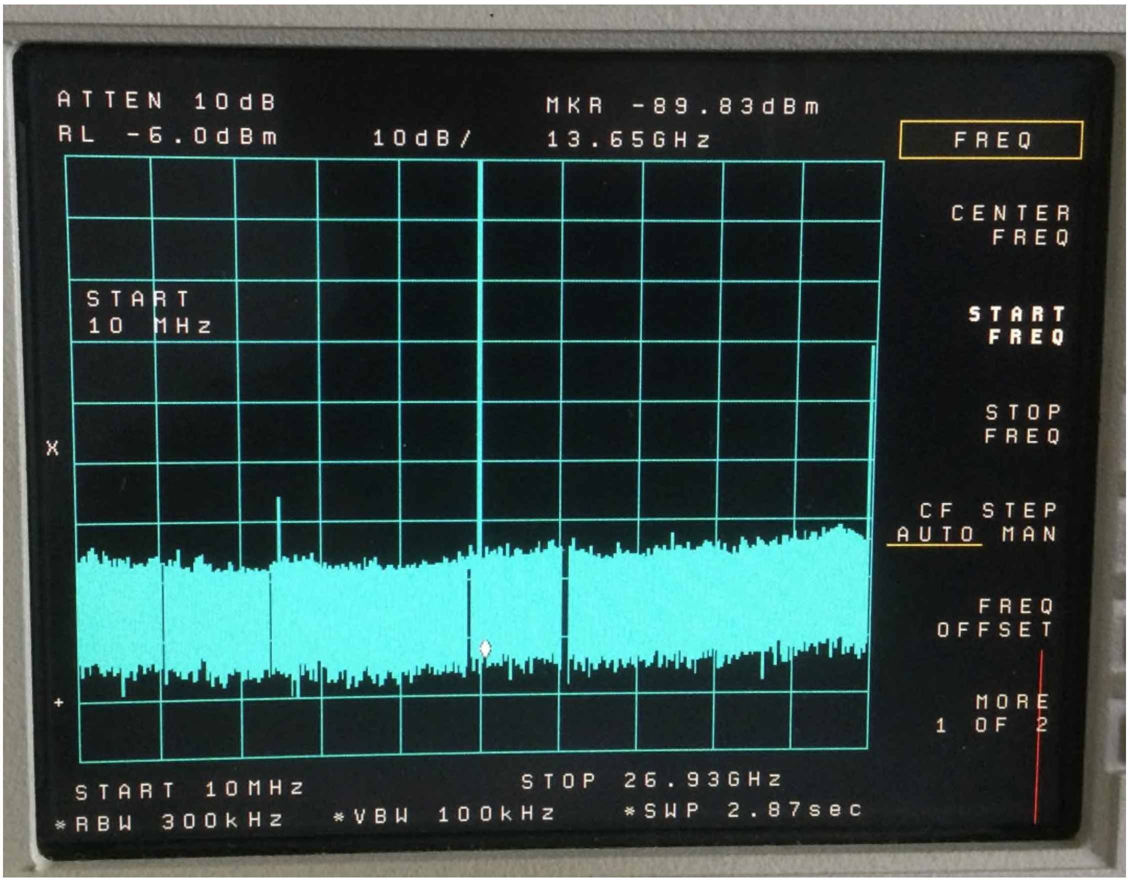
Okay then, the unit has possibilities. Frequency control is by moving the cursor, then using the up down button to change. Power control is a simple 1 – 31. Not in dB but an arbitrary number related to output level. There is an output on/off, and a sweep mode.

So firstly I looked at the other WB-SG1s by BG7TBL on offer. There appears to be many versions with maximum frequency of 4.4 / 6.4 / 9.5 / 15 / 18 / 20GHz. It would appear that earlier low frequency versions probably use the Analog Devices ADF4350/51, and the 9.5GHz version something else ADF5355 possibly.





On the spectrum analyser the synthesiser noise looked reasonable, well actually pretty good.



The high performance and lack of F/2 suggests that the 15GHz version uses the Ti LMX2594. While the 20GHz version likely uses the LMX2595 (with 18G versions ones that don't make 20GHz?).

One of the big problems with wideband synthesisers is the gain of the VCO (sensitivity). If for example the VCO covers 8GHz with 3V, then the gain is 2666MHz / volt. So just 10uV of noise on the control line will FM modulate the VCO 26kHz. Thus ultra-low noise voltage regulators are required. This together with non-optimal layout and grounding, is where many of the low cost ebay synthesisers fall down.

It would appear that the opt15G version of this generator uses the Ti LMX2594. This is a really good low noise synthesiser. It uses seven VCOs covering 7.5 to 15GHz, keeping the VCO gain down, and by not using doubling eliminating F/2 products. Also the comparison frequency can be 300MHz for a fractional-n synthesiser. Plus most of the low noise regulators are integral in the chip.

Output below 7.5GHz is obtained by division.

The other problem is the accuracy, stability and noise performance of the reference. To obtain the best noise performance close in, requires the use of a low noise reference. This on-board references must be pretty good. Plus there is provision for an external ref.

For the upcoming millimetre contest, I needed a synthesised source on 13.390GHz. This to multiply up to 241.02GHz, for a transmit beacon. A x18 multiplication would show up any noise issues. That is noise increased by 25dB from the 13.39GHz signal, With 10MHz reference phase noise increased by a massive 87.6dB.

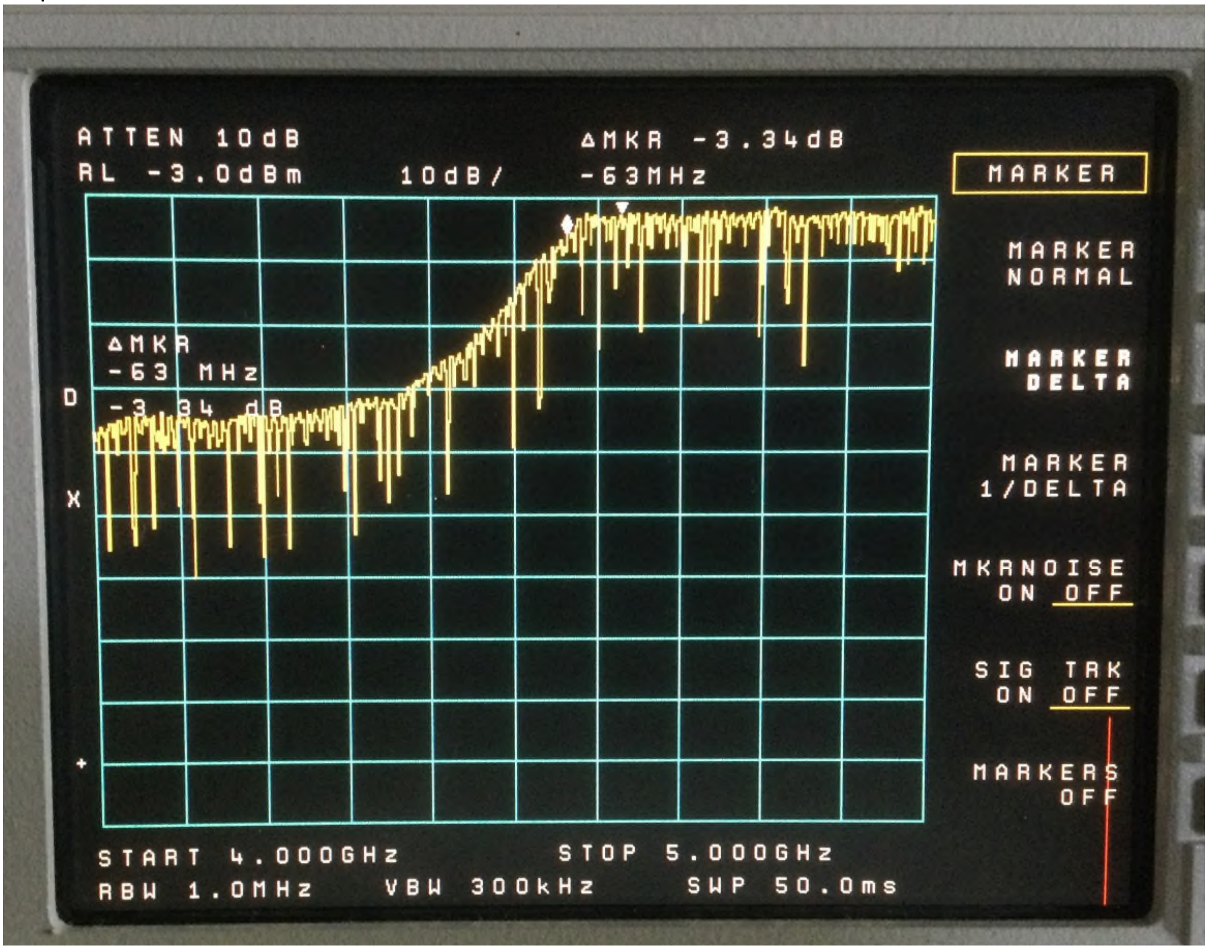
As a TX signal on 241 it sounded fairly good. An honest 'T' report would probably be 7 or so. Although that is on a par with other units multiplied to that frequency.

So overall I am impressed with this 15GHz generator.

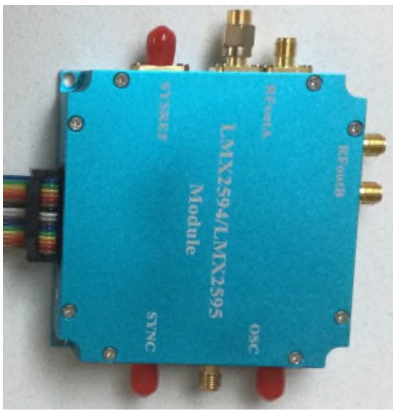
Over the frequency range 100MHz – 15GHz. Amplitude output with level set to 0, varied from 0 down to -9.5dBm. With amplitude set to 31, output was +9.8 down to -0.75dBm. Actually it does not appear that bad being +/-1.7dB 100MHz – 8GHz., +/-3.2dB 8-15GHz.

Reviews of lower frequency units are on-line, so I will not repeat some of the comments here.

External programming is available, although I have not tested it so far.
The separate low frequency output is a fixed level of around 3Vp-p, and it a long way from a sine wave. It you want to use this part of the generator (1Hz-200MHz), then I would suggest an external switched attenuator. Or, maybe just a pot if using it for audio.
The swept function is useful with a spectrum analyser for tuning filters etc.
It was found that the number of points needed to be set low, then the analyser slowly builds up the response.



Before buying the signal generator, I had tried a Chinese copy of the LMX2595 evaluation board. This with supplied interface works well with Texas Instruments software. However it is quite easy to get lost in the huge number of settings. Plus it does not retain the last settings. So ideal to produce a very low noise signal while connected to a computer. No use at all in the field.
Anyone volunteering to produce a PIC or Arduino controller? There are only 40 or so registers to load?



Radio propagation research for the amateur

Potential tool for RRI - TROPO and sporadic E monitoring.

Plus, Dual band Hand portable at a bargain price – brief review.

G3WRT I.J.Dilworth

Figure 1. Zastone 889 showing GPS data

More than a year ago I bought the Zastone 889 dual band NBFM handheld. Complete with a substantial Li battery and charger/stand as illustrated. It has proven to be reliable and of good solid quality 145 and 433MHz, plus sensitive GPS. The colour display is genuinely nice/attractive and the inbuilt speaker clear and loud enough. I can recommend it as a sensitive RX. I have spoken to someone with it on the Colchester GB3CE repeater for which I was the beacon keeper along with Ernie G8HOR for many years. It is now on the hospital in Colchester and no longer at the University – health, safety and insurance strike again. This handheld does produce a healthy transmit power - probably more than one should be exposing one's brain and ears to so I also bought an extension mic/speaker which I have never yet used (where did I put it?). Just scanning a few repeater and simplex channels on both bands here in my lowly shack is convenient and useful. I have attached its

SMA female antenna socket to a lead and adapter so I can connect it to my (low profile) slot antennas [1] on each band (also in the shack as illustrated in figure (2) on an up down mount via a rope! to avoid standing wave nulls, and this has proven much more reliable in the light of the existing standing waves (which change with my movements), in the shack, and the (marginal) diffraction path to GB3IH I experience. For me, a good buy at a ridiculously low price – when I bought it. I have never tried programming it although I have seen programs on the web. Just manually for me and it has a plethora of other features I have not tried, e.g., crossband repeater. If you have two (I have not yet) then one can tell you where the other is via the GPS data – I read.

Figure 2. Low profile 145 and 432 MHz slot antennas in the shack, rope up/down able.

Figure (3) Nested 50 and 70MHz vertically polarized slot antennas in a loft 1dBD omni. Much more convenient than a half wave dipole. Copyright G3WRT

Potential applications.

An interesting facility of this handheld is the built in GPS which appears to update every second. What I find especially interesting is the height, above sea level (asl), which is displayed. Thinking about it the height GPS registers and displays, in this equipment, depends on the tropospheric density at any time. I have been monitoring how that changes with time at my QTH. It appears to change in height in meters but not by a lot, there appears to be no 100cm variation, yet the display shows xx.x m. So, it is just metres asl that are displayed. I have not yet tried to record the change with time. It occurs to me this could be used to predict or monitor tropospheric lifts. If we had a network of these it surely would. Solar powered Buoys in the North Sea? (I live in Suffolk). It also has potential for predicting E openings but only loosely until we understand the physics of these better. Stratospheric wind shear and the resultant ionisation are the current 'pole sitters' [3]. That implies tropospheric ducting are a relatively minor but nevertheless important added parameter especially since we know that radio refractive index, (RRI) are significantly affected by rain cells etc. [2] and my own unique simultaneous V, H and C polarisation copolar and crosspolar observations at 11.6GHz. Monitoring my 889 display indicates that the RRI height does change (in one metre steps) and frequently. I think we can be sure the changes I observe, quite rapid changes, indicate this is a tool asking to be used as a quasi-rapid barometric, humidity etc. i.e., RRI monitor.

Beacon advances for the 21st century

We are nearly a quarter way through this century and have not really advanced the beacon network for decades. Anyone else had the same thoughts and made advances? We can contribute to radio propagation research that is not possible for government agencies, or even of interest to them. This is an idea and tool we can use; I think. Maybe something to add to all beacons not only for tropo

scatter but for sporadic E too? Why not? in Europe? Along with GPS slaved frequency to allow FT.* reception in vastly decreased bandwidths? More effort of course for the beacon hardware and providers but also far more useful than just the usual repetition of QRA and so on. A good reason to contribute to beacons and their running. Is there a will to do this?
Some of us are still vaguely, in my case. but still competent on CW. It might increase the usage of the beacon whilst also encouraging CW competence too. Plus, FT.* versions for those more advanced than me, plus the advantage that the beacons might then be detected under normal tropo conditions if they are GPS locked, by modest stations and antennas, i.e., most of us.
In the time I have typed this, my QTH! has gone from 61m asl to 27m asl. It is nominally 42m asl here over long observation. The troposphere is moving and maybe a lift travelling up the North Sea soon? I can see rain laden clouds passing quite rapidly above me. It is complicated by the fact that several satellites (it does not tell me how many) are producing the height result and of course they are arriving at different elevation angles, so it is a given this is an integration of all available satellites and so a blob of the troposphere above my location.
That is not to mention what I suspect is the orientation of the ionosphere above the electrically charged clouds underneath. Which I am convinced are the partial reason the polarisation of the propagation is as important as the amplitude in sporadic E. I.e. I think a dual polarisation, or a circularly polarized antenna will be more reliable than a single polarisation to minimize the rapid fading we experience. Then maybe a decent i.e., a proper QSO will be possible even in sporadic E? rather than the usual rapid contest like nonsense.
To demonstrate I need someone near, say, Banff, to have an electric field probe (simple enough) and to correlate that with propagation to the Faroe Islands 28.33MHz beacon here in Suffolk or similar reflection distance, because this seems likely to be the one skip distance. I am quite sure other beacons offer similar opportunities. Anyone interested in the Banff area in sporadic E, from the UK Suffolk, vicinity? Potentially adding to radio science knowledge.

PS
I have just ordered another today and now it's called ABBREE AR-889G GPS SOS Walkie Talkie 10W 999CH Duplex Repeater Night mode Dual Band VHF UHF Hunting Radio Station HF Transceiver. Still a relative bargain at 75 quid. I doubt it is 10W output, but I will measure it, probably 5W. It does have lo/hi power settings. Please take care protect your brain and especially your ears from RF fields, irrespective of the recent (decades late) Ofcom missive.

[1] Low profile slot antennas. Submitted 2021. QEX/QST/CQ/RSGB/PW I was told by an editor 'publishing is a fickle business', so I now follow suit. My first article, Wireless world in 1975 I received 75 quid a page. It is now 60 quid a page in PW – 46 years and is it worth doing?

[2] 'The physics of clouds', Mason. Oxford press, although old Is a seminal excellent body of work well worth consulting.

[3] http://tropic.ssec.wisc.edu/real-time/windmain.php?&basin=atlantic&sat=wg8&prod=shr&zoom=&time=

Further reading
Sporadic E propagation - Wikipedia

The Reflex Klystron

Peter Chadwick G3RZP

Although the Cavity Magnetron is considered pivotal to the development of centimetric RADAR, it was of little use on its own. Developed from the split anode magnetron of the late 1920s – which was, besides Barkhausen-Kurtz oscillators (Appendix 1), the first real microwave generator – the cavity magnetron patented in the Soviet Union in about 1930 and unknown in the West at that time, provided previously unheard-of levels of microwave power at a fixed frequency.3 But without a receiver, this would be of little use, and thus efforts were needed to produce devices suitable for receivers – which also included suitable point contact silicon diodes for receiver mixers. The split-anode magnetron (which required an external tuned circuit) was a possible approach up to around 600 MHz, but had problems of noise and in any case, true centimetric RADAR `required something capable of higher frequencies. The answer lay in the development of the tuneable reflex klystron and the 'industrialisation' of the design to allow quantity production. But just as important was the development of the silicon point contact diode by H.W.B. Skinner which was productionised at the British Thomson Houston establishment at Rugby.

The Heil Tube

This was the result of the proposal of a German physicist, Oskar Heil and his Russian wife, Agnessa Arsenjeva of the Leningrad University Department of Physics, in 1935 of *velocity modulation* of an electron beam into bunches of varying electron density and the interaction of such a beam with a resonant circuit. Later, Mrs Heil returned to Russia where she remained for the rest of her life: it is considered probable that she would not have been allowed to leave the USSR. Oskar Heil came first to the UK where he worked for Standard Telephones and Cables (STC), and then returned to Germany, finally moving to the USA in 1947.

The principle of velocity modulation is that by providing a *drift space* for the an electron beam to transit and enclosing the drift space with a resonant cavity, the density of the electron beam within the cavity will be regulated by the electric field in the cavity. Because the electron is a moving charged particle, it has a magnetic field associated with it which induces a current in the resonant cavity. The electron field has a fluctuating number of electrons because of the way they are 'boiled' off the cathode: this gives rise to *shot* noise, the same way as in conventional valves. This noise component excites the cavity resonator and the resultant electric field is distributed across the cavity, leading to acceleration of the electrons causing them provide bunches of electrons. As the bunches of electrons are accelerated, their energy increases according to the well-known relationship $e = 1/2mv^2$.

The Heil tube used a resonant coaxial line and so had a lower Q than the cavity resonator, leading to the signal from the Heil tube being relatively noisy. They were however used quite extensively in microwave link and Electronic Warfare (EW) equipment and various of them would operate up from as low as 800 MHz up to 4GHz, with powers at the lower end (800 – 1000MHz) of >2 watts. STC at Footscray in Kent were substantial manufacturers of Heil tubes (calling them Velocity Modulated Oscillators) from the 1940s through to the 1960s. The major difference between the Heil tube and the reflex klystron was that in the Heil tube, the electron beam was magnetically focussed.

The natural tendency of a beam of electrons is to repel each other and thus broaden the beam: in the reflex klystron, the cavity is shaped to provide sufficient electric field to keep the beam 'bunched'.

The 'drift tube' of the Heil tube (Fig 1) was coupled to an external cavity (Fig 2) from which the RF was extracted. Some of the lower frequency - ca.1 GHz – tubes had a 'top cap' connection to the resonator tuning line. A typical set of voltages with respect to earth would be resonator 0 volts, Cathode -350volts, grid volts -390, screen volts 0 to +50, anode volts +20. Total input power, depending on frequency, between 10 and 20 watts and output power, again frequency dependent up to 500mW. The actual positioning of the magnet should be varied such that, depending on the actual tube used, the anode current is about 80 to 90% of the cathode current.

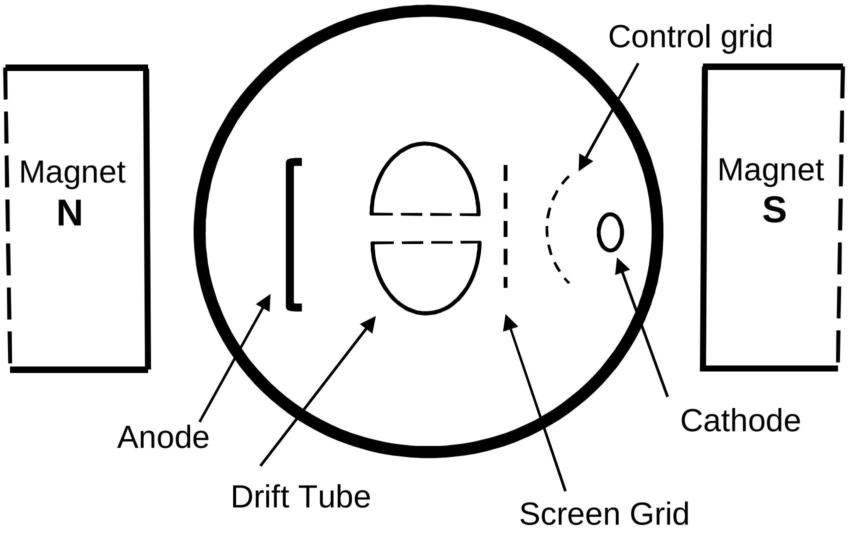


Fig 1 The Heil tube – plan view

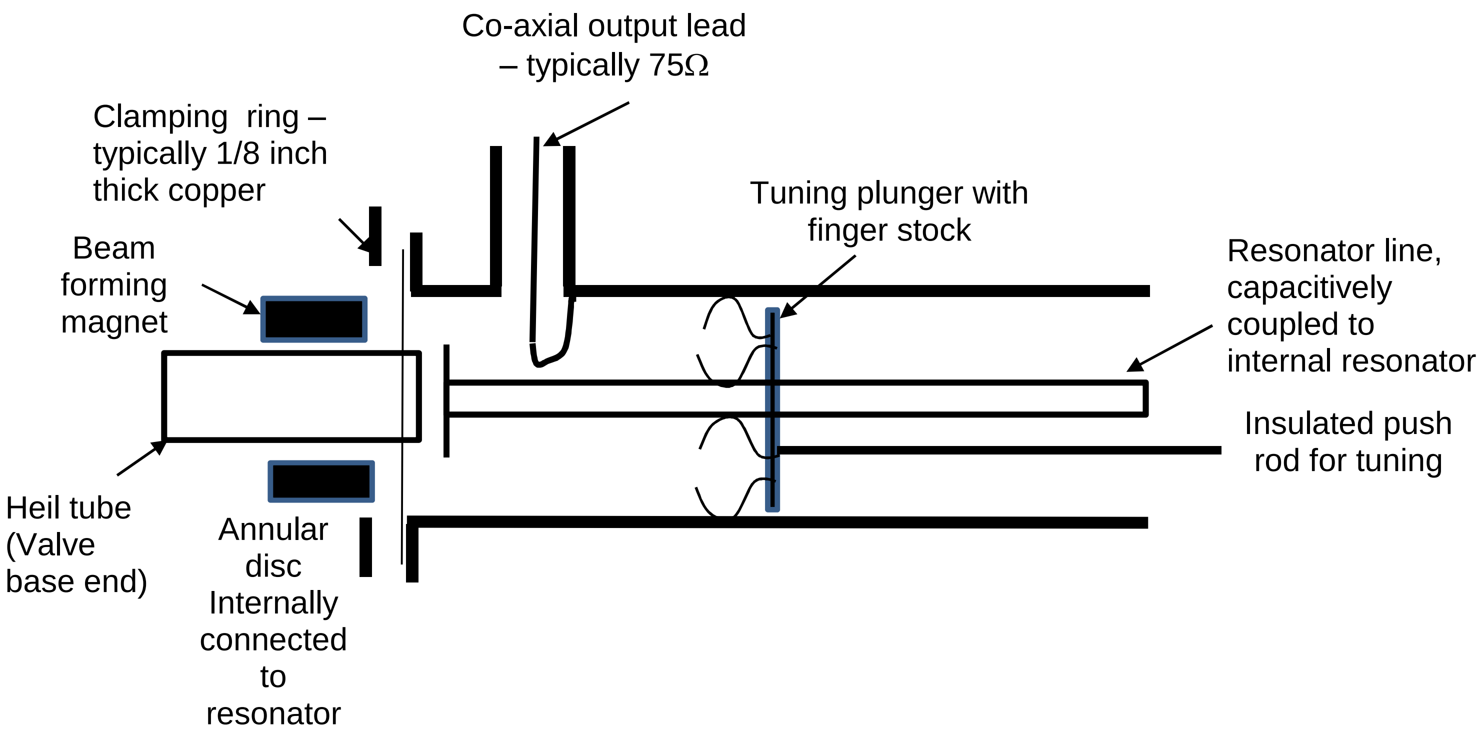


Fig 2. Heil tube and typical resonator assembly

The Varian brothers' klystron

In the two cavity amplifying klystron of the Varian brothers, (Fig 3) the bunching of the electron stream in the first cavity (known as a *rhumbatron* from the Greek for 'circulating waves') is followed by acceleration of the electrons – and thus an increase in their energy – and in the second cavity, then giving up energy to the cavity and so slowing down. The term *klystron* was derived from the Greek for 'waves on a shore'.

High power (10kW +) devices generally have multiple cavities and magnetic focussing to keep the beam together, as well as water or vapour cooling of the collector. One high power (20kW output) device used in the 1960s for the Apollo mission ground station on Ascension Island had the focus coil of copper tube with cooling water flowing through it, while the 6 GHz waveguide had plates with copper pipes attached outside the guide so that the waveguide itself could be water cooled! This was needed because the transmitter was handling a continuous analogue signal of 100% duty cycle, unlike the relatively low duty cycle of RADAR.

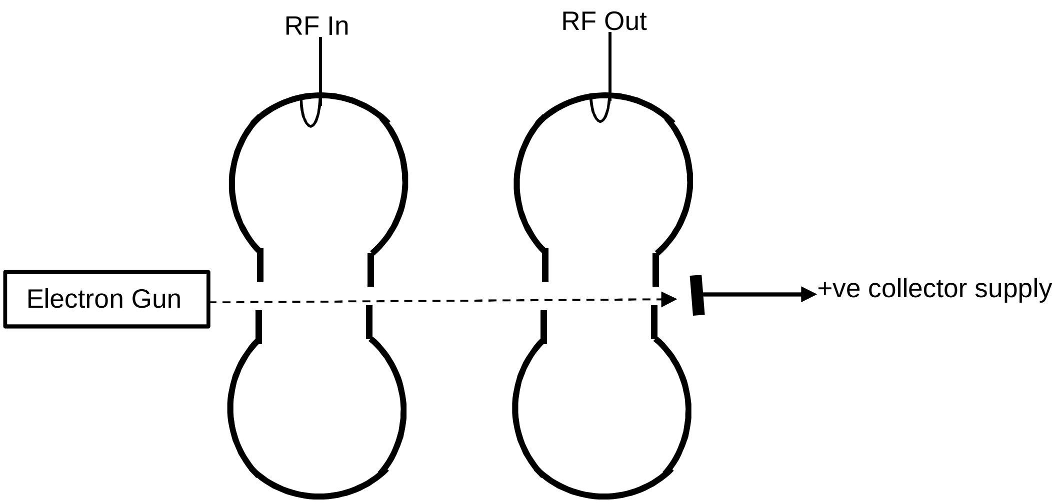


Fig 3. The Basic Varian brothers Klystron Amplifier

To make an oscillator with the Varian klystron, a feedback loop is needed between the two rhumbatrons. However, any change in phase shift or resonance of either rhumbatron will affect the frequency of oscillation. Some improvement in efficiency can sometimes be realised by having the collector at lower voltage than the second rhumbatron cavity: this is known as 'depressed collector operation' and can offer a substantial power saving. When used on a travelling Wave tube (TWT) amplifier with the helix at 22kV, operating the collector at 18kV and a current of 2 amps meant 8kW less heat to be removed from the collector as compared with running at 22kV.

The Reflex Klystron

In the US in about 1939, the suggestion had been made that by reflecting the electron beam back through the same cavity that had led to the bunching in the first place, whereupon the bunching was intensified, an oscillator would result. This was the idea, which developed by a group of Admiralty scientists working under Robert Sutton (see Appendix 2) in the Wills Physics Laboratories of the University of Bristol, led to the reflex klystron. At about the same time in Moscow, the Russian scientists Devyakov and Daniltcev were working along very similar lines, and both groups (unknown to each other, of course) produced working reflex klystrons at about the same time. In Bristol, a practical problem remained in the tolerance and capability of adjustment of the cavity. Later development would allow some mechanical adjustment of the cavity within the vacuum envelope using metal bellows, but this was not considered feasible at that time. Robert Sutton describes (Ref 1) how on a visit to the General Electric Company (not to be confused with the US General Electric) Hirst Research Centre in Wembley, he found that GEC had developed a method of sealing glass to copper, which allowed part of the cavity to be external to the vacuum, and thus capable of frequency adjustment by a tuning plunger. This was done by sealing a diaphragm of copper into the glass tube, with suitable shaping of the electrodes formed in the copper diaphragm to direct the electron beam. The problem found with the method was that the thickness of the copper was critical: too thick and the glass cracked, while too thin and the copper buckled. The technique of sealing copper to glass was well known for attaching substantial external anodes to glass envelopes in, for example, the M-O Valve Company 'Catkin' receiving valves, but with thin diaphragms needed for the klystron, a new approach was required. The method that R. W. Sutton's team of Admiralty scientists working at Bristol University adopted to get round this problem was to form a relatively deep corrugation in the thin copper disc where it was sunk into the wall of the glass tube.

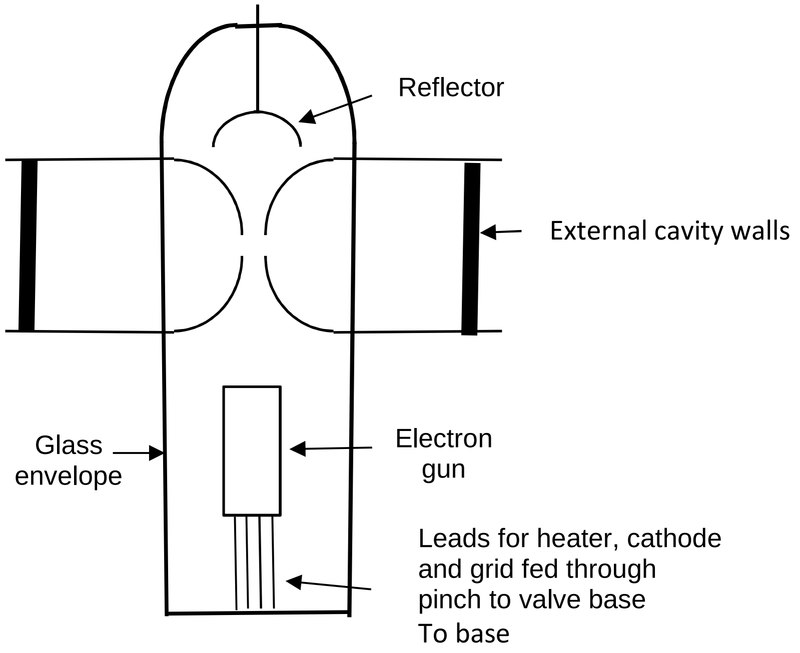


Fig4. The basic Reflex Klystron Sutton tube

The cavity was in the form of a ring of two diecast silver-plated semi-circular segments that clamped onto the thin copper annular rings which were sealed with the envelope, while the whole assembly of valve and external cavity was mounted in a relatively substantial die cast frame work. The cavity was at earth potential, with the RF output through a coaxial cable socket: the cathode was some 1700 volts or so negative with respect to earth and the reflector some 300 volts negative in the original which was given the number NR89 (fig 5): there were three production variants - CV35, 36 and 37, covering differing portions of the frequency range around 3GHz. The CV37 was replaced by the CV67. One discovery with the NR89 was that the clamping of the external cavity segments to the discs had to be tight and continuous around the whole disc periphery.

The power produced was quite high, being of the order of 200mW. Some recently seen correspondence suggests that this relatively high power was needed for satisfactory operation of the mixer used in the receiver.

The NR89 was 'productionised' by EMI to make the CV35/36/37 series: the CV37 later became CV67. Some private correspondence of Sutton's suggests that Hirst Research were 'peeved' at not getting that work, because they appeared to feel that they had done a lot of the work that Sutton's team had built on.

The technology was also exported to Australia, where many thousands of the CV35/36/37 were produced in addition to those made in the UK.

Having developed the technology for sealing the discs into the glass tube, it was used with the cavity segments to make 'T-R switches' (Transmit – Receive switches) to protect the delicate silicon mixer crystal diodes used in the radar receiver. The T-R cell was located on a branch waveguide one quarter wavelength away from the main feeder waveguide. It consisted of a spark gap in the cavity, which being inside the glass envelope had a small amount of ionisable gas in it. This was driven into conduction by the transmitted pulse: because of the impedance transformation along the branch waveguide, this looked like an open circuit to the main waveguide and a short across the receiver feed. In order to speed up de-ionisation after the pulse (which could lead to a failure to detect targets at short range), other gases - which often included water vapour – were included in the cell. This was known in the US as the "Soft Sutton tube", as valves with non-perfect 'hard' vacuums were described as 'soft tubes' in the US or 'soft valves' in the UK. Interestingly, a 'Soft tube' in the US is now taken to mean one with weak emission!

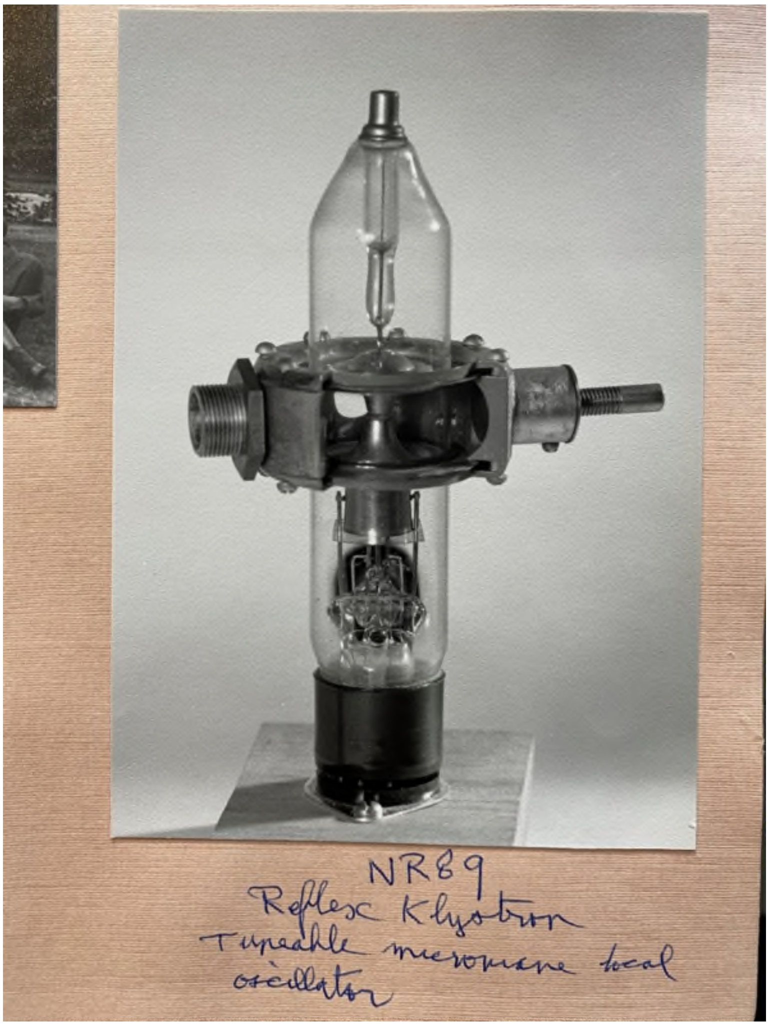


Fig 5 The NR89 klystron used in the early Type 271 centimetric Naval radar. Note that the external cavity has been partially cut away. Photograph by courtesy of J. R. Sutton

The CV35/6/7 series of klystrons

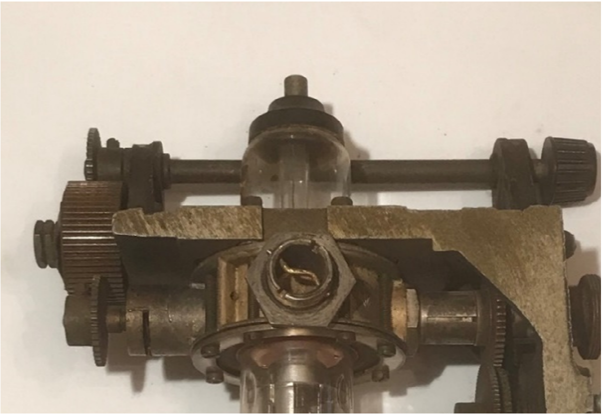


Fig 6. An example of the production series. This came from an H2S power supply,/local oscillator assembly, widely available just after WW2. Note the cast aluminium framework to hold the klystron and assist in cooling: at the top is the arrangement for fine tuning a plug within the cavity to adjust the frequency, while at the bottom is the mechanism to rotate the output coup[ling loop for optimum output. The large nut is on the coarse frequency adjust plunger.

Fig 8 The substantial cast aluminium mounting frame, which also served to heat sink the klystron

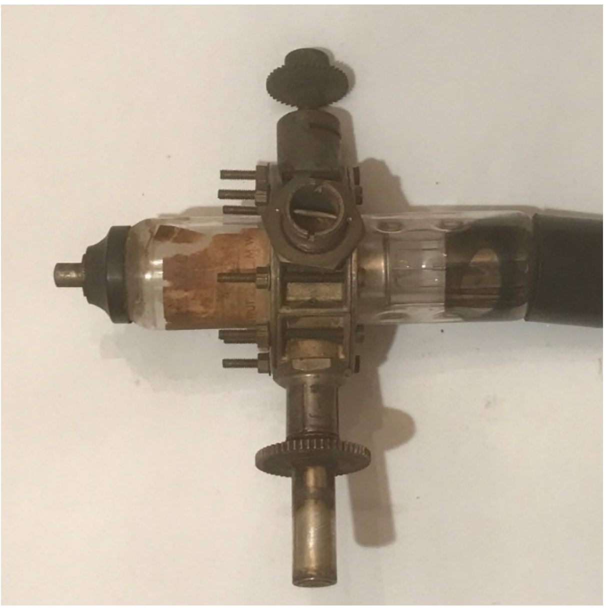


Fig 7.Removed from the frame work: at the top is the fine tuning plunger and at the bottom is the coupling loop, integral with the output coax connector.

Fig 9. The two silver plated cast brass cavity segments, and the rings to clamp onto the klystron annular diaphragms. The output coupling loop can be seen just inside the lower cavity segment

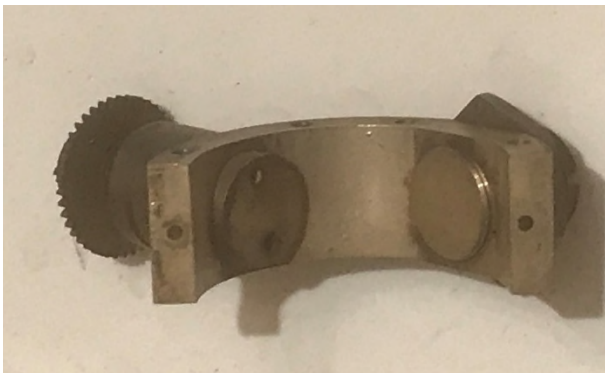


Fig 10. The cavity segment containing the fine tuning plunger (left) and one of the two coarse tuning plungers (right)

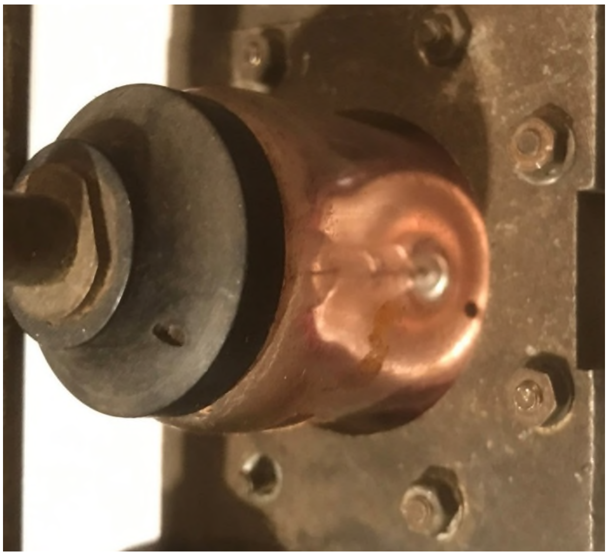


Fig11. The small silver coloured object is the reflector electrode, which is biased negatively with respect to the cavity

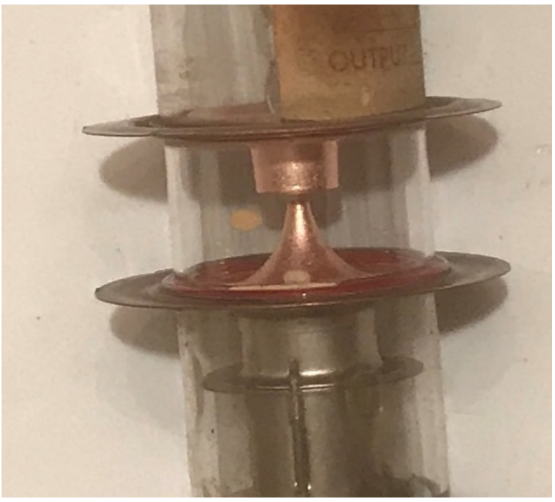


Fig 12. The annular diaphragms forming the drift space (rhumbatron) in which the electron stream is bunched

Figures 6 through 12 show the klystron, its mounting frame, the cast brass silver plated cavity segments and the annular copper discs with the shaped electrodes that formed, with the external cavity segments, the rhumbatron.

Later external cavity reflex klystrons

Post war, a number of external cavity klystrons were developed, such as the CV2116 shown in Fig 13

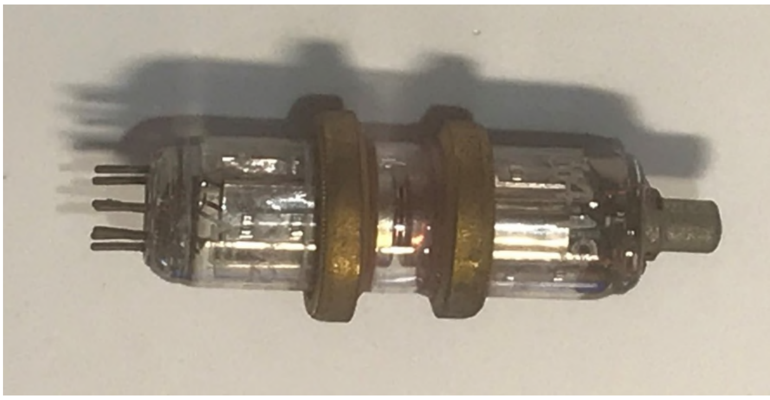


Fig 13. A wide range tuneable klystron for use in coaxial line resonators

These were typ erators and as local oscillator in one or two wide frequency coverage microwave surveillance receivers.

Conclusion

Although Sutton's work is now largely forgotten, much as the reflex klystron is, there can be no doubt that it and the 'soft Sutton tube' T/R cell had major impact on the practical development of microwave radar until their place was taken over by solid state devices, although there are still microwave valves in use, mainly because there is nothing else with the same mobility as an electron in a vacuum!

Appendix 1. The Barkhausen-Kurtz oscillator

In 1920, the German physicists Heinrich Barkhausen and Karl Kurtz at the Dresden Technische Hochschule produced the Barkhausen-Kurtz oscillator, the first thermionic oscillator able to operate above 300 MHz.

This consisted of a triode with a short-circuited quarter wave transmission line between grid and anode, with the grid biased heavily positive and the anode biased negative. This led to electrons from the cathode being rapidly accelerated towards the grid, passing through the grid and then being repelled by the negatively charged anode back towards the grid. Passing through the grid, the electron could make several passes, and the result of the varying electric field led to the resonant transmission line being excited. The acceleration and deceleration of the electrons led to *'bunching*' or '*velocity modulation'*, an effect used in various other microwave devices such the Heil tube, the klystron, the Backward Wave Oscillator (BWO or Carcinoton – so called by its French inventors because it could be 'a cancer to radars'!) and the Crossed Field Amplifier (CFA) etc. The early 1930s experimental cross channel telephone link on about 1.7GHz used Barkhausen-Kurtz oscillators.

Barkhausen oscillations appeared in some TV line output (*sweep*) stages when the line output stage anode volts fell below the screen grid volts: these produced visible spots or dark lines, often jagged, on the right hand side of the TV screen - known in the US as *'snivets'*. Of course, this happened when the grid was driven to maximum positive part of the sweep cycle, and so the anode and screen currents were maximum and thus the voltages minimum. One method of avoiding this was to arrange to place a suitable voltage pulse on the suppressor grid of the line output stage pentode, which is why some line output valves had the suppressor grid brought out to a pin rather than being internally connected to the cathode.

Appendix 2. Robert W. Sutton, CB, OBE

R. W. Sutton was born in St. John's Wood in London on November 11, 1905, the son of a violinist who was a founder member of the London Symphony Orchestra. Although it is hard to find much about him on the internet or in publications about the WW2 radar war, there can be no doubt that his work, basically on vacuum tube technology, was pivotal to making microwave RADAR possible, to the same extent as that of GEC on industrialising the magnetron and BTH on industrialisation of the silicon diode used as mixer in RADAR receivers.

Robert went to Imperial College in 1926, and started a PhD degree. Before he finished, he left to join Ferranti in Manchester to set up a valve factory. Robert went to Imperial College in 1926, [to study Physics] and started a PhD degree supervised by George Finch (https://en.wikipedia.org/wiki/ George_Finch_(chemist)) with whom he used to go mountaineering in Switzerland. In the mid 1930s, he left to join E. K. Cole in Southend to do a similar job, but shortly before the outbreak of war, left them to join the Admiralty Signal School at Portsmouth. Here he was to build up a team to develop special valves for the rapidly expanding RADAR programme. After the fall of France in June 1940, the team were moved to the H. H. Willls Physics laboratory at Bristol University. The GEC Hirst Research Laboratories at Wembley had developed a method of sealing copper to glass, which Sutton saw there while on a visit. The difficulty was that if the copper was too thick, the glass cracked, while if it was too thin, it buckled. Sutton's approach to the problem was to form a groove in the annular copper discs which coupled outside the vacuum containing envelope to the cavity resonator. By September 1940, they had demonstrated a reflex klystron that became known as the Sutton tube. The same construction was used for TR switches, which contained an ionisable gas with addition of some water vapour to the gas in the cell (to speed up de-ionisation) led to the device being known in the US as a 'soft Sutton tube'. In between all this work, Robert

Sutton also was a member of the Bristol Home Guard. The original NR89 klystron was 'productionised' by EMI, just as the Randall and Boot cavity magnetron was 'productionised' by GEC Hirst Research, where a major advance that turned the 6 cavity 500watt E1188 into the 8 cavity 100kW E1189 with an oxide cathode was made by Eric Megaw, G6MU and his team. A further advance was the suggestion by Sayers of the Admiralty Signal School, of strapping alternate segments.

Photograph courtesy James R. Sutton

.
After WW2, Sutton was in charge of setting up the Services Research and Development Establishment at Baldock..here they did a lot of work on new technologies including early work on Gallium Arsenide and other semiconductor devices, lasers, neutron sources and other electronic devices. He was not enamoured of working for the Civil Service, always opting for decisions by concensus rather than voting.. Nevertheless, he remained there until his retirement

He married Elizabeth Wright in 1951, the sister of Peter Wright of the book 'Spycatcher' fame and whose father had been Director of Research at MWT (Marconi' Wireless Telegraph Company Ltd). This allowed him to move into house in Baldock, enabling him to move the grand piano out of his office into the house! He had three children, a son and two girls: he was imbued with a love of music, which he passed on to his children. Sarah becoming a professional cellist, while both Janet and James are keen amateur musicians. James did a degree in Physics at Exeter University prior to joining Plessey Semiconductors in Swindon as a graduate integrated circuit design engineer in the Radio Communications department, where he was a colleague of the author – and presented the author with records of Mozart's 'Di0++++++++++++ before he left Plessey to work in Italy! This job at Plessey made James a very rare bird – a 3rd generation electronics engineer.. There are some (very few) websites that describe Robert Sutton as the " inventor of the reflex klystron". His son disputes this on the basis that Robert Sutton was more of a 'vacuum technologist', although not disputing that the work of his father was seminal in enabling the production of the reflex klystron and the T/R cells that made wartime microwave RADAR possible. Robert Sutton was appointed OBE in 1946 and a CB (Companion of the Bath) about the time of his retirement. In retirement, he had a very wide range of interests and started to fulfil a long held ambition by starting to learn to fly helicopters at age 90! He died on December 14, 1997.

References

1. E. B. Cellick. 'Metres to Microwaves', Peter Peregrinus Ltd, 1990.
2. Private communication to Robert Sutton from an individual at GEC
3. https://en.wikipedia.org/wiki/George_Finch_(chemist)

Acknowledgements

Figures 6 -13 courtesy G4FNC
The author gratefully acknowledges the assistance given by James Sutton in the preparation of this article.

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Scatterpoint activity report

Activity News: May/June 2021

By John G4BAO

Please send your activity news to: **scatterpoint@microwavers.org**

From John G4BAO

I've moved all my GHz antennas to one mast for easier access so should be a bit more active now. The Photo shows the new setup with 1.3, 3.4, 10 and 24GHz all on one gable end pole that I can easily lower with a winch arrangement.

Using a system of cable switching and RX combining, I've minimised the coax cable weight on the mast. The two boxes on the pole are the 3.4GHz G4DDK VLNA9 switched masthead preamp and a TX feeder changeover relay/resistive receive combiner for the 1.3 and 3.4GHz systems. The 1.3GHz VLNA23 masthead preamp is immediately below the rear of the 44element Wimo Yagi. The 10GHz preamp and the 24GHz transverter are slung under the dish feed arm.
As far as QSOs go, a bit thin this month. No EME tests month and I've come to a halt on the 24GHz EME system due to too much VHF Sporadic E!
The only GHz QSO of note was on the 19th of May. My first 10GHz rainscatter QSO of the season with Maurice F6DKW (JN18CS) at 414km. On the same day I copied the GB3MHZ 24GHz beacon as well as getting enhanced signals from GB3PKT, GB3LEX and GB3SEE on 10GHz. Once again as seems to be the norm in rainscatter, no humans were available for QSOs.
A one-hour session in the May SHF UKAC brought the "usual suspects" on 10 GHz and 3.4GHz but no DX of note.

From Per DK7LJ

The new DL0SHF 24GHz EME beacon has been operating regularly since the 5th of June. It runs Q65-60D on 24048.025 MHz.to a 3.7m dish at with a 4.5W solid state PA. The beacon can be switched on request to a 118W TWT. I would appreciate reports, especially at the 4.5W level. It has already been reported by Kjeld OZ1FF at a consistent -18/-19 dB on his 2,4 m offset dish.

From Neil G4DBN

During the tropo on May 29th By beaming west at the chimney of Drax power station I could copy a number of beacons by reflection, including OZ5SHF, DB0VC, DB0GHZ, PI7RTD, PI7ALK, all at better strengths than direct> I could also copy GB3PKT, GB3LEX, GB3FNY and GB3CAM. All on the same waterfall. It's a very useful facility, that chimney, just about omni. I suspect there was an elevated duct and I was getting a better way in via the chimney than beaming direct. DB0VC is 763 km, OZ5UHF is 730 km, and DB0GHZ was a ridiculous 599 at 578 km.

From Barry G8AGN

I'm hoping to be able to do some more 30THz Moon noise measurements soon at the full Moon. I have now properly focussed up my mirror dish which should make quite a difference. I have been in correspondence with Giles G1MFG, about using his imagers to copy 30THz cw, so I hope he does try it and report his findings - that's how we all make progress and increase our knowledge. I may try putting a detector with more than one pixel in one of my dishes - only 8 x 8 but it will be interesting to see what the image looks like and whether it offers any advantages - I suspect not because there is no way to combine the signal outputs from each pixel and each pixel in an array will be smaller in area than one large pixel as in the MLX90614 which I am currently using.

From Dave G1EHF

On Sunday 30th May I joined Barry G4SJH on Walbury Hill (IO91GI44) for the first 5.7/10 GHz session of the year. I provided the 5.7 GHz station, with 15 Watts to a 1.1 m offset dish, with 'bow-tie' feed. Conditions were average but the weather was kind to us. Nine contacts were made on 5.7 GHz, with ODX of 183 km to Keith G4ODA.

‘Now where did I put those UKuG leaflets for interested onlookers’ Barry G4SJH during the 5.7/10G contest.
photo from Dave G1EHF

On Thursday 3rd June we held an informal 47 and 76 GHz activity day. The original intent had been a quick test of my latest 47 GHz transverter build (see pic) but in the end there were five stations active, including some DATV contacts. Noel G8GTZ, Dave G4FRE and myself were at Combe Gibbet (IO91GI25), Neil G4LDR was near Stockbridge (IO91GC68) and John G8ACE at Lane End (IO91JA47). My latest system comprised an HSMS-8202 diode pair as a mixer, in 4 mm diameter guide and driven with +18 dBm of LO at 11664 MHz. The guide feeds an NEC Pasolink horn and dish, mounted on its original housing. I also had a new local beacon, with another HSMS-8202 mounted on UT-141 at the focus of an aerosol can base (as much as there is a focus!). This has +17 dBm of 15696 MHz drive. Both transverter and beacon are GPS locked. From the simple 47 GHz transverter I was pleased to receive reports of my SSB signal from Neil at 26 km and John at 40 km. I have no idea of the output power of the TX or NF of the RX. I suspect both are pitiful but at least it works! Neil could also hear my simple beacon, which is useful for alignment purposes.

Finally, completing a busy microwave week, the M0HNA/P group (G3TCU, G3TCT, G4SJH and myself) took to Walbury Hill again for the June Low Band on 6th June. I provided the 3.4 GHz station with 15 W to the same 1.1 m offset dish used earlier for 5.7 GHz. Activity was low as usual with no propagation into continental Europe to the East unfortunately (no 3.4 GHz in France). 11 contacts were made with ODX of 199 km to Tony G4CBW.


PASOLINK 50

Contests

May 2021 Lowband Contest Results

The move of the RSGB 10GHz Trophy event so that it coincided with this contest was judged to have reduced activity on the low bands by several leading entrants. The timing may be reviewed for 2022.

The winner on 1296MHz was Phil G3TCU operating one of the M0HNA/P stations. Runner up was Anthony G7LRQ. Leading Low Power entrant was John G3SQQ Some decent distance aircraft scatter contacts were made, the best was John G4ZTR's QSO with DJ6OL in JO52AP at 628km.

There were two entries on 2300MHz for this session. M0HNA/P operated by G4SJH was the winner, with Pete G1DFL/P runner up. The M0HNA/P to G3XDY contact was the best DX at 200km.

Anthony G7LRQ repeated his leading position on 2320MHz in the same event last year, with M0HNA/P operated by G4SJH not far behind as runner-up. Best DX was G4ZTR's contact with DJ5AR at 562km. G3SQQ was the leading low power entrant on this band too.
3400MHz was won by G4ZTR with a good margin over runner up M0HNA/P, operated by Dave G1EHF. The best DX was from G4ZTR to G4CBW at a distance of 249km.

Certificates go to the following band leaders, runners-up and leading low power stations.
1296MHz M0HNA/P, G7LRQ, G3SQQ
2300MHz M0HNA/P, G1DFL/P
2320MHz G7LRQ, M0HNA/P, G3SQQ
3400MHz G4ZTR, M0HNA/P

John G3XDY
UKuG Contest Manager

Section All 1.3 GHz							
Pos	Callsign	Loc	QSOS	Score	Norm	ODX	Kms
1	M0HNA/P	IO91GI	46	10,386	1,000	DF0MU	609
2	G7LRQ	IO91TQ	40	8,700	837	GM4JTJ	570
3	G4ZTR	JO01KW	26	6,579	633	DJ6OL	628
4	G3TCT	IO81QC	28	6,020	579	GM4JTJ	617
5	M0GHZ	IO81VK	29	5,650	544	PA0WMX	567
6	G4LDR	IO91EC	17	3,795	365	GM4JTJ	620
7	G3SQQ	IO93JC	19	3,197	307	GM4JTJ	403
8	GM4BYF	IO85JV	10	2,847	274	M0HNA/P	519
9	G0HIK/P	IO84KD	15	2,824	271	G3XDY	371
10	GM8IEM	IO78HF	4	1,675	161	G4CBW	607
11	GW4JQP	IO71KR	6	1,571	151	G3XDY	437
12	G4GFI	IO91VH	15	1,498	144	G8XVJ/P	237
13	G4BXD	IO82UJ	9	1,405	135	G3XDY	242
14	G6GVI	IO83SN	7	1,011	97	M0HNA/P	255
15	G4GUG	IO81WQ	6	474	45	G4ZTR	209
16	GM4DIJ	IO85IW	2	30	2	GM8MJV	23

Section All 2.30 GHz							
Pos	Callsign	Loc	QSOS	Score	Norm	ODX	Kms
1	M0HNA/P	IO91GI	4	607	1,000	G3XDY	200
2	G1DFL/P	IO91JM	1	26	42	M0HNA/P	26

Section All 2.32 GHz							
Pos	Callsign UBNs	Loc	QSOS	Score	Norm	ODX	Kms
1	G7LRQ	IO91TQ	13	2,649	1,000	F8DLS	393
2	M0HNA/P	IO91GI	16	2,533	956	ON4CJQ/P	445
3	M0GHZ	IO81VK	11	2,269	856	ON4CJQ/P	497
4	G4ZTR	JO01KW	10	2,126	802	DJ5AR	562
5	G4LDR	IO91EC	10	2,008	758	PA0JCA	461
6	G3SQQ	IO93JC	9	1,442	544	G4LDR	225
7	GM4DIJ	IO85IW	2	30	11	GM8MJV	23
8	G1DFL/P	IO91JM	1	26	9	M0HNA/P	26
9	GM4BYF	IO85JV	1	7	2	GM4DIJ	7

Section All 3.4 GHz							
Pos	Callsign UBNs	Loc	QSOS	Score	Norm	ODX	Kms
1	G4ZTR	JO01KW	7	1,197	1,000	G4CBW	249
2	M0HNA/P	IO91GI	8	868	725	G4CBW	199
3	M0GHZ	IO81VK	6	822	686	G4ZTR	220
4	G4LDR	IO91EC	5	646	539	G4ODA	212
5	G4BXD	IO82UJ	4	610	509	G4ZTR	222
6	G1DFL/P	IO91JM	1	26	21	M0HNA/P	26

June 2021 Lowband Contest Results

Although portables were able to operate in this event, activity was lower than usual and not many European stations featured in the logs.

M0HNA/P had a substantial lead on 1296MHz, with John G4ZTR as runner up. G4ZTR also worked the best DX with DJ6OL in JO52 at 628km. Steve G1PPA/P was the leading low power entrant.

A total of four stations were recorded as active on 2300MHz, with logs received from two, with M0HNA/P ahead of Mike G8CUL.

On 2320MHz M0HNA/P also held sway with a fairly closely fought contest with John G4ZTR as runner up. Anthony G7LRQ and also recorded the best DX with GM4JTJ at 570km, with several other stations also near this mark when working Jon. John G3SQQ was the leading low power entrant.

G4ZTR turned the tables on M0HNA/P on 3400MHz, with a substantial lead. Best DX distances were limited, with the best QSO being between G4ZTR and G4CBW at 249km.

Certificates go to the following band leaders, runners-up and leading low power stations.

1296MHz M0HNA/P, G4ZTR, G1PPA/P

2300MHz M0HNA/P, G8CUL

2320MHz M0HNA/P, G4ZTR, G3SQQ

3400MHz G4ZTR, M0HNA/P

John G3XDY

June 2021 Low Band Contest 1296MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	M0HNA/P	IO91GI	44	9690	DF0MU	609
2	G4ZTR	JO01KW	27	6231	DJ6OL	628
3	G4KUX	IO94BP	14	3915	GM8IEM	453
4	G7LRQ	IO91TQ	24	3850	DF0MU	528
5	M0GHZ	IO81VK	18	3223	ON4CJQ/P	497
6	G4BRK	IO91HP	18	3044	F8DLS	443
7	G1PPA/P	JO03AE	17	3041	ON4CJQ/P	415
8	G3SQQ	IO93JC	19	2747	G6TRM/P	248
9	G8CUL	IO91JO	15	2436	G4KUX	342
10	GW4JQP	IO71KR	9	1850	G3XDY	437
11	G4BXD	IO82UJ	13	1738	G3XDY	242
12	GM4BYF	IO85JV	4	1712	M0HNA/P	519
13	G6GVI	IO83SN	7	1445	G6TRM/P	342
14	G4LDR	IO91EC	8	1364	G4KUX	395
15	G8AIM	IO92FH	12	1235	G6TRM/P	208
16	GM8IEM	IO78HF	2	849	G4KUX	453
17	GM4DIJ/P	IO74NQ	3	697	GM8IEM	396
18	G0NZI	IO92GM	5	453	G4ZTR	172
19	G3WJG	IO91RP	2	85	M0HNA/P	72

June 2021 Low Band Contest 2300MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	M0HNA/P	IO91GI	3	415	G3XDY	200
2	G8CUL	IO91JO	3	357	G3XDY	174

June 2021 Low Band Contest 2320MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	M0HNA/P	IO91GI	20	3574	ON4CJQ/P	445
2	G4ZTR	JO01KW	16	3249	GM4JTJ	569
3	G7LRQ	IO91TQ	19	2923	GM4JTJ	570
4	G4BRK	IO91HP	15	2841	GM4JTJ	562
5	G3SQQ	IO93JC	16	2670	GM4JTJ	403
6	G8CUL	IO91JO	15	2182	GM4JTJ	568
7	M0GHZ	IO81VK	11	1490	G3XDY	246
8	G4LDR	IO91EC	8	1133	G8DMU	320
9	G3WJG	IO91RP	5	432	G4ASR	171
10	GM4DIJ/P	IO74NQ	2	207	MS0TA/P	109
11	G0FCU/P	IO91SF	3	190	M0HNA/P	71
12	G0NZI	IO92GM	1	24	G8AIM	24

June 2021 Low Band Contest 3400MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G4ZTR	JO01KW	9	1505	G4CBW	249
2	M0HNA/P	IO91GI	11	1078	G4CBW	199
3	M0GHZ	IO81VK	8	957	G4ZTR	220
4	G4BXD	IO82UJ	7	920	G4ZTR	222
5	G4BRK	IO91HP	7	695	G4CBW	170
6	G8CUL	IO91JO	6	480	G4ODA	150
7	G4LDR	IO91EC	4	466	G4ZTR	197
8	G8AIM	IO92FH	4	309	M0HNA/P	107

2021 Lowband Contest Overall Results

Best three count to the total

1.3 G

Pos	Call	07/03/2021	11/04/2021	02/05/2021	06/06/2021	Total
1	G4ZTR	1,000	775	633	643	3,051
2	M0HNA/P		1,000	1,000	1,000	3,000
3	G7LRQ		815	837	397	2,049
4	M0GHZ	561	262	544	332	1,699
5	G3TCT	372	565	579		1,516
6	G3SQQ	307	401	307	283	1,298
7	G4LDR	336	244	365	140	1,085
8	G8CUL		650		251	901
9	GM4BYF		379	274	176	829
10	G4BRK		511		314	825
11	G4BXD	269	173	135	179	756
12	GW4JQP		226	151	190	567
13	G0HIK/P		291	271		562
14	GI6ATZ		559			559
15	G1PPA/P		206		313	519
16	G3TCU	418				418
17	G4KUX				404	404
18	GM8IEM	49	75	161	87	372
19	G8AIM	98	142		127	367
20	G6GVI	39	54	97	149	339
21	G4GFI		184	144		328
22	G3YJR		279			279
23	GD1MIP		269			269
23	G3UKV		269			269
25	PE1EWR		188			188
26	G4KZY		149			149
27	M0AFJ/P		138			138
28	G0LGS	95				95
29	GM4DIJ(/P)		13	2	71	86

30	G0NZI				46	46
31	G4GUG			45		45
32	G1JPV	41				41
33	G8EOP		11			11
34	G3WJG				8	8

2.30 G

Pos	Call	11/04/2021	02/05/2021	06/06/2021	Total
1	M0HNA/P	1,000	1,000	1,000	3,000
2	G8CUL	992		860	1,852
3	G3YJR	302			302
4	G1DFL/P		42		42

2.32 G

Pos	Call	07/03/2021	11/04/2021	02/05/2021	06/06/2021	Total
1	M0GHZ	1,000	744	856	416	3,016
2	M0HNA/P		775	956	1,000	2,731
3	G7LRQ		897	1,000	817	2,714
4	G4ZTR		1,000	802	909	2,711
5	G3SQQ	727	681	544	747	2,699
6	G4LDR	616	353	758	317	2,044
7	G4BRK		926		794	1,720
8	G8CUL		799		610	1,409
9	G8AIM	279	295			574
10	G3UKV		419			419
11	G0HIK/P		152			152
12	G3WJG				120	120
13	GM4DIJ(/P)		43	11	57	111
14	G3YJR		89			89
15	G8EOP		62			62
16	PE1EWR		61			61
17	G0FCU/P				53	53
18	GM8IEM		45			45
19	GM4BYF		35	2		37
20	G1DFL/P			9		9
21	G0NZI				6	6

3.4 G

Pos	Call	07/03/2021	11/04/2021	02/05/2021	06/06/2021	Total
1	G4ZTR	1,000	1,000	1,000	1,000	4,000
2	M0HNA/P		826	725	716	2,267
3	M0GHZ		780	686	635	2,101
4	G4BXD	388	386	509	611	1,894
5	G4LDR	529	481	539	309	1,858
6	G4BRK		518		461	979
7	G8AIM	367	375		205	947
8	G8CUL		606		318	924
9	G3UKV		562			562
10	G1PPA/P		515			515
11	G1DFL/P		230	21		251
12	G4BAO	224				224
13	G0HIK/P		211			211

UKuG MICROWAVE CONTEST CALENDAR 2021

Dates, 2021	Time UTC	Contest name	Certificates
20-Jun	0900 - 1700	122-248 GHz	
27-Jun	0600 - 1800	2nd 5.7GHz Contest	F, P,L
27-Jun	0600 - 1800	2nd 10GHz Contest	F, P,L
11-Jul	0900 – 1700	2nd 24GHz Contest	
11-Jul	0900 – 1700	2nd 47GHz Contest	
11-Jul	0900 – 1700	2nd 76GHz Contest	
25 -Jul	0600 - 1800	3rd 5.7GHz Contest	F, P,L
25 -Jul	0600 - 1800	3rd 10GHz Contest	F, P,L
29-Aug	0600 - 1800	4th 5.7GHz Contest	F, P,L
29-Aug	0600 - 1800	4th 10GHz Contest	F, P,L
12-Sep	0900 - 1700	3rd 24GHz Contest & 24GHz Trophy	
12-Sep	0900 - 1700	3rd 47GHz Contest	
12-Sep	0900 – 1700	3rd 76GHz Contest	
26 -Sep	0600 - 1800	5th 5.7GHz Contest	F, P,L
26 -Sep	0600 - 1800	5th 10GHz Contest	F, P,L
10-Oct	0900 - 1700	122-248 GHz	
17-Oct	0900 - 1700	4th 24GHz Contest	
17-Oct	0900 - 1700	4th 47GHz Contest	
17-Oct	0900 – 1700	4th 76GHz Contest	
15-Nov	1000 - 1400	5th Low band 1.3/2.3/3.4GHz	F, P,L
Key:	F	Fixed / home station	
	P	Portable	
	L	Low-power (<10W on 1.3-3.4GHz, <1W on 5.7/10GHz)	

2021 Contest Calendar

Jun	Low band 1.3/2.3/3.4GHz 4	F, P,L	6-Jun	1000 - 1600	Aligned with some Eu events
Jun	REF/DUBUS EME 5.7GHz	*Arranged by REF/DUBUS*	12 to 13-Jun	0000 - 2400	REF/DUBUS EME 5.7GHz
Jun	1.3GHz Activity Contest	*Arranged by RSGB*	15-Jun	1900 - 2130	RSGB Contest
Jun	122-248GHz		20-Jun	0900-1700	
Jun	2.3GHz+ Activity Contest	*Arranged by RSGB*	22-Jun	1830 - 2130	RSGB Contest
Jun	5.7GHz/10GHz	F, P,L	27-Jun	0600-1800	
Jul	VHF NFD (1.3GHz)	*Arranged by RSGB*	3-Jul to 4-Jul	1400 - 1400	RSGB Contest
Jul	24GHz/47GHz/76GHz		11-Jul	0900-1700	
Jul	1.3GHz Activity Contest	*Arranged by RSGB*	20-Jul	1900 - 2130	RSGB Contest
Jul	5.7GHz/10GHz	F, P,L	25-Jul	0600-1800	
Jul	2.3GHz+ Activity Contest	*Arranged by RSGB*	27-Jul	1830 - 2130	RSGB Contest
Aug	1.3GHz Activity Contest	*Arranged by RSGB*	17-Aug	1900 - 2130	RSGB Contest
Aug	2.3GHz+ Activity Contest	*Arranged by RSGB*	24-Aug	1830 - 2130	RSGB Contest
Aug	5.7GHz/10GHz	F, P,L	29-Aug	0600-1800	
Sep	24GHz/47GHz/76GHz		12-Sep	0900-1700	
Sep	1.3GHz Activity Contest	*Arranged by RSGB*	21-Sep	1900 - 2130	RSGB Contest
Sep	5.7GHz/10GHz	F, P,L	26-Sep	0600-1800	
Sep	2.3GHz+ Activity Contest	*Arranged by RSGB*	28-Sep	1830 - 2130	RSGB Contest
Oct	*1.3 & 2.3GHz Trophies*	*Arranged by RSGB*	*3-Oct*	*1400 - 2200*	RSGB Contest
Oct	*432MHz & up*	*Arranged by RSGB*	*3 to 4-Oct*	*1400 - 1400*	IARU/RSGB Contest
Oct	122-248GHz		10-Oct	0900-1700	
Oct	24GHz/47GHz/76GHz		17-Oct	0900-1700	
Oct	1.3GHz Activity Contest	*Arranged by RSGB*	19-Oct	1900 - 2130	RSGB Contest
Oct	ARRL Microwave EME	*Arranged by ARRL*	23 to 24-Oct	0000 - 2359	ARRL EME 2.3GHz & Up
Oct	2.3GHz+ Activity Contest	*Arranged by RSGB*	26-Oct	1830 - 2130	RSGB Contest

Nov	Low band 1.3/2.3/3.4GHz 5	F, P,L	14-Nov	1000 - 1400	
Nov	1.3GHz Activity Contest	*Arranged by RSGB*	16-Nov	2000 - 2230	RSGB Contest
Nov	ARRL EME 50-1296MHz	*Arranged by ARRL*	20 to 21-Nov	0000 - 2359	ARRL EME Contest
Nov	2.3GHz+ Activity Contest	*Arranged by RSGB*	23-Nov	1930 - 2230	RSGB Contest
Dec	ARRL EME 50-1296MHz	*Arranged by ARRL*	18 to 19-Dec	0000 - 2359	ARRL EME Contest
Dec	1.3GHz Activity Contest	*Arranged by RSGB*	21-Dec	2000 - 2230	RSGB Contest

EVENTS 2021

Events may be subject to cancellation due to the Coronavirus
For latest information consult https://microwavers.org

2021

June 25-27	Ham Radio, Friedrichshafen - online	www.hamradio-friedrichshafen.de
August 19-22	EME 2021, Prague – Now 12-14 August 2022	www.eme2020.cz
August 21-22	BATV Convention, Midland Air Museum, Coventry	www.batc.org.uk
September 24-25	National Hamfest – Postponed until 2022	www.nationalhamfest.org.uk
October 10-15	European Microwave Week, London, Excel	www.eumweek.com
October 17-21	IARU-R1 Conference, Part-2 Novi Sad	conf.iaru-r1.org

2022

May 20-22	Hamvention, Dayton	www.hamvention.org
June 24-26	Ham Radio, Friedrichshafen	www.hamradio-friedrichshafen.de
September 25-30	European Microwave Week, London, Excel	www.eumweek.com

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Tuesdays 08:30 local on 3626 kHz (+/- QRM)

73 Martyn Vincent G3UKV