



# Chelmsford Amateur Radio Society

## Newsletter

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**Next meeting: 4th October - 7.30pm, Oaklands Museum**

**CARS Annual General Meeting**

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### Club Nets - Tuesdays 20:00h

**Net Controller: TBD**

- #2 - GB3DA 11th October
- #3 - GB3ER 18th October
- #4 - 80m 25th October  
3.756MHz
- #5 - 160m n/a  
1.947MHz

**Essex Ham Net  
Mondays 20:00h GB3DA**



Inside one of Chris, G0DFZ's lovely microwave transverters, shown to us at the September meeting.

Contact details for the newsletter: [editor@g0mwt.org.uk](mailto:editor@g0mwt.org.uk)

## Editorial

Hello again, and welcome to the latest edition of this newsletter. The AGM is upon us and a renewed, revitalised and thoroughly enthusiastic Committee will be voted in. We hope. There will be some changes; that is sometimes inevitable. You will have seen in last month's issue that Chris, G0IPU is standing down as Chairman; he stood in after the previous incumbent resigned and has carried on doing that job to the best of his ability amongst all the other commitments he has - notably educating the Scouting movement - a subject very dear to his heart, CARS training sessions, his music & band and his normal family life.

It is not fair to ask someone to carry on doing a job when it becomes a burden, not a pleasure, so please consider giving something back to the Society and consider if you could carry out this role. Please also consider some of the other roles. None of us are getting any younger!

I've had a busy month with many problems to solve from Windows to Windoms, via broken equipment and several interference problems and some of them are proving difficult to sort out, but I hope to get there eventually.

**National Hamfest:** What happened? Where was everyone? The flea market seemed a lot smaller than when I went two years ago (and generally overpriced) and acres of available space within the hall. There were seemingly adequate crowds at times, but I wonder how much buying was going on. Plenty of IC-7300 rigs with the "free speaker" on offer from all the usual suspects, but of seven people I know who attended from our area, only a handful of parts like connectors and other small items were harvested with a total spend of probably under a tenner. Is this a sign that things are changing?

This is probably going to be the last edition of the Newsletter in this format. Whilst I am very grateful to all those who supported me in submitting articles, I rather wish there had been more and it is getting to be more of a strain than I hoped to produce a monthly edition with enough content. The next editions will be somewhat slimmer and, most likely, will contain only items submitted by the membership and without those created by me as pages fillers. - **Ed.**

### Dates for your diary

*Please note: the dates may be subject to change...*

|                    |   |
|--------------------|---|
| Tue. 4th October   | Meeting - CARS Annual General Meeting                                   |
| Mon. 17th October  | Skills Night - Danbury Village Hall                                     |
| Sun. 23rd October  | Science Discovery Day at Sandford Mill                                  |
| Tue. 1st November  | Meeting - 25 minute chats (not 25 @ 1min each...)                       |
| Mon. 21st November | Skills Night - Danbury Village Hall                                     |
| Tue. 6th December  | Meeting - Christmas Social Evening                                      |
| Mon. 19th December | <b>No</b> Skills Night! - everyone will be taking it easy...            |
| Tue. 3rd January   | Meeting - Riding the radio waves - Jane Humphreys                       |
| Mon. 16th January  | Skills Night - Danbury Village Hall                                     |
| Sun. 5th February  | Canvey Rally - Paddocks Community Centre, Long Road, SS8 0JA            |
| Tue. 7th February  | Meeting Talk on Diplomatic Wireless - by Peter Grimshaw, M0HSG          |
| Tue. 7th March     | Meeting - Classic Computers - Andy Chapman, G7TKK                       |
| Tue. 4th April     | Meeting - RF Kits Design & Manufacture - David Powis, G4HUP (hupRF.com) |
| Tue. 2nd May       | Meeting - Tricks with Coax - John Regnault, G4WSX                       |
| Tue. 6th June      | Meeting - table top sale  |
| Tue. 1st August    | Meeting - Constructor's competition                                     |

## CHELMSFORD AMATEUR RADIO SOCIETY AGM

The CARS Annual General Meeting will take place on Tuesday October 4th at Oaklands Museum starting at 7.30 p.m.

There will be the annual reports from the Club's officers, the opportunity to hear about our progress over the year and the many activities in which CARS took part.

Voting will take place for members to choose both new and standing members of the Committee. Nominations for new committee members should be passed to our Chairman, Chris Chapman, G0IPU as soon as possible. Chris will be standing down as Chairman so, if you would like the job, please contact Chris in the first instance.

Presentations for 'The Amateur of the Year Award', certificates for the Construction Competition and the M1FDE Shield will be awarded to the winners during the meeting.

In addition to reports and elections, there will be an opportunity for members to voice their suggestions for future events and overall running of the Society.

After the break there will of course the usual much renowned CARS raffle - again organised by Chris

Thinking of joining the CARS committee?

- Would you like to help in planning the Club's future activities?
- Are you good at helping organise public events?

Do you have a 'special interest' you would like to introduce to CARS? At the next meeting members will have the opportunity to stand for election and put their ideas into practice.

Please contact any committee member or Secretary Colin, G0TRM (before the day).

## September's Meeting – Millimetric Microwaves

For the September meeting, we welcomed back Chris Whitmarsh, G0FDZ who had previously given us a talk on the Kent GB3VHF/UHF beacons.

Many of you will have glanced at the very highest frequencies shown your licence schedule and thought to yourself "Who on earth uses these frequencies?". The millimetre wave bands are where the wavelength falls below a centimetre and for amateurs these are:-

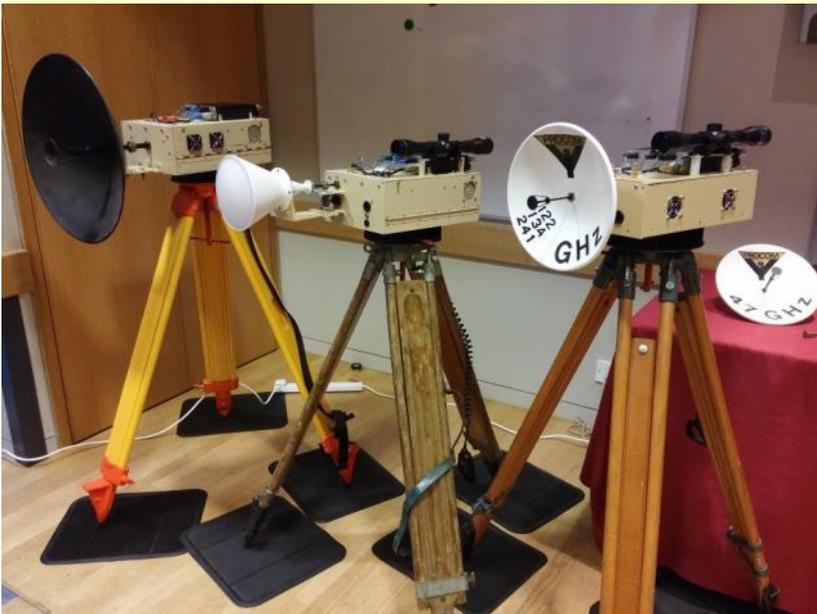
It so happens that a small but dedicated group of microwave enthusiasts in the UK do use these and they regularly make QSOs, sometimes at surprisingly long distances and with very low power. Equipment for these bands is not to be found in your local emporium so it is one of the areas where some outstanding home construction occurs.

Some of the plus points include the challenge of new microwave territory, particularly above 100GHz, the self-training in of new techniques (even compared to lower microwave bands) and the fun and the sense of achievement of getting it going and operating. Even these bands are not the limit with a few countries having access to the sub-millimetre bands above 275GHz whose huge potential is under investigation for security scanners, super-Wi-Fi and various scientific uses. Some of the recurring issues to be faced are:

- Where do get the kit from – which is often solved by multiplying and mixing, though that can result in QRP power levels due to the lack of amplifiers
- Dealing with the path losses in the atmosphere (mainly the water vapour) - most of the distance records are from high points on cold low-humidity days. Mike Willis, G0MJW has free software for this

In the case of the latter the total path loss is the sum of the free space path loss, oxygen losses, water vapour – and any additional losses due to mist or rain. Paths are essentially optical line of sight with very little refraction

| Frequency, GHz | Wavelength, mm (Approx) |
|----------------|-------------------------|
| 24             | 12                      |
| 47             | 6                       |
| 76             | 4                       |
| 122            | 2.5                     |
| 134            | 2                       |
| 241            | 1.2                     |



Some impressive examples of the engineering Chris, G0DFZ has been involved with and the other paraphernalia that is required to make the QSOs on these hands.

These guys are a dedicated bunch; no chance of just turning on one of these rigs on a Sunday morning for an idle rag chew! - Ed.



Chris, G0FDZ has been operational on these frequencies for many years and brought along an extensive slide set that explained techniques used for equipment on each of the mmWave bands

At these frequencies coax is very lossy (if it works at all). Above 24GHz waveguide is quite common and is relatively low loss. Antennas are, in principle, quite simple and a mix of horns or dishes are used.

A key benefit of small wavelengths is that the antennas are compact, but still give remarkably high gain (often ~40dB and occasionally even higher) - the downside of which is you have align the equipment and point things very accurately so a common feature is that telescopic sights are a key accessory.

Chris has operational equipment for all of the millimetre-wave bands and brought it along to show us, along with his presentation.

In the early years wideband-FM from Gunn Diodes was used and ranges of a few kilometres were achieved (sometimes with talkback on 144 MHz). Nowadays this has all changed to narrowband operation courtesy of using surplus synthesisers that provide an initial source in the ~11-13GHz range and set up as part of a transverter from a VHF or UHF source radio. Several bands do have transverters commercially available from DB6NT (Kuhne Electronics) in Germany though they are pricey. Instead, Chris and others often prefer to acquire the bare mixer circuit boards from DB6NT and assemble their own. On the drive side Chris brought with him his FT817s - he has several so he can have one per transverter!

Chris gave an example of the conversion for the 24 GHz band:-

$11.952 \times 2 (= 23.904) + 144 \text{ MHz} = 24.048 \text{ GHz}$  (the standard IARU freq.) – whereupon the output waveguide acts as a natural high pass filter and removes the lower drive frequencies from the output spectrum. At 24 GHz other parts are readily available so he has a 2Watt PA and GaAs FET LNA.

The transverter approach remains the same for higher bands, but PAs and LNAs are scarcer. The 24GHz band is one of the lossy ones due to a water resonance, but even that has line of site QSO distances of 100+km and even further can be obtained by exploiting troposcatter or rainscatter.

For higher bands at 47GHz and beyond harmonic mixers are used and CW and SSB are the norm. However, for transmitters, fundamental mixing is preferred, as that gives the most power.

As frequencies rise the size of the components, particularly the beam lead mixer diodes, becomes minute and some careful handling is required.

It was nice to see plenty of slides of people operating, and quite a proportion were in Essex, including from Danbury Hill, Brentwood and Hanningfield Reservoir. Alas John Wood, G4EAT who was a keen operator, became a silent key in Feb-2015, but Roger, G8CUB is now pushing ahead nearby.

The presentation and the kit being demonstrated showed how all bands including 122, 134 and even 241 GHz had been activated by Chris – though the latter with just microwatts at present.

Despite the milliWatt powers, the high antenna gains have given impressive UK QSO Distances including:

- 24GHz: 408km
- 47GHz: 203km
- 76GHz: 129km
- 134 GHz: 35 km

That doesn't include moonbounce which is "doable" on 24 and 47GHz (with TWT amplifiers)

After the break, the talk was wrapped up with lots of questions from the interested audience (some of whom are ex engineers or were intrigued by the construction work). Chairman Chris, G0IPU helped draw the raffle and we concluded a really educational and eye-opening evening.

**Murray, G6JYB**

*Editor's note: I'm not sure what happened on this occasion, but there don't appear to be any pictures of Chris either giving his lecture or receiving his due reward. If you are reading this, Chris; there is no slight intended - merely a cock-up on the part of the editor (who was there at the meeting, but thought others had that in hand) and others, who probably thought the same! Sorry!*

## Your Radio Society really needs your support!

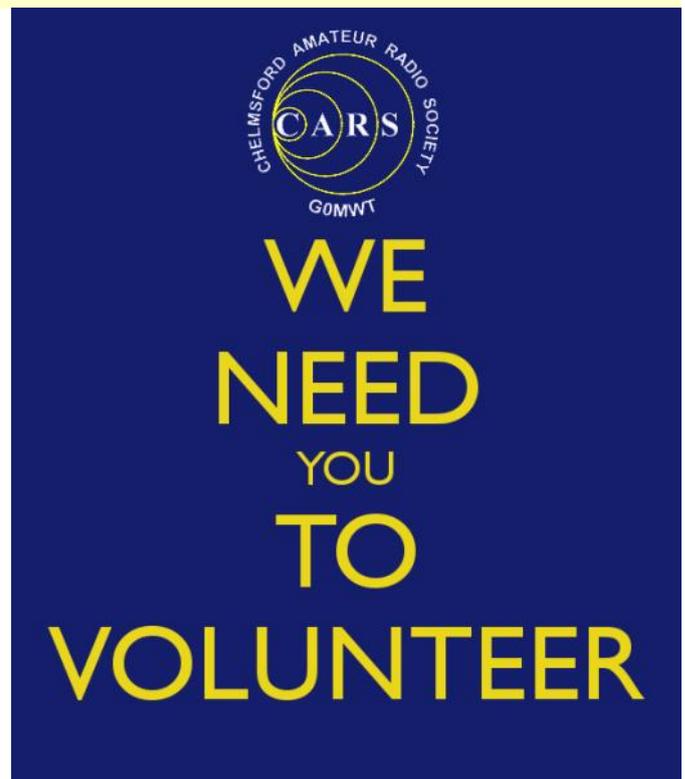
The AGM is upon us and, at present, your committee is still too small to be effective; more members are required, along with a Chairman. As I said last month, I intend to stand down as Chairman and this is mainly due to time constraints, there are just not enough hours in a day to complete some tasks I have taken on (some might say I should learn the word "NO").

So - please do get involved in the running of the Society; please do not hesitate to contact me at the usual address: [chairman@g0mwt.org.uk](mailto:chairman@g0mwt.org.uk).

We need people to help on the event planning, operating and the like, and your help will be most gratefully received.

TTFN. Chris, G0IPU

*Committee meetings are held at Danbury Village Hall a week Wednesday after the CARS club night meetings. Tea, coffee and biscuits are provided and start times have been variously between 7 and 7:30 p.m., depending upon members' preferences. - Ed.*



## Science Discovery Day October 23rd 2016

The Radio Society has been invited to Sandford Mill by Tim Wander, G6GUX to take part in the Science Discovery Day on the 23<sup>rd</sup> October 2016 from 10:00am to 4:00pm. As with all events we are looking for support from the membership. If you would like to take part in the radio station utilising the club call sign, GX0MWT then please contact me on [g0ipu@g0mwt.org.uk](mailto:g0ipu@g0mwt.org.uk). Keep an eye on the website for more information on this, and other Society outside events.

Chris, G0IPU

*If you haven't yet taken part in these events or, possibly, haven't done so for a while, then come along and get stuck in. You may or may not wish to operate, but there is usually a steady stream of visitors to the hut that want to know something of what is going on. If operators are busy making and/or logging contacts, it is useful to have someone else at hand to explain what is happening, the nature of radio in general and amateur radio in particular - Ed.*

## September Skills Night

This was a good evening for your scribe. I actually got to find out how to demodulate some of the digital modes and how tolerant the hardware and software can be of signal/noise ratio. I had hoped to talk to Richard, G7OED about data modes but he couldn't attend, so Pete, M0PSX helped me out with a demo of the free EssexPSK decoder software. Not having a live radio, he used a recording on his phone and held it near the laptop's microphone. It all worked OK. Next, he demonstrated Ham Radio Deluxe in dummy mode and I got a handle on that. Unfortunately, I had to miss out on the JT65 as I was data gathering for this tome, but next time, perhaps? Thanks, Pete.



Steve, M0SHQ was also along with a demo of his BlueDV personal D-Star hot spot using a Blue Stack micro. All very interesting but, I'm afraid, I still can't see the appeal. I can well understand the usefulness of such a system to keep in touch via the PC if you need to, but then Skype has a similar function, doesn't it? Still; whatever rubs your rhubarb...

Roy, G4JAC brought along some lovely, almost Heath Robinson examples of DF radios - the sort of thing I remember from the 70's when I used to take part in DF hunts. We sold our car one day, meaning to get another one after a few

months, but did without one for about 13 years in the end. I used to take part on my bicycle and was even able to be competitive in some cases. Thanks for the memories, Roy, but I doubt I would be able to charge about the roads now as I once did!

Melvin, 2E0DNS brought along some of his examples of home construction. He also brought me some very useful info on websites to visit for help with availability of kits and other circuit information.



Thanks, Melvin. Chris, G0IPU was on hand to help out with any construction and soldering issues and, naturally, ran the quiz, during which attendees seemed to find something to discuss and comment on.



Mike, G4NTV once again brought along his analyser and that again found favour with the masses (in fact, numbers were slightly down compared to peak attendance, but there were a lot of first-timers, so that has to be a good thing).



Rob, M0KCP also came along to enthusiastically represent Essex CW Club and did his best to find some reasonable signals to work on 20m. Unfortunately, the antenna was found to tune to best SWR at about 33.65 MHz with another dip to 2:1 SWR at about 29MHz. This is fine for the demos that take place at the training sessions for the Foundation course, as a series of 10m QSOs take place. This band is chosen as at the time of the evening they are held, CARS can pretty much guarantee a QRM free band. The connector had also suffered from being left outside and the mechanical coax connection was intermittent, so more work is required there. Tea, coffee, cakes & gossip supplied by Anne, David & Myra as usual.

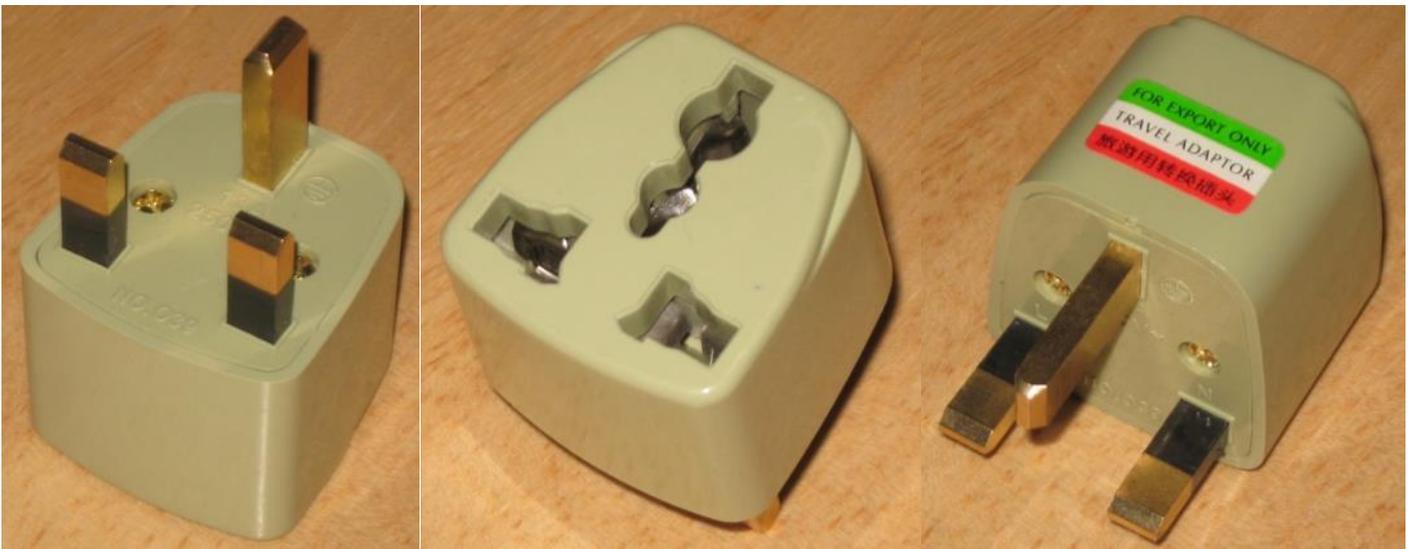
All in all, a good event and the best bit is we can be sure they will continue to run, providing a source of fun, entertainment, news of events, knowledge and experience to all. Even Pete, M0PSK was glad to be able to do his demonstrations as it made a change from his usual role as Master of Ceremonies. - **Ed**.

## Salutory lesson

My Blofeld handi has been playing up and I felt it was the 1,800mAh battery, so I looked on the Internet for a replacement. It indicated that 1,800 was old hat and 3,800mAh was the new "in thing". I bought one from "Light in the Box" and it turned up from China after 4 weeks or so; the extended pack clips neatly where the old battery fitted and charges OK. It does not play up during the CARS Net overs.

The trouble is the "Light in the Box" site emails every 2 hours with some advert or another and I cannot get rid of them. Packed in the same jiffy bag was a beautifully made 13A Adapter which to me seemed a bit too small. I took it apart and found it does NOT have a 13A or less fuse. This means if you plug a Continental piece of equipment into it – it will be fused to the limit of your particular ring main. Continental wire will usually burn at 12 Amps or less so you have a violent situation on your hands – if you come across something like this – destroy it with a hammer.

John, G8DET



## Maldon & District U3A Maritime Group Trip

### Bawdsey Radar Museum and Woodbridge Tide Mill

John, G8DET forwarded me this write-up from a trip he went on. The author is happy for it to be reprinted here in our Newsletter:

On a bright but cool Monday morning at 8:00am, 51 members of the Maldon U3A left Maldon to visit the Bawdsey Radar Museum Transmitter block and the Woodbridge Tide Mill. An excellent journey with no traffic delays got us to Bawdsey ahead of time. We were met by John and Roy, our two guides, who gave us a brief overview of the museum and then took us inside to a very welcome cup of tea and coffee, with biscuits. We then went around the museum at our own pace to view all of the many and varied exhibits which gave an interesting history of the development of Radar (Radio Detection And Ranging); John and Roy always being on hand to answer our many questions.



The Transmitter Block on the Bawdsey Manor Estate is part of the world's first operational Radar station. In 1935, in a field near to Daventry, Robert Watt and Arnold Wilkins successfully demonstrated that an aircraft could be detected using radio waves. The team soon needed more space and secrecy for research and in 1936 the Bawdsey Manor estate was purchased. The scientists became known as the "Bawdsey Boffins". The development work at Bawdsey resulted in the first ever operational radar station at Bawdsey which became the model for a chain of stations along the coast. Bawdsey remained operational as a research station into the 1990's and as a museum, has recently been awarded Lottery Funding.

We left Bawdsey at 12:00 and then went for lunch at the Wyevale Garden Centre near Woodbridge.

After lunch we then went to the Woodbridge Tide Mill, where we were met by four guides who divided us into four groups and took each group around the Mill, each guide giving us a very interesting and informative tour which finished with a demonstration of the Mill in operation and milling wheat; we were able to purchase this freshly ground flour. Woodbridge was one of the first tide mills in the country, and was unquestionably the last one working – operating for well over 800 years. The earliest record of a tide mill on the River Deben is in 1170, it was owned by the Augustinian Priors for around 350 years until Henry VII confiscated it. In 1793 the present mill was built on the site of earlier ones. It finally closed in 1957, it was

saved and restored and opened to the public in 1973. The mill operates purely on water power, a large "Pond" is filled by river water during the flood tide, then during the ebb tide, the water is released from the pond to drive the large water wheel which in turn drives all of the milling equipment.

### Malcolm Case

*That looks like a nice destination for a day out. Perhaps CARS should investigate a group trip. With entrance at only £4 and car-sharing, it should be a relatively cheap day out.*

*I looked up the website and was very slightly dismayed to find that the last open day for 2016 was 11th September, when there was a \*special\* heritage open day to view the empty building. Unfortunately, it is now closed until September 2017 when it will re-open after conservation work has been completed. - Ed.*

[bawdseyradar.org.uk/open-days](http://bawdseyradar.org.uk/open-days)

## USB, EMC and Oddity

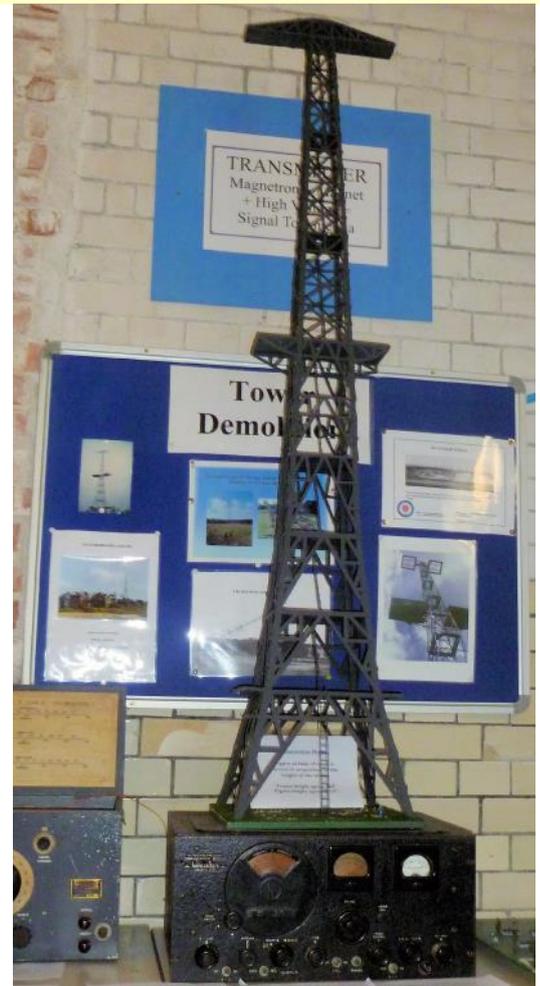
I bought a new PC a while back and with it, a Microsoft 3050 wireless deskset. For some years on my old computer I had used a cheap Trust wireless deskset which, despite having plenty of features and mouse buttons was not particularly brilliant and the mouse resolution was fairly poor. Very occasionally the mouse would stutter, or go slow and jerky, and the keyboard would sometimes miss characters. I put the former down to the PC doing something in the background and hogging the processor and the latter down to my habit of running the batteries to the absolute minimum cut-off voltage. This PC had a PCI card with two USB 3 ports that I only occasionally used for backups and most of the time was not used.

After I received the new PC, I noticed the mouse performance with the new deskset was also slow and jerky and would occasionally hang. The keyboard also seemed to mistype on occasions as well. I'll be the first to admit my typing is not good, but the mouse was definitely not down to me.

Four of the new PC's six USB 3 slots are at the rear and because I didn't want to keep reaching round and/or moving the PC, I fitted variously the deskset dongle, cables for USB-A, USB-B, USB mini-B, USB micro-B and UC-E6 etc. to the machine and this filled pretty much everything up. I have an external DVD drive, memory sticks, card reader, two 'scopes, the GPS, cameras and several USB 2&3 hard drives etc. I don't want to use all these at once, of course, but although unpowered, they may be connected and they use slots that would otherwise need repeated disconnecting and reconnecting. The PC has USB 3 slots so I got a 4 port USB 3 PCI card and an external powered Anker 7 port USB 3 hub was also called for.

I transferred the deskset dongle to the external hub and all was well for a while, but then I started experiencing lockups of the deskset. I found this could be cured by connecting the old Trust deskset dongle (in addition) to a PC port and normality would be resumed for a while until the 3050 locked up again. I then found that either inserting or removing the Trust dongle would 'release' the 3050 deskset until the next lockup when it could be toggled into action again. The 3050 dongle could be put into the PC and it would then work, but with the performance limitations previously mentioned.

In the meantime I had bought an SDRPlay RSP1 digital radio dongle and was using the SDRUno software. You can tune the radio by a variety of methods, but one obvious one is to highlight one of the digits in the frequency display with the mouse pointer and then use the mouse wheel to increment or decrement the display as required. This works to a point, but then adjacent digits will randomly jump and change of their own accord—despite not being selected or commanded to do so.



SDRPlay have a Facebook presence and although I absolutely *detest* that execrable organisation, I signed up so that I could access the SDRPlay and SDRUno user groups. Despite my best efforts at being cautious with privacy and using an email address that is not contained in my PC, I find that my address book has been hijacked by Facebook. OK. I have now found out how to delete the contacts, but I can't seem to stop the "people you may know" thing. You don't seem to be able to stop them making suggestions - it seems that you can only limit it to "everyone" or "friends of friends". Why isn't there a "NONE" option for Pete's sake? After a while I realised that it was essentially only the wireless desksets that were doing it. Two pukka wired USB optical mice were pretty much fault-free, but a cheap wired optical from the £1 shop very occasionally misbehaved with the software as well. SDRPlay initially said it was a peripheral problem and nothing to do with them. *Last minute update: I talked to them at Hamfest; SDRPlay say they hadn't seen this before and no-one else was reporting it but that they will try to replicate it.*

I contacted Anker and they said "sounds like USB 3 interference with the 2.4GHz link - we remind you that this is mentioned in our literature". Well, try as I might, I couldn't find any warnings for this product on their website or the hub's documentation, but the internet is full of reports of the problem and Anker do say about their passive 4 port USB 3 hub: **Compatibility: 2.4GHz wireless devices, MIDI devices and some USB 3.0 devices may not be supported. Try using the host port or a USB 2.0 connection.** Some people report that their WiFi link is being wiped out by the remote hubs and they are having to revert to using USB 2 ports.

Eventually, at Anker's suggestion, I put the dongle on a USB 2 lead and it pretty much cured the problem when typing and using the mouse in word processing and graphics editing, but it hasn't fixed the SDRUno problem. I then also fitted a USB 2 two-port adaptor plate to the internal motherboard USB 2 header but, as this sits cheek-by-jowl with the USB 3 PCI adaptor, it is not trouble free at all and I still have the SDRUno fault. Whilst I was trying to sort the problems, I came across this post on the SDRPlay Facebook group:

*"There is a common theme that pops up over and over as folks fire up their SDRPlay for the first time. It is usually noise from a switching power supply. Most likely the one in the computer itself. This is often caused by a GROUND LOOP and is not the fault of the plastic case that the SDRPlay is made of. Instead of getting out the aluminium foil (lots of pix on the 'net of people with cooking foil around the cases - Ed), folks would be far better off spending their time learning about ground loops and how to prevent them. Remember, all of the hard work you put into shielding your case will be negated by the fact that wires are shipping noise right past the shield and into the case. In my estimation, shielding the case should be the last thing you try not the first. This stuff is the essence of an entire field of science called EMI/EMC (electromagnetic interference and electromagnetic compatibility). Things like common mode noise vs. differential mode noise and radiated susceptibility vs. conducted susceptibility are major areas of design, testing and troubleshooting for electrical engineers, technicians and hobbyists. There is a ton of good information on the web for anyone to learn the basics so they know how to track down and eliminate noise. The SDRPlay is a miraculous bundle of high technology but it can be brought down by the simplest of cheap switching power supplies that are all over a modern house. A newcomer to the hobby would do well to learn about the advantages of an isolated dipole over a long wire, single point grounding and even the advantages of using your SDR with a battery powered laptop. (There are myriad switchmode regulators in a modern laptop - Ed.) The great folks on this forum can help with the software side of the SdrPlay as well as the "RF" side to get you up and running with minimum fuss. I encourage all of the "old timers" to post any links that they have found helpful regarding RF noise, tracking and elimination, grounding, RF ground vs DC ground, ground loops and of course good old fashioned beginning antenna theory. That little black box contains a ton of fun as well as a lifetime of learning. Like golf, it is easy to play but hard to master!"*

Looks like one step forward, two steps back in the radio world. I used to spend a lot of time solving EMC problems at work but I didn't think I would run into this sort of gross compatibility issue. In any case, if the PC PSU is creating interference, in all likelihood, so is the motherboard. It is likely to run down the USB power and data lines, so even putting ferrites on the USB lead probably won't help. Mind you, if I have the UHF rig running, the portrait monitor I am using to type this document up opens the squelch on GB3ER every time I turn it on. The monitor in question is quite old (circa 2004?) and I know nothing of its history, as I was given it, but I would have thought it postdates the relevant EMC regulations.

Why is nothing ever easy? - **Ed.**

## Interesting news—University of Manchester press release

### Assessment of the impact of solar activity on radio signals in the atmosphere boosted by new measurement method

An innovative new methodology for assessing the effect of space weather on radio signals in the ionosphere has been published in the journal *Radio Science*.

Researchers from The University of Manchester's Jodrell Bank Centre for Astrophysics have developed and demonstrated a process for continuous electron density measurement of the previously under-explored D region of the ionosphere – a part of the atmosphere that previously could only be sensitively probed by short-lived rocket-borne instruments.

Accurate and up to the minute data on the interaction between space weather and electron density is vital to maintain services that utilise radio signals – everything from the Global Position System (GPS) used in smart phones, aircraft navigational systems through to the astronomical signals received by radio telescopes.

The new study combined a statistical approach implemented in a unique software modeling programme called IONONEST with data from the Kilpisjärvi Atmospheric and Imaging Receiver Array (KAIRA) radio telescope in Finland, which is capable of making sensitive broadband measurements of the absorption caused to the cosmic radio background by the ionosphere. The resulting data confirmed the process was a successful methodology for measuring the effect of solar weather, the changes it caused to the ionosphere and the resultant impact on radio signals.

Dr Anna Scaife, Head of the Interferometry Centre of Excellence at The University of Manchester and one of the study's authors, said: "From sitting in a converted train carriage in the frozen north of Finnish Lapland repurposing the KAIRA telescope to crunching data through IONONEST, we have used the technology in new and innovative ways that can really push this science forward. Our aim with this project was to develop ionospheric techniques that can be used more widely by researchers across the world.

"Unlike other methods of measuring the lower ionosphere, the techniques we have developed can be run effectively continuously - providing a long term database that can be used as a basis for ionospheric predictions – and the provision of services for both consumers and scientists that rely on accurate and stable radio wave activity, bridging the gap between science and society."

The electron density in the D-region is substantially less well understood than the other layers of the ionosphere, and cannot be measured effectively via the most common methods used for observing the ionosphere, such as ionosondes, incoherent scatter radar and GPS networks. Prior to the IONONEST methodology, the primary method to measure electron density height profiles in the D-region was the use of rocket-borne instruments which provide direct observations, however this method is expensive and only produces a single set of data per flight. The use of incoherent scatter radar is limited because the technique is less sensitive than using rocket-borne instruments as well as being both expensive to build and limited in latitude coverage.

The IONONEST methodology uses a statistical technique called nested sampling to invert the multi-frequency data recovered by KAIRA and recover parameterised height profiles of the electron density through the D-region of the ionosphere. The technique is capable of both constraining the optimal parameters of these models as well as statistically selecting the best model from a set. Since the KAIRA telescope is built on the same technology as the larger distributed European radio telescope LOFAR, the IONONEST code can be used directly to perform ionospheric measurements from any LOFAR station.

The results of the study were published in the article 'IONONEST – A Bayesian approach to modelling the lower atmosphere' in *Radio Science*, 14 September 2016.

KAIRA was funded by the University of Oulu and the FP7 European Regional Development Fund and is operated by Sodankylä Geophysical Observatory. This research was made possible by the European Research Council under grant ERC-2012-StG-307215 LODESTONE and by the South East Physics Network (SEPnet).

*That all sounds quite interesting. I wonder how this may be applied to the hobby and what information could be gleaned in reality. John, G8DET suggested that if there is money to be made from this, we are unlikely to see any benefit in the short term. I wonder if the data will be released to the general public. Ed.*

## The Railway Man

In an amateur radio newsletter? Really? Well, yes, as it has a relevance. I picked up this book in a charity shop. Written by Eric Lomax, it details his life and experiences in the war as a prisoner of the Japanese working on the Burma Railway.

From an unremarkable and basic non-technical academic background where he wasn't having any fun at an ineffective school, as an only child Eric developed a life-long fascination and obsession with railways, engines, timetables and a sense of order that applied to everything from lists to his sense of geography. At his father's suggestion he applied for a Civil Service competition for a single post as a sorting clerk and telegraphist at the GPO in Edinburgh. To his, and everyone else's surprise, he took first place in the city and was awarded the position. On the morning the brown envelope arrived, his father told Eric he could leave school that day.

Growing up in a world where tinkering and inventing was second nature and home-built radios were commonplace, he got stuck into the task of rote learning that Post Office Telephones instigated in the day, learning and memorising entire circuits (so they could be reproduced in exams), telephones, Morse signalling and telegraphy. When conscription was introduced, he decided to "optimise his position" by joining the Supplementary Reserve of the Royal Corps of Signals. In this way, he had a head start and was involved in the organisation and mobilisation of other reservists. He applied for a Commission and went to Catterick for an intensive course that, he says, taught them "radio, telegraphy and telephony to a level beyond the GPO's dreams".

His last job before joining the army was to maintain records for the Post Office Telephones transport all over the south-east of Scotland, recording things like garaging requirements, fuel consumption, break-downs and accidents. His future became the minute administration of GPO machinery, counting and accounting in careful detail for the means of the public's communications and the people who kept it running.

The book goes on to detail how he got caught up in the war in the far east and how he came to be captured. During that process, he was doing his best to transport equipment and maintain reliable communication in the various countries and areas he was stationed in. He tells of a ship's captain refusing to carry the large glass carboys of concentrated sulphuric acid for the batteries that the radios relied on, for example. Also, "theory is one thing, jungle propagation is quite another". Low powered radios and RF absorption by the foliage etc. all led to problems with maintaining reliable comms. They found the telephone lines were the most effective means of communication (*but not very portable - Ed*) then he hit upon the idea of "Line Assisted Wireless" whereby he would set up the aerials a few feet below the lines and the parasitic coupling this afforded extended the range considerably.

The salient points for me in the book are then the descriptions he gives of his and others' efforts to make and operate radios in the camps to keep in touch with what was going on in the outside world. The fact that they had to make, and hide, the radios and the antennas which, as they were mainly poorly fashioned crystal sets, had to be long enough to be resonant in order to be effective.

He mentions a character by the name of Lance Thew who was very talented, but described as a bit of an absent minded professor. He was so absent minded, that he once walked across the main camp square with a glowing hot soldering iron in his hand from where it had been heated, to where it had to be used as though it were the most natural thing for a prisoner to be walking about with the tools of his electronics trade.

They had a remarkable amount of freedom in some camps. The Japanese, knowing the prisoners had nowhere to go and that they would want to look after themselves, allowed some trading contact with the locals. As their skill and daring progressed, they started to steal and otherwise acquire the components they needed. One such, was a broken domestic radio that they managed to press into service with a modified buzzer from a field telephone set and an old battery as a power supply (*presumably, this acted as the old "vibrator" voltage step-up device - Ed*).

Eventually, their luck ran out, they were discovered and then started the almost impossible violence, torture and interrogations to which they became subjected. It beggars belief what the human body can stand.

Transfers from camp to camp, jail and hospitals with a certain amount of medical subterfuge allowed Eric to survive and see more of this clandestine activity and they were finally able to hear the news of the atomic bombs with the relief that came with all of that. He discovered that radios had been made and fitted into coffee tins, broom heads, bamboo tubes &c. Some of these stories we know about now. At the time, it would have been a revelation to Eric.

After the war was ended, Eric met up with one of his interrogators, Nagase Takashi and (some) wounds were healed. Nagase was staggered to realise that Eric and his cronies had heard about the atomic attacks two days before the Japanese captors themselves had heard.

Upon his return, Eric signed up for another two years and applied for the post of Signals Officer at Edinburgh University Senior Training Corps, where he lectured young officer cadets on radio theory.

After that stint, he decided he wanted to go into the Colonial Service but, as his old GPO job had been 'reserved' for him when he left in 1939, he had to go back to claim it before he could be transferred out from it. He was there for all of two weeks, when he re-joined in 1948, and the first thing that was handed to him was his old folder with his notes and jottings outlining the requirements for garaging and maintaining the Post Office fleet of vehicles - unopened and untouched in all those years. - **Ed.**

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## Button batteries

How harmful can they be? I was listening to a piece on the radio recently about children swallowing them and the damage they can do. Apparently, most batteries swallowed will pass through the system in the normal way within a few days but, if they get lodged in the oesophagus (quite easily, it seems) the current electrolyses the saliva creating an alkaline that can burn through the lining of the oesophagus - causing catastrophic injury, or even death if they go through major blood vessels. The injuries are very difficult to treat and in one such example quoted, the three year old had endured over thirty operations with more to come. You wouldn't credit a single 1.5V cell could be so bad for you; the 3V lithium cells, doubly so. - **Ed.**

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## Smart meters

Soon after I had mine installed, Pete, M0PSX asked on his Monday night net if it had changed my habits in any way. None whatsoever, I replied. After all, I knew exactly how much each item in the house used and what need did I have to change?

At some point though, I wondered what the difference would be between heating the entire hot water cylinder by gas and then by electricity. We have a fairly large water tank that is reasonably well insulated with an integral foam jacket and the heating coil heats from the bottom of the tank upward, but heat slowly bleeds out again afterward from that feed pipe. The immersion sits at the top of the tank and only heats a small part of it. Switching from gas to immersion heats enough water to give us both adequate showers and whatever else casual hot water we need. If a bath is needed, the gas boiler can be employed.

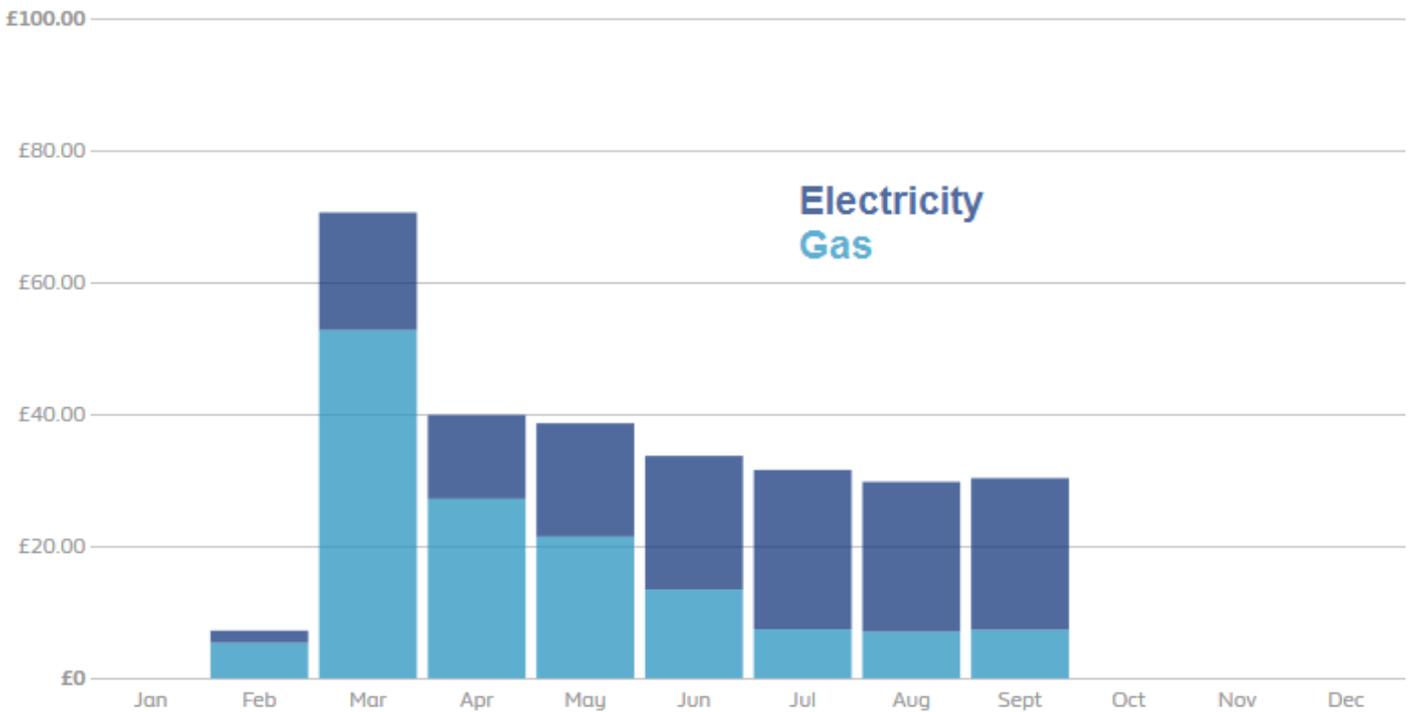
The water tank is situated almost as far from the sink as you could get and runs off about a gallon of water before the water runs hot and then, after you have run off the water you need, leaves about the same amount of hot water sitting in the pipes to cool down. Accordingly about 2 gallons (~10 litres) gets wasted. I had long ago taken to boiling a kettle for washing up small items such as a couple of cereal bowls, or plates and cups for a light sandwich lunch. If I co-ordinate main meal washing up with the evening shower, then the pipe run heat only has to be lost once, as opposed to each occasion I wash up.

Granted, this sort of anal regime wouldn't suit everyone; least of all large families (or those with multiple girls in the household and all the demands of hair washing and drying etc.) but at least I know I'm doing my bit so I can feel a bit less guilty about using the PCs and amateur radio gear.

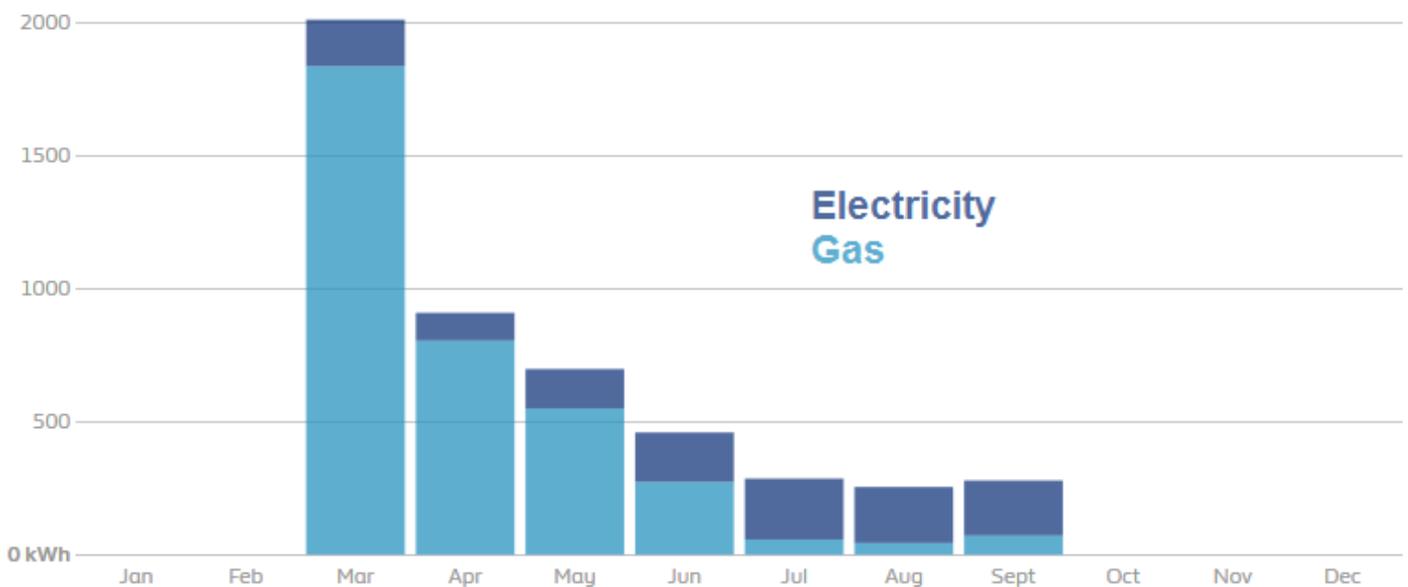
The graphs on the next page give a direct comparison of the cost and energy per month. The graphic is much more meaningful than the figures might suggest. Although the cost is similar for both regimes, the energy consumption is dramatically lower, saving a lot of CO<sub>2</sub> in the process.



**Cost per month**



**Energy consumption**



To reiterate, the cost difference is minimal, but the energy consumption is greatly reduced. In June, we were muttering “flaming June” and there was an element of room heating still involved, but the figures for July-September, when the heating hadn’t been used tell their own story, and convincingly so.

**50 shacks of grey**

She looked at me cooly. “Tonight I am your slave. You may do what want with me. Tell me what you would like.”

So I made her clear out the shack.

## Energy II

Carrying on from the previous section, I went to record the meter readings from the domestic smart meter display and found it looking blank, with the message "Network lost. If problem persists, contact customer service". The next day, it was all working again. I don't know what caused it or what the problem was, but I wonder how reliable it will be long term and whether they will continue to support the consumer repeater.

It's all a far cry from the early days of the grid. I have just been reading (flicking through, more like) a history of Southern Electric. When it was set up in 1948 after Nationalisation, it incorporated all the small regional suppliers with the problem of having to deal with myriad different supply systems, overhead cables, ratings and voltages and the dreaded mix of a.c. and d.c. supplies. Wanting to standardise on 11 and 33kV distribution, they inherited 2.2, 3.3, 6.6 and 22kV systems. The domestic mains voltage levels were also different, something I was not previously aware of. I liked the story of the supply to Avebury, a site of archaeological importance that had seventy consumers being supplied with 230V d.c. by the local garage owner and his two diesel generators; the supply being routed overhead with wires of any convenient gauge that was handy, via old GPO poles, trees and anything that looked useful. It took five years of wrangling with the local authorities over supply line aesthetics to get the supply standardised to 240V a.c. and run along the road.

The Board's fleet of some 700 vehicles were all different and up to 20 years old in 1948. By 1958, they had standardised and increased the fleet to some 1200 vehicles and were trying out the new fangled mobile VHF communications. Wow! This helped enormously when the distribution upgrades were put into place and the new system switched on over the course of one night. When British Leyland stopped making 1 ton and 30cwt LandRovers, the board bought some Russian 1 ton 4WD trucks and got into all sorts of political hot water for the decision.

Of course, in those days, you were stuck with your local electricity supplier, so was there a possibility of choosing a different tariff? Well... Yes, there was. It seems there was an almost mind boggling array of tariffs and a directive from the British Electricity Authority to bring the minimum rate up to 3/4d per unit (that's three farthings, not three and fourpence). There were 25 different tariffs for lighting varying from 0.75d to 7d, 31 for heating, cooking and water heating from 0.75d to 2.5d, 59 two-part tariffs between 0.875d and 1.75d and ten block tariffs (whatever they are) between 0.875d and 2d. How did they know what you were using the electricity for in those days?

Other problems included the different meter test and repair houses. In 1948 they inherited 22 meter test stations and by 1960, they had rationalised to five. Two years later, they had built air conditioned and temperature controlled premises to take on the work of three of those five and provide the stable atmosphere required for that kind of work. So if they weren't kept in air conditioned environments, were the meters all out of cal before that? Who knows? - **Ed.**

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## The good old days

It's all very well harking back to those times (above). When you get old, all days are good...

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## Line frequency interference?

I was given an old TM-733 that has a dreadful hum on the transmission (even when run on a battery) which interferes with the 110.9Hz CTCSS access tone on DA and ER. I haven't taken it apart to find out why, but I also have a lot of receive hum on my direct conversion Pixie transceivers, so I wondered if I could measure the field strength at line frequencies and harmonics thereof. My mains supply is overhead and runs right past the shack so was it possible that I was getting a very high field strength?

I started with making a shorted loop of 10 gauge copper wire about 1m diameter and put a current meter clamp round it. This proved too insensitive, so I put the loop in series with the low voltage output of a mains transformer and looked at the voltage on the primary. The frequency response of the transformer is very poor, of course, but there were all sorts of spikes visible suggesting large(ish) harmonics on the mains lines. The transformer was obviously of limited use in seeing the induced current.

Next, I made up a low noise 40dB amplifier using a TL072 and put that on the loop current sensor. This showed that there was, indeed, a pickup but only mainly in the horizontal plane. My soldering iron was running and as the thermostat clicked in and out I could see the change in current induced in the loop as a trace on the 'scope. The waveform wasn't what I expected, so I assume that it must be down to the frequency response of the sensor, although there were some very large harmonics indeed according to the 'scope's FFT analysis. If the frequency response is as poor as it looks, it begs the question what the accuracy of the sensor is in measuring the mains current that is then reported to these domestic energy meters that the energy suppliers give away.

Naturally, as I waved the loop nearer the soldering iron, the trace increased in amplitude to the point where the amplifier output became saturated. As I write this, I haven't calibrated the system, but I will do so. I have cobbled together a 40W audio amplifier that I can drive into a 4Ω load and I will use a combination of true RMS DMM, my 'scope and signal generator to measure the sensitivity and frequency response to see if I can really estimate what I am getting in terms of A/m (or whatever units are normally used). I have no idea if this exercise will tell me anything at all in practical terms, or if it will be just another useless bit of information I will have gathered

A d.c. coupled Hall effect sensor would be a better bet and just about every mobile phone has one installed (or three - in different axes) but these get polled at a relatively low frequency. In my case it's at about 15Hz in the LG G3 Android phone which is well below Nyquist and that will obviously not resolve 50Hz, let alone any harmonics thereof.

If you are in any way mildly curious about what's in your phone, I can recommend an app called Sensor Kinetics that will give you chapter and verse on such as gyroscope, magnetometer, gravity sensor, accelerometer, linear acceleration, rotation sensor etc. It has the capability of revealing data about other sensors such as proximity, temperature, light, pressure and humidity if the phone has those sensors built in. The app can graph the sensor outputs and log them to a file for access at a later date. - **Ed**.

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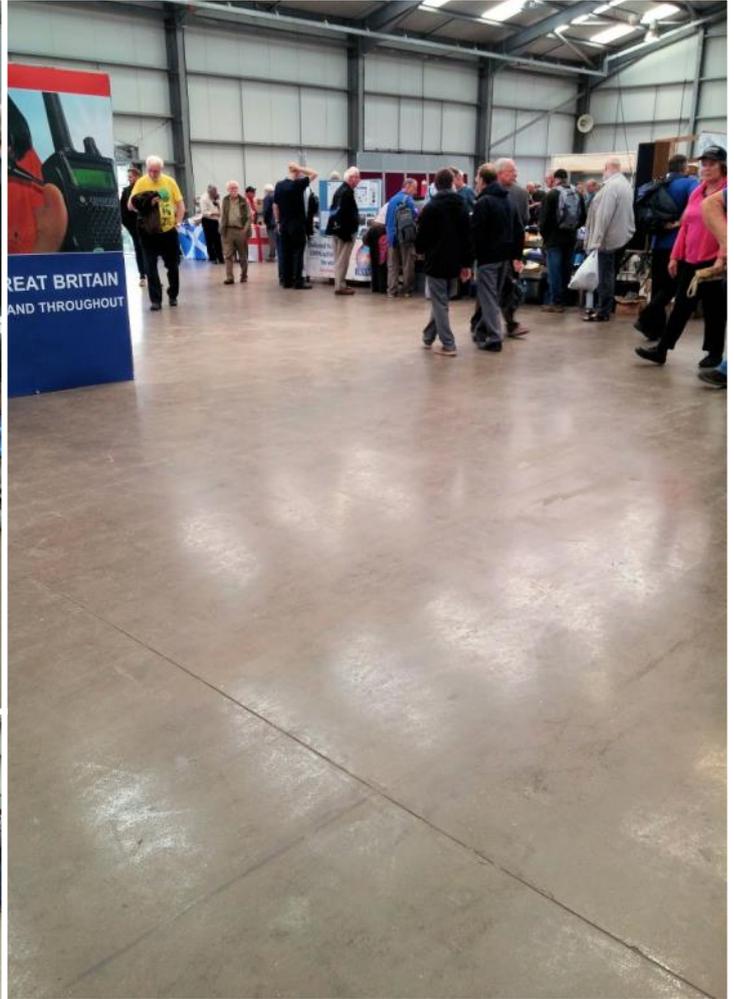
## Unwelcome surprise

I recently undertook to sort out an old Advance OS2100 oscilloscope that had chronic focus and brilliance problems. The fault was obviously in the HT circuit, so, I was dealing with voltages up to 1.3kV. Having not probed a circuit at that level for quite some years, I was a bit apprehensive as my 'scope probes would not cope with that voltage. Tony, G4YTG loaned me an AVO and a high voltage multiplier. It turned out the multiplier was unnecessary, as the native instrument was capable of reading up to 2.5kV.

Four of the six high MΩ resistors in the EHT circuit were hopelessly high in value or open circuit, but two others had been replaced in recent history with modern metal film resistors which seemed OK. Additionally, the circuit diagram said that two of the resistors should have been 4.7MΩ but these had been replaced by 1.5MΩ components, the 1MΩ brilliance control had 330k soldered across it with no reasons or notes given and the mains ON/OFF control had been hard wired across the contacts.

Several club members responded to my plea for suitable replacement components, notably John G8DET and Colin, G0TRM and I was able to start fault finding. After replacing the components, I still couldn't get a handle on the fault and measuring the in-circuit voltages was proving difficult with a 20kΩ/volt meter. Luckily, I realised that an elderly Hi-Z DMM that I rarely used actually had a suitable voltage range and I set about making those measurements. I was gingerly poking about in the circuit, not knowing the breakdown potential of the test leads I was using, when the vibrating reminder alarm on my phone went off in my pocket. I nearly sh@t a brick. It reminded me of when we were at work and an unkind soul would creep up behind you and clap loudly, or drop a book during a particularly delicate measurement...

Anyway, the symptoms then pointed to the modern, high value metal film resistors and, sure enough, one of them had gone open as well. (Yes, I know, I should have unsoldered and checked them *both*). After replacing that, I was half way there. Normality was nearly restored. I found a quiescent control had to be adjusted to provide acceptable performance. I have no idea why it had been adjusted so far from the desired position; maybe it had something to do with the altered component values and extra 330k component. The owner was pleased and I was glad to have been able to finally puzzle it out. - **Ed**.



**National Hamfest:  
Where was everyone?**

