Chelmsford Amateur Radio Society

Newsletter

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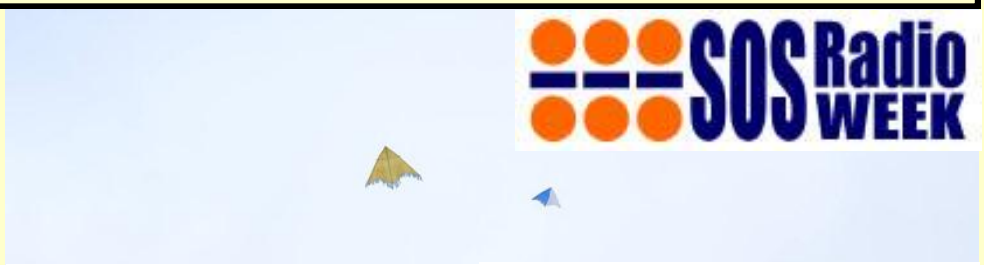
Next meeting: 2nd Feb - 7.30pm, Oaklands Museum

'Satellites' - Steve Hedgecock, M0SHQ

Inside this issue:



Club Nets - Tuesdays 20:00h
Net Controller: TBD

#2 - GB3DA	9th February
#3 - GB3ER	16th February
#4 - 80m 3.756MHz	23rd February
#5 - 160m 1.947MHz	n/a

Essex Ham Net
Mondays 20:00h GB3DA

Contact details for the newsletter: editor@g0mwt.org.uk

Editorial

Hello again, and welcome to the latest edition of this newsletter. Next month will see the 600th issue and we hope to make it a special one, so please let's have your reminiscences and anecdotes from the past years that the club has been in existence.

What pictures do you have in your archives? Do they tell a story, or reinforce one you may have to tell? If so, then how about sending me some copy and let's get it into print. If you only have hard copy, then a scanner can work wonders. If you don't have a good scanner, surely someone in the club will be happy to copy something off for you.

My last editorial was entirely tongue-in-cheek but I was absolutely delighted to receive an email from John, G8DET that was forwarded, in turn, from Peter Chadwick, G3RZP. It goes to prove that there is nothing new under the sun and extracts are copied below in an item on conductive inks and other themes, that proves being an engineer is not always the geekish, boring, nondescript life that the public sometimes perceive it to be.

Trevor, M5AKA also got in touch and went some way to answering my question as to what the DAB vs. FM energy equation is. "*As I recall, DAB is energy inefficient at both the transmitter and the receiver. The modulation used means that a very high degree of linearity is needed in the TX (far more linear than amateurs use for SSB). I forget the exact figures but the PA is something like 40% efficient for DAB as against 70-75% for FM. DAB receivers can consume up to 8-10 times the power of an FM RX.*"

Membership Expiry

This month, those who haven't paid their subscription renewal will be without their newsletter. If you know anyone who hasn't received theirs, then please let them know the reason!

A recruitment success?

Nick, M0NIB popped up on the Essex Ham net to say that his son Adam had asked for an electronics kit on the strength of using the CARS kit at the Museum of Power. He is now an enthusiastic user of his Christmas present! Chris did a good job at that event… ***Ed.***

Dates for your diary

Please note, the dates may be subject to change...

Tue. 2nd February	Meeting - 'Satellites' - Steve Hedgecock, M0SHQ - Getting started in Amateur Radio satellites; a beginners guide, covering FM Satellites and APRS via the ISS .
Sun. 7th February	31st Canvey Island Radio & Electronics Rally, Long Road, Canvey, SS8 0JA
Thu. 11th February	Foundation mock exam at Danbury Village Hall
Sun. 14th February	Harwell (HARS) Rally, Didcot Leisure Centre, Mereland Road, Didcot, OX11 8AY from 10.00am-3.00pm
Mon. 15th February	Skills Night, Danbury Village Hall
Thu. 18th February	Foundation Course Exam at Danbury Village Hall
Sun. 28th February	Brainham BRATS Radio Rally, Rainham School for Girls www.brats-qth.org
Tue. 1st March	Meeting - Advertised planning talk postponed. Details of new talk in next issue.
Mon. 21st March	Skills Night, Danbury Village Hall
Tue. 5th April	Meeting - '2MT Writtle - The Birth of British Broadcasting' - Tim Wander, G6GUX
Sat. 23rd April	GX0MWT - Operating at Sandford Mill for International Marconi Day

Electrically conductive inks

Peter Chadwick, G3RZP *wrote the following (slightly edited) pieces:* Thanks for the CARS Newsletter, and this might be of interest. The concept of electrically conductive tattoo inks was something I investigated over 10 years ago, and the difficulty is bio-compatibility. You may ask why I was interested...

Back in the 2002-2011 years when I was working in the Ultra Low Power Group at Zarlink Semiconductor (previously Mitel Semiconductor, previously GEC-Plessey Semiconductors, just Plessey Semiconductors before that and now Microsemi) I was doing systems engineering design on a integrated circuit transceiver covering 401-405MHz for the Medical Implant Communications Systems - MICS - which we were working on at Zarlink. With an allowable ERP of -16dBm, a tattooed antenna on the body would be a great help. We looked at quite a few possibilities for implanted antennas and gave BAe at Baddow a contract for some work, which was carried out by Alan Boswell, G3NOQ. What pacemaker manufacturers currently use at 400 MHz is a small loop: the total of antenna 'gain' and body loss at 400MHz is about 35dB or so (that's a plus or minus 10dB!) Because of battery impedance in a pacemaker - which is high to limit possible fault current - the maximum RF you can get is around 1mW and, as the loop is at best around -10dBi, a better antenna would be very useful.

The device has proved successful and is in pacemakers by St Jude Medical, while another similar device is in Medtronic pacemakers. There is also an ETSI standard for using the band 2480-2500 MHz. The Zarlink chip used by St Jude had contracted GM3SEK with writing the application note and GW4ZVL as part of the evaluation team at Caldicot... other evaluations were done using pigs at a facility in Sweden. Interestingly, a loop implanted to give vertical polarisation when near the surface gave greater horizontally polarised signals as the implant depth was increased. This is not an activity, however, for the squeamish, so what is needed is a high conductivity, flexible and bio-compatible tattoo ink... which needs to be able to last up to 20 years.

As an aside, when a query was received from Australia about the use of the chip in electro-stimulators for erectile dysfunction, you can imagine the comments from the engineers.....especially on the effects of QRM! It did get used in some applications in spinal stimulation for paraplegics allowing, in at least one case, for the patient to be able get out of a wheelchair and take a few steps.

So there's an application just waiting for chemist and biologist to come up with the answer!

John, G8DET replied: I am aware of implanted things in chests because my great friend in Cheltenham, the late Robin Harvey, G4BBR's wife in Cheltenham had a defibrillator in hers. Shirley said she had never known it to actually "go off" but it did regulate her heart. Robin was the Clerk of Works for the MOD STRAD installation at Boddington, near Gloucester – he then moved to GCHQ in the later 1960s and was on the design team which produced the Doughnut in Cheltenham before he died of cancer.

Shirley's was put in when they were quite new in Oxford. A few years ago they went on a cruise all around the Baltic and when they came back there was a letter requesting Shirley to have the battery changed. When she was opened up they found a wire had fallen off – goodness knows what would have happened if this had occurred while "at sea" and she was taken ill. (*Comments about IEE snipped - Ed.*)

And Peter replied thus: I'm an IEEE Senior Member, for what that's worth. I'm now retired and past it all, although I am now Chairman of Royal Wootton Bassett Age Concern and not quite sure why!

Plus (very proud here, shirt buttons straining!) I now have the plaque for DXCC Honor Roll #1 spot, with all 340 current DXCC entities worked and confirmed!

Pleased with that attainment in 2015 with K1N Navassa for the final entity.....52 years after starting DX chasing!

It was interesting doing work on medical implants. I was also Chairman of ETSI ERM-TG30 group, in charge of standards for 'Wireless Medical Matters' from 2007 to retirement in 2013, but a number of the actual measurements we made were definitely not for the squeamish, although I must admit that doing the measurements involved in one paper from Belfast University on propagation from a female reproductive implanted transmitter might have been more than just interesting!

It's good to have news from around and about. ***Ed.***

Tuesday 5th January Meeting

The meeting with the usual notes and pleas for help at the next CARS event, which was the RNLI SOS Radio Week event at the Marconi Sailing Club near Steeple.

Then John, G8DET took the floor to talk on an issue with fuse boards and the material it was made of and a letter he sent to IEE that got published in their E&T magazine (for more on this please contact John).

Meteor Detection using 2m Amateur Radio - Peter Meadows, M0ZBU

Peter opened his talk on meteor detection using 2m amateur radio by giving an overview of the talk with some terminology and facts about meteors. A meteoroid is a small rocky or metallic body travelling through space and a meteor, or "shooting star" is when a meteoroid enters our atmosphere (irrespective of its size from a grain of sugar, or larger). If it gets to the ground without burning up in the atmosphere it becomes a meteorite. On the way down, if the "shooting star" is brighter than magnitude -4 it is termed a "fireball". Meteors can be random in the earthbound direction or, depending on the time of year, emanate from a specific part of the night sky. Meteor showers are associated with comets. In October the Orionids emanate from the constellation of Orion and are the debris field from Halley's Comet; the Leonids, emanating from the Leo constellation, are from the Comet Tempel–Tuttle. The December Geminids are from asteroid Phaethon and emanate from the Gemini constellation.

The zenith hourly rate (ZHR) is the number of meteors seen for a single observer if the radiant were at the zenith in a dark clear sky.

Shower	Activity	Maximum	V km/s	ZHR
Quadrantids	Dec 28–Jan 12	Jan 04	41	120
Lyrids	Apr 16–Apr 25	Apr 22	49	18
η-Aquariids	Apr 19–May 28	May 05	66	40
Dayt. Arietids	May 14–Jun 24	Jun 07	38	50
S. δ-Aquariids	Jul 12–Aug 23	Jul 30	41	16
Perseids	Jul 17–Aug 24	Aug 12	59	150
Orionids	Oct 02–Nov 07	Oct 21	66	15
Leonids	Nov 06–Nov 30	Nov 17	71	15
Geminids	Dec 04–Dec 17	Dec 14	35	120
Ursids	Dec 17–Dec 26	Dec 22	33	10

Main Meteor Showers 2016 (ZHR > 10)

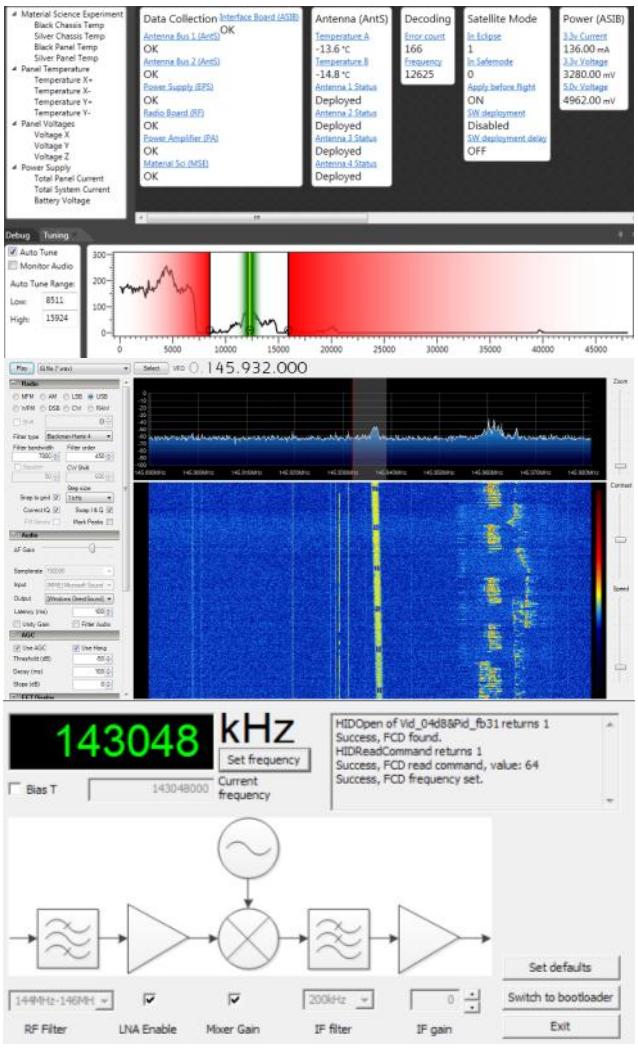
Now to the radio bit. When a meteor enters the atmosphere at speed, friction heats/burns the meteor producing a streak of light and leaving an ionised trail in the atmosphere which enables radio waves to be reflected off it. The radio reflections can be used to determine the relative size of the meteor strike (its amplitude) and the relative approximate speed and deceleration (amount of Doppler shift and frequency width). Some radio amateurs use this as a communications mode (meteor scatter), but that propagation mode was not the subject of this talk. Peter then described the method of utilising distant known radio transmitters; in this case, one of two that are reliable from the UK, the BRAMS system at 49.97MHz and GRAVES at 143.050MHz. The BRAMS (Belgian RAdio Meteor Stations) is a network of radio receiving stations. A dedicated beacon was installed in September 2010 in Dourbes (south of Belgium). It emits a CW circularly polarised signal at a constant power of 150W. The GRAVES system is used for the tracking of satellites and space debris. It is located near Dijon in central France. Its transmitter points south and, for its intended use, the receiving station is located 360km to the south. This transmitter is the one Peter uses as the radio source for his observations.

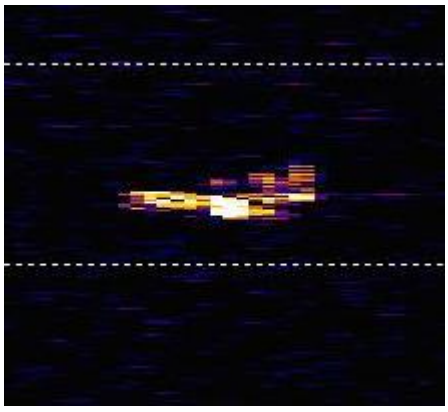
The antenna used for the observations was described next and Peter showed his home constructed 3 element Yagi, for which all the parts were obtained from B&Q and made to dimensions taken from an article in the Sky at Night magazine.

The antenna needs to be mounted 3 meters above the ground and away from RFI. As to the polarisation, that is best assessed on the background QRM (minimum noise) received on installation. The antenna will need to point towards Dijon with an upward tilt of 10° and azimuth of about 145° (SE).

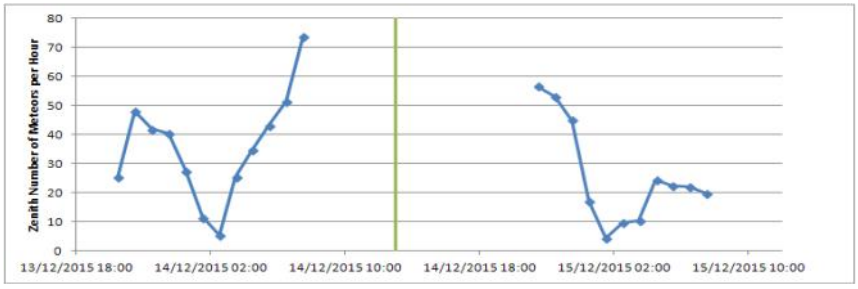
On the receiver side, the FUNcube dongle and SDR# software were used to receive the meteor reflection. You will not hear the GRAVES Tx unless there's a meteor, so testing the receiver is best on the FUNcube-1 / AO-73 satellite which was launched on 21st Nov 2013. Listening on the TLM beacon at 145.935 (300mW when in sunlight) or the transponder at 145.950 to 145.970 MHz, or any 2m beacon. Care should be taken with siting the FUNcube dongle and PC/Laptop; some distance between both is a good idea for RFI purposes.

SDR# is used to display telemetry and transponder signal. FUNcube dashboard software used to decode telemetry. Once tested, Peter went on to show how Meteors looked on the waterfall display and how to set the frequency of the FUNcube Dongle. For the GRAVES a frequency 2 kHz below the transmitter frequency is set. Also Peter uses Spectrum Lab to display received audio from the SDR# showing time a frequency.

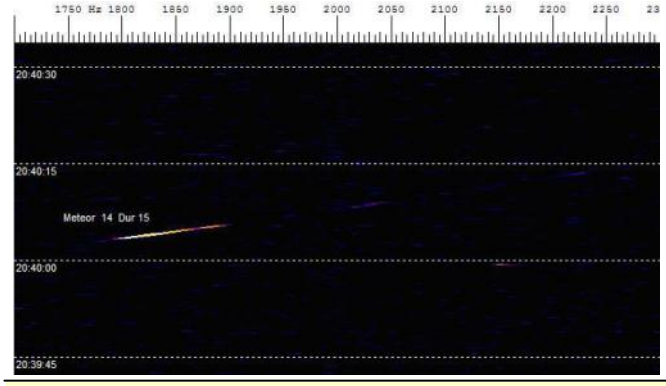




Example taken 14th/15th Dec

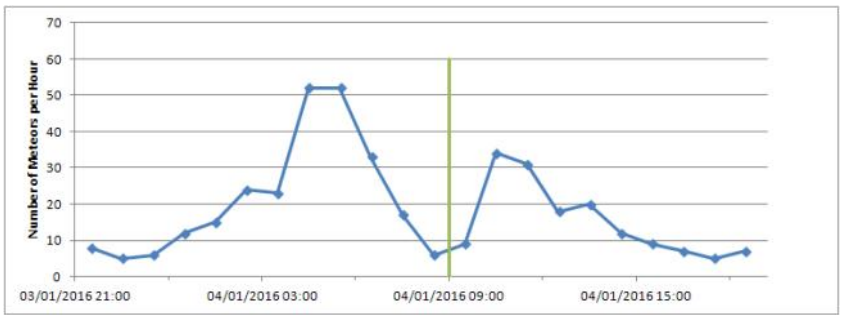


Some representations of the acquired meteor detections.

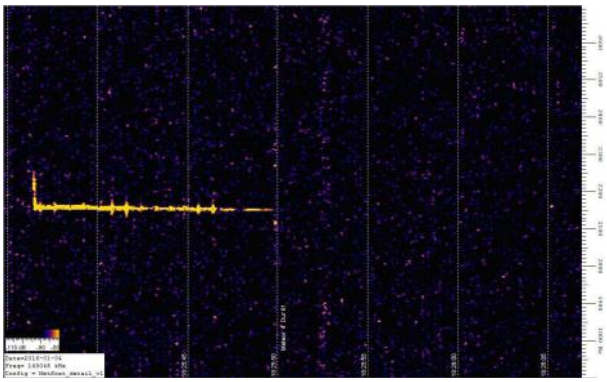


On the left is the International Space Station as seen using the meteor detecting system.

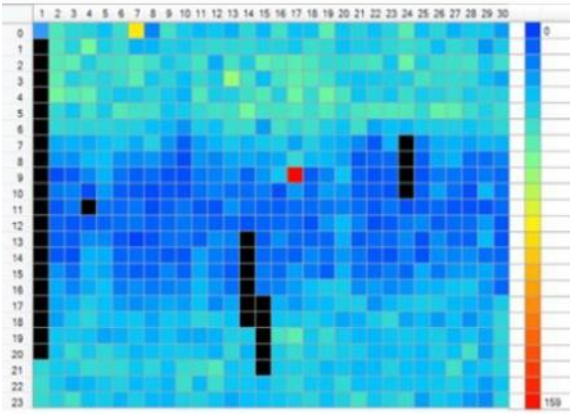
Peter then showed his results of the Quadrantid meteor shower, peak predicted for 4th January 2016 at 07hrs UT from a radiant at 88° at 08hrs and 10° at 20hrs UT and receiving 405 meteors detected from 21 hours of observation.



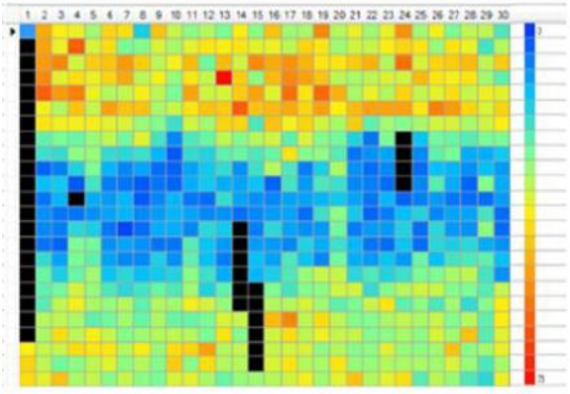
Some interesting examples of the meteor pings received for the Quadrantid meteor shower this year. Other objects can also leave a trace on the display; the moon is one, along with other airborne objects (aircraft, satellites etc.) including things that defy explanation, as yet.



Recording this info for long term reference is achieved using a program called "Scatterthon" which is used to clean and normalised the Radio Meteor Observing Bulletin (RMOB) colour plots



Data before Cleansing



Data after Cleansing

Peter then went on to describe optical techniques for observing meteors. He uses an astronomy camera from The Imaging Source for taking still images of the night sky with 10 second exposures. Images are taken sequentially almost without any time gaps, with the data from the camera fed back to a shed based laptop, that monitors the time and shuts the system off before dawn, thereby saving the camera from excessive light. One issue that came to light was misting of the lens in the cold. This was overcome by a home made dew cover, which is attached to a 12v mains transformer - also inside the shed. With this system, Peter can achieve 3000 images in a night; each 1Gb is size and, hopefully, a few bright meteors captured as well.

As can be see from the pictures overleaf, Peter has had great success on the stills front. He went on to elaborate on the use of video cameras such as the monochrome Watec 902H2 Ultimate. These operate at 25 frames per second generating ~3GB/hr and are housed cameras with demisting heaters and are much more sensitive, recording more meteors. It is also possible to tell the composition of the meteor by looking at its spectrum.

2010-08-11 00-42-49 to 00:46:04 UT

2010-08-18 23-30-46 UT

Peter concluded his presentation with an event that he recorded in the Leonid Meteor Shower; he captured a "Fireball" on both radio and optical systems.

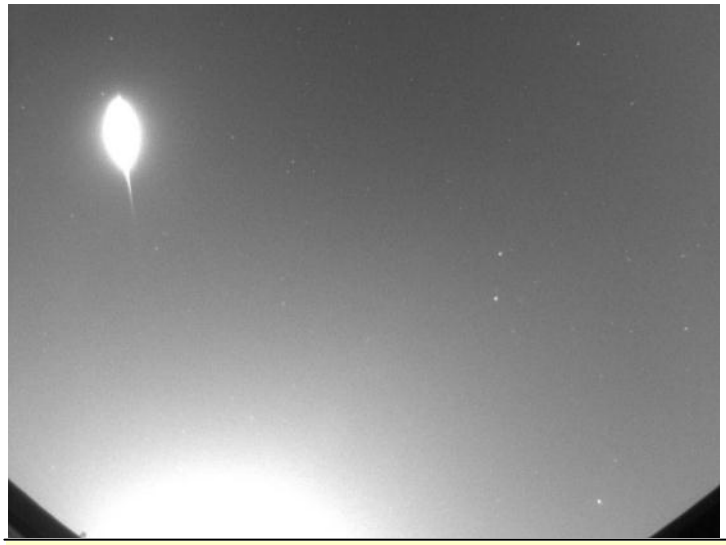
Question time then followed and some discussion on the anomalous signals that have been received from behind the antenna system's favoured direction and whether any one else has had a go at this method of observing meteors. Several of the audience indicated they had. Personally, I have had a go back in the 80's on 6M (GB3ANG) / 4M (Gdansk FM Radio Station) as the radio source. It was interesting to listen to, but I never ever thought of the technical aspect that Peter has applied to this interesting phenomenon.

All in all, a very technical presentation delivered in a pleasant, relaxed and easy to understand way.

2010-12-15 05-30-23 UT (Geminid)

Many thanks to Peter, M0ZBU for the informative meeting.

Chris, G0IPU



Leonid fireball path

Web Links

Information on meteroids: https://en.wikipedia.org/wiki/Meteoroid

GRAVES: http://www.onera.fr/dcps/graves/

BRAMS: http://brams.aeronomie.be/

Sky at Night Magazine article: http://www.britastro.org/radio/downloads.html

FUNcube satellite: http://funcube.org.uk/

Satellite overpasses: http://www.heavens-above.com/

SDR# free software: http://airspy.com/download/. Recently been upgraded to use .Net 4.6 and so not applicable for older operating systems (see http://www.rtl-sdr.com/tag/sdrsharp/)

FCD+ Frequency Control Program: http://www.funcubedongle.com/?page_id=1225

Spectrum Lab: http://www.qsl.net/dl4yhf/spectra1.html

RMOB Colourgramme Lab: http://www.rmob.org/download.php?lng=en

Scatterthon software: email info@radioastro.org.uk

Network for Meteor Triangulation and Orbit Determination (NEMETODE): http://www.nemetode.org/

UK Meteor Observation Network: http://www.ukmeteornetwork.co.uk/

UK Radio Meteor discussion board: http://www.radio-space.co.uk/forum/

International Meteor Organization: http://www.imo.net/

Peter, preparing for the well received marathon slide show.

And being modestly and, perhaps, slightly inadequately rewarded for his efforts

Ed.

How to they do it?

Chemists do it periodically on the table
Mathematicians do it by numbers
Astronomers do it in the dark
Planetary scientists do it looking at Uranus
Radio amateurs do it in shacks, and
in sheds
in bedrooms
in living rooms
in kitchens
on hilltops
in muddy fields.
on seashores
on islands
with friends
in public
with enthusiasm
until it Hertz
And, in some cases, for a very long time...

Medium Wave Shutdown

John, G8DET sends this newsletter to several other clubs and societies and one of those he receives in return, via Trevor, M5AKA is the South Dorset Radio Society's "CATsWHISKER" (sic) and the January edition contained the following information:

"AM has fallen silent across Europe as engineers in France, Germany and Luxembourg turned off most of their Medium Wave signals at midnight on New Year's Eve.

Deutschlandradio closed down its seven Medium Wave transmitters; and Radio France, France Info, France Blue RCFM and France Blue Elsass all went off. RTL also turned off the famous 1440 (208m) Luxembourg apparatus. In the UK the BBC is also gradually shutting down its power-hungry BBC local radio AM transmitters and hoping no one will notice."

The end of an era, eh? ***Ed.***

RSGB long service members

I have scanned the February RadCom and found the following. Have I missed any?

69 year (70 in Feb this year) Brain Thwaites. G3CVI.
65 Ken Dews. G3PMW.
60 John Greenwood. G3KRZ.
58 Dave Penny. G3PEN.
57 Prof Les Barclay. G3HTF.
55 Willy McClintock. G3VPK.
53 Carl Thomson. G3PEM.
52 Peter Chadwick. G3RZP.

57 I have also noted an ex-Chelmsford man – Peter Blair, G3TLF, the original Moonbounce man.

Congratulations to all. **John, G8DET**

Battery check?

We've all seen it happen, haven't we? Forget to look at the batteries and then find a festering mess, as **Colin, G0TRM** did. I have found that ACF-50, a product I used on my motor bike, has proved very useful in combatting this, and other sorts of corrosion.

The manufacturers say that ACF-50 actively displaces electrolytes that cause corrosion (e.g. water) and contains no waxes, resin, silicone or Teflon; in fact *NOTHING* that will gum up or detune anything and that it can safely be used on sensitive electronics. "*The thin Fluid Film chemistry penetrates corrosion deposits where it chemically emulsifies and displaces the electrolyte. This isolation process keeps the corrosion cell deactivated*". It can last for up to two years if it isn't actively removed (e.g. by heavy weather etc.)

It also creeps like nobody's business and displaces water from multi-strand cables and coax braid, so will get to the unreachable corners eventually—so that's handy! Coat your connectors before assembling... Bought in aerosol spray cans, It ain't cheap (~£17 for a 13oz. can on Amazon), but you use it very sparingly indeed, so it lasts for ages. Look up this YouTube ACF-50 demo and judge for yourself. ***Ed***.

Clive Ward, G1EUC SK sales

Sale items still remaining are listed below. If you are interested in any of this equipment, then please contact Murray Niman, G6JYB at: enquiry@g0mwt.org.uk

Manuf'r	Model	Description	Type	Comments	Price
AKD	6001	6m FM Mobile	Radio	Rather basic – inc. mic	£20
Kenwood	TM-251E	2m Tx, 2+70cm Rx FM Mobile	Radio		£40
Kenwood	TM-431E	70cm FM Mobile	Radio		£40
Alinco	DX-70	HF+50MHz Transceiver	Radio	Inc. EMS14 desk microphone	£200
Eimac	4CX250B	250W Valve	PA-Valve	Inc. Eimac box	£20
Eimac	4CX250B	250W Valve	PA-Valve	Inc. Eimac box	£20
Selectron	PL519	HF linear amplifier valve	PA-Valve	Inc. box	£10
Selectron	PL519	HF linear amplifier valve	PA-Valve	Inc. box	£10
Watson	RC1001	1.6-6MHz 3kW SWR/Power meter	Meter	N.B. 6MHz freq. limit	£30
Hansen	FS-700H	1.8-60MHz SWR/Power meter	Meter		£20
Yaesu	FT-230R	2m FM Mobile Transceiver	Radio	No NBFM/CTCSS	£20
Yaesu	FT-730R	70cm FM Mobile Transceiver	Radio		£20
Yaesu	FT-480R	2m All-Mode Mobile – 10W	Radio	No CTCSS etc.	£30
Harvard	420 M	CB 27/81 – FM	Radio	CB	£15
DNT	M40FM	CB – FM	Radio	CB	£15
Alinco	ALR-72E	70cm FM Mobile Transceiver	Radio	Inc. mic	£30
Icom	IC-255E	2m FM Mobile Transceiver	Radio		£20
DCI	DCI-145-2H	2m Bandpass filter	Filter	May be held in reserve	£40
DCI	DCI-435-10C	430-440MHz Bandpass filter	Filter	May be held in reserve	£40
Videologic	DRX-601E	DAB HiFi Stereo Tuner	Tuner	Good condition, inc. remote	£20
?	PG-753	Satellite Finder Kit	Misc		£5
Bremi	BRS-27	3A Power Supply	PSU	Working	£4
E.Mon?	?	3A Power Supply	PSU	Broken mains switch	£2

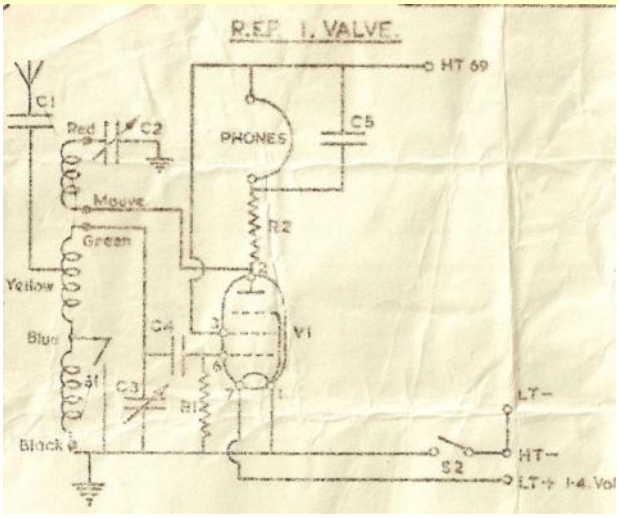
Up for grabs

I have three Ikea white tabletops that I no longer need. Two are 120cm x 60cm and one is 100cm x 60cm.

They were used together as an L shaped bench in my shack, but are now no longer required. One of the larger and the smaller had a Contiboard edge attached with screws to hold mains extension leads and to stop things falling off the back, so there are about 4-5 holes in one longer edge of these but, other than that, they are pristine as they have always had a protective cover on the tops. The Contiboard is also available. Suitable legs are available from almost any DIY place, but Ikea do adjustable ones that are cheap, robust and adjustable. The table tops are pre-drilled for these.

If you are interested in these items, then contact Steve, G4GHO at editor@g0mwt.org.uk. Donations to club funds, please.

The Repanco REP 1 One Valve Radio



Most domestic receivers in the early days of broadcast radio had a short-wave band in order to listen in to the foreign stations such as “Voice of America” or “Radio Moscow”. I used to listen in on my parents’ Bush radio in the fifties. The communist Eastern European countries like Bulgaria were very keen to communicate with western listeners and were at great pains to send QSL cards on receiving a signal report. In the course of this I discovered the amateur radio bands with all the different call signs. As the sunspot activity was at its height, DX stations could easily be heard on a long wire aerial on twenty metres. Nearly all of the transmitters were AM, there was a lot of morse and a very few experimenters were using SSB.

This leads me to the title of this article: the Repanco REP 1 one valve radio. Later in life after the radio was long gone and the internet had arrived, I wondered if it would be possible to find out details of this long forgotten radio. I couldn’t even remember the name but very quickly, after a search for one valve radios, there it was - including pictures and all the construction details; this bought all those long forgotten memories back.

I bought the radio as a kit from the “Home Radio of Mitcham” shop by mail order. A postal order (remember them?) for thirty three shillings and six pence (33/6 = £1.67$^1/_2$) plus postage was posted off and it arrived in time for my birthday. Now; how to solder? I lived in an area on the Ayrshire coast where there weren’t any radio amateurs that I knew of, so I bought a soldering iron and multicore solder at the local hardware shop. Construction went smoothly thanks to good instructions and, amazingly, it worked. Using some ex-army surplus headphones, I could easily tune into the medium and long wave bands using an outdoor long wire aerial from my bedroom to the tree at the bottom of our garden.

This radio had sold in the thousands in the fifties and I suspect many of the older radio amateurs started out building this set which sparked off their interest in amateur radio - and maybe even going on to a career in the industry itself.

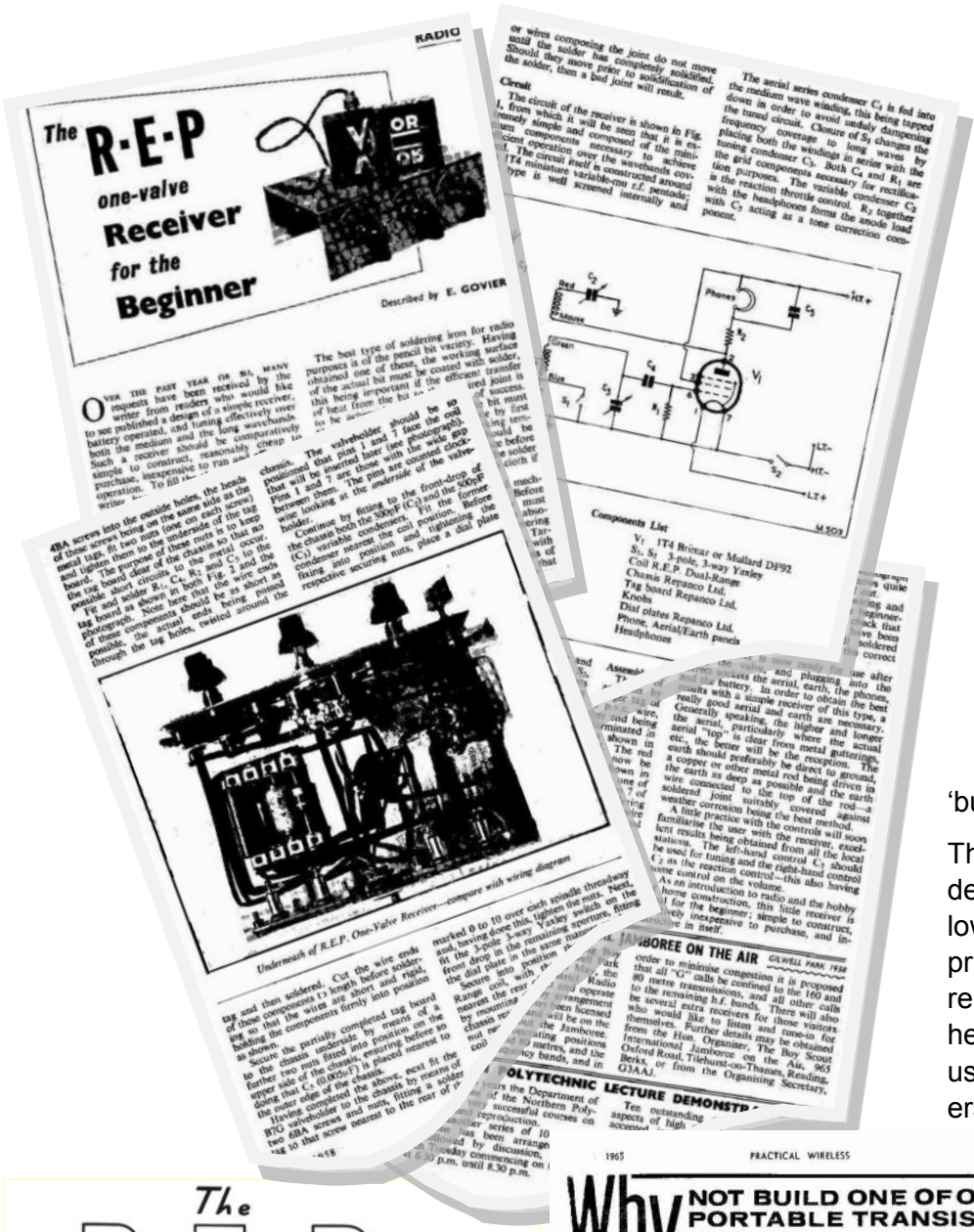
The Repanco Company is still trading as Repanco Bartlett, making high quality components for the electronics industry and can be found at www.repancobartlett.co.uk.

Details of the Repanco one valve radio can be found on the website www.vintageradio.me.uk/kits/kitnav.htm.

Just as an aside, I searched on the Google photo site for REP 1 and it came up with a picture of my QSL card. This puzzled me, until I realised I had mentioned this radio on my QRZ page, proving Google’s search engine moves in mysterious ways.

Oliver, M0WAG

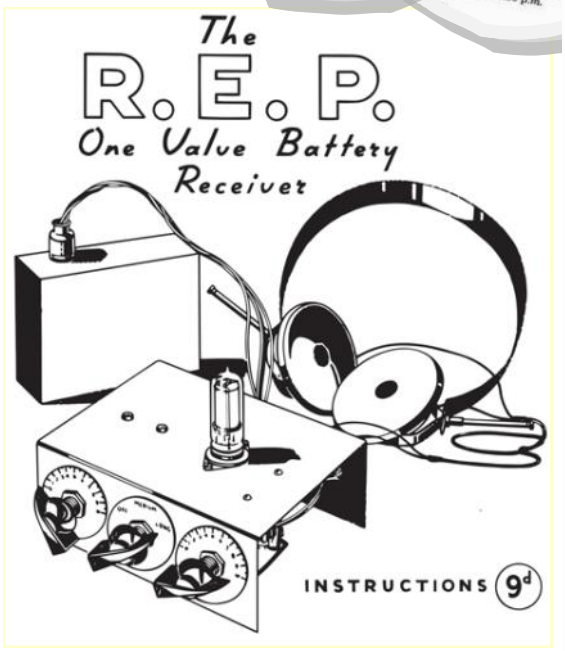
No sexism there, then?



Ah—those happy days when we built stuff for next to nothing and the performance was on a par with the price. In my case, I pored endlessly over the adverts in the electronics magazines that were in vogue.

I remember those Sinclair kits and the 'straight' sets from Radio Exchange in Bedford. Absolutely appalling, those sets were. The Pocket Five had a cheap plastic case with a chrome speaker grille. The coils were wound on wooden dowel and the chassis was a bit of folded cardboard which the circuit had to be pasted over. You punched holes in the 'chassis' and inserted 'bus bars' and folded them over.

The components were then soldered to these bus bars by following the component outlines printed on the chassis layout. I remember the advice to shunt heat from the transistor leads by using a pair of snipe nosed pliers, or applying a wet rag!



I don't think we ever got as much as a squeak from the one that a friend and I built.

I had some success with one of the Sinclair Micromatic radios though. Powered by button cells and using a crystal earpiece, it was tuned with a compression trimmer!

Ed.

Several intrepid CARS members went along the the Marconi Sailing Club on 23rd/24th January to take part in the RNLI SOS radio week (end). Saturday morning was gloriously sunny and if I could have chosen to have gone along then, I would have.

By going along on Sunday, I missed the kite flying, but at least the Social Club's heater, which hadn't been functioning the previous day, was brought back to life and the temperature inside the premises was eventually raised above the outside temperature!

It was an interesting day. It was the second time I had experienced the Club's Comet CHA-250B antenna and again it proved reluctant to perform adequately. Originally installed at the Club at about 4m off the ground atop an aluminium pole, the background and electronic noise level was at a constant S5-S6 on the bands where any useful signals could be heard. Eventually, it was brought down to ground level and a 1.5m length of pole was unceremoniously plonked into the soft soil adjacent the club house.

This brought the noise levels down and the signal level up (it wasn't just imagination) but it still proved difficult to get out with, although perseverance saw several RNLI special event stations being worked and entered into the log.

It had been thought that the vertical, as close to the water as it was would give a better account of itself, but it was a little disappointing not to be a bigger signal on the band that we apparently were.

It was resolved to look into a better means of providing multi-band operation at future events of this kind and to employ a remote ATU to match a long wire.

Actually, there is no reason why a simple fishing pole vertical antenna should not give a better account of itself with a remote ATU as the losses would be lower. A 10m pole is longer than the CHA-250B, lighter and easier to erect and support. Poles up to 20m are available from SpiderBeam and it would be interesting to try one of those for portable use. In calm conditions they are self-supporting, but I believe they do a guying kit for rougher conditions or for more permanent installations.

Let's see what 2016 brings… ***Ed***.

Thought for the day

If your nose runs and your feet smell, it's probably because you've been made upside down...

Antenna query

At the January Skills night, my RigExpert AA-600 analyser was being used by several people whilst they were checking and optimising their 2m Slim Jims. A question was raised: "How could you use this to measure a long wire?" My answer was to pull out a PL259 adaptor that had a couple of small fly-leads and croc-clips attached (picture overleaf).

Next question: "With one lead on the antenna, what do you do with the other lead?

Answer: "Connect it to your ground system".

"But I use an ATU"

"Well, that must be connected to ground"

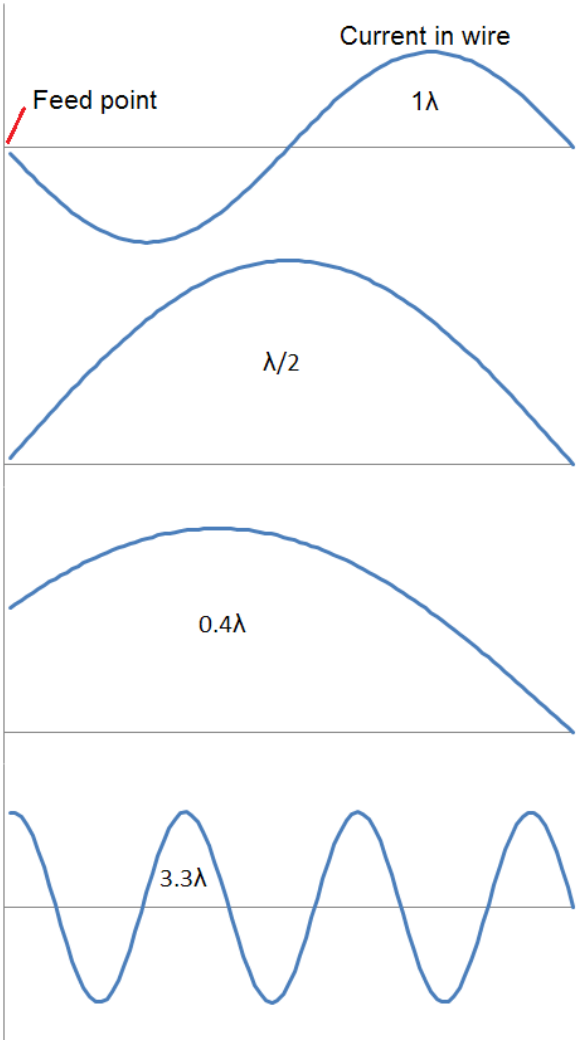
"No, it's connected to the transmitter!"

"But the Tx is connected to ground"

And so on...

The upshot of this conversation was that the questioner would welcome a publication that told him how to assess and understand what the impedance of the antenna he had erected actually was. Anything he found was either too technical or just "cut it to this length" without saying why the length had to be used. I can't help with calculation either—it would involve too many variables. In the short time available and with no presentation materials to hand, it was difficult to make a simple case and I suggested that I might try an outline explanation in this newsletter.

So, here goes…



Imagine that you have a long wire. Ignore the fact that it might be (probably is) electrically short on the lower HF bands; all you want to do is match it to your Tx.

Imagine also, that the wire is free at the far end—i.e. not loaded with anything. The impedance seen here will always be high, as currents in the aerial will have nowhere to go except into the æther, This means that the impedance at the driving end (feed point) will be whatever is dictated by the length of wire and frequency of measurement.

The four diagrams at the left show a piece of wire that is excited by four different frequencies. Those frequencies are irrelevant except for the fact that two of them show a high impedance at the feedpoint, and two show intermediates. If the wire was multiples of λ/4, the current would be at a maximum. Anything else is going to have a higher impedance, be it a net capacitive or inductive reactance.

If you wanted to measure the impedance at that point, you would have to insert your impedance meter/antenna analyser Take the case of the AA-600. Like all such modern digital instruments, this is basically a DDS to generate the frequency into the load and an accompanying SDR to measure the reflected signal.

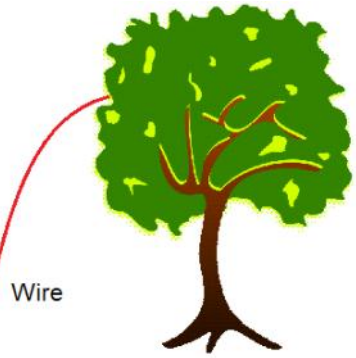
The instrument is equipped with a coaxial output and that can be converted to a long wire or twin feeder by the addition of some croc-clips or a 4mm banana plug adaptor shown overleaf. Not exactly sophisticated, and won't win any prizes for precision, but it's good enough to give us a guide as to what's happening.

Now if you connect the long wire to the "live" terminal of the analyser and measure whatever quantity you wish,

the chances are that you would see a hopeless SWR, representing a high impedance at pretty much every frequency you choose to measure.

The reason for this is that the analyser body is electrically very small compared to the wavelength and does not have the capability to act as a counterpoise to the long wire.

The resulting measurement will then only show the high impedance of the small “counterpoise” in series with the long wire impedance. Not so good...



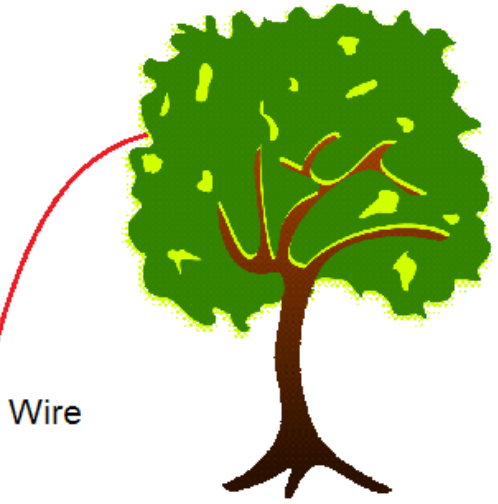
So: how to fix this? Simple. Just connect the other end of the analyser to ground. And what constitutes ground? Well, the ATU may, or may not, have a ground stake connected and you may have a radial or counterpoise available. Either way, there will be a mains earth (but that will have an indeterminate, high impedance). You would think that it would be OK to just connect the analyser between the antenna wire and the counterpoise alone. That would give you some results, but only for the antenna in isolation.

The body of the analyser is plastic and the electronics is contained only on a small PCB. The only connection to ground is via hand capacitive coupling to your body, or to whatever the analyser is resting on.

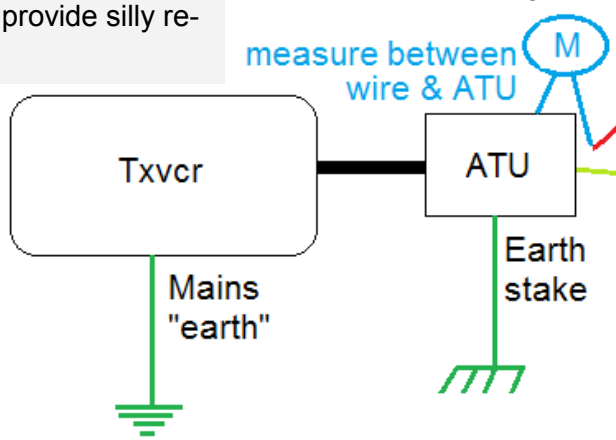
This would provide silly results.

When you connect the ATU to the antenna, the counterpoise will then be connected in parallel with both the earth stake (if one exists) and the mains earth. For it to be meaningful, the ground return of the analyser should be connected to the RF system ground as the ATU sees it.

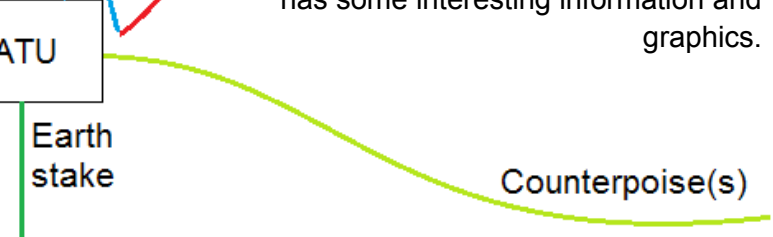
This will change the antenna impedance seen by the analyser, but it will now reflect the true operating impedance.

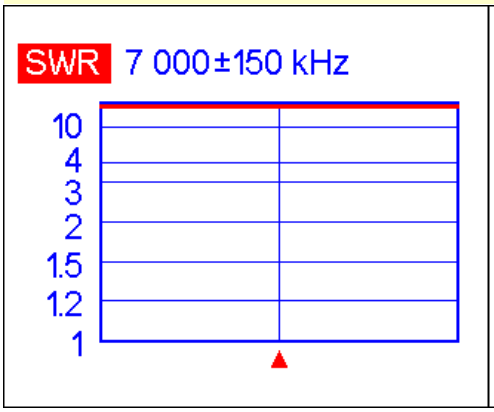


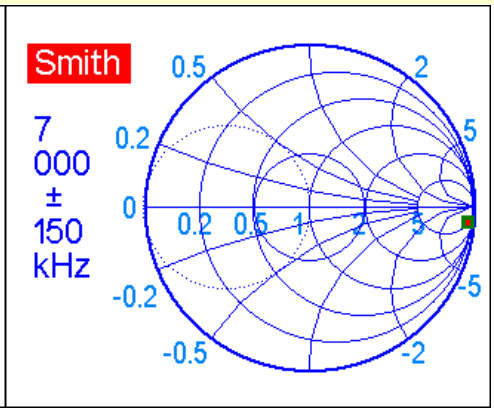
See over for reasoning:



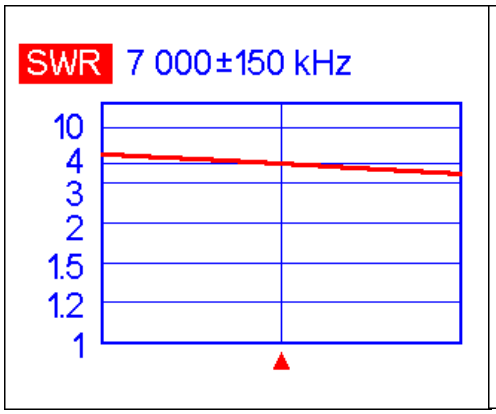
http://udel.edu/~mm/ham/randomWire/ has some interesting information and graphics.

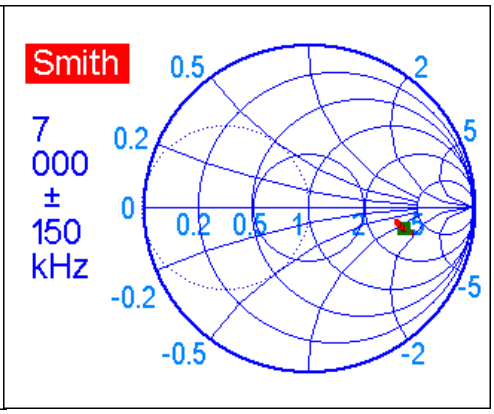






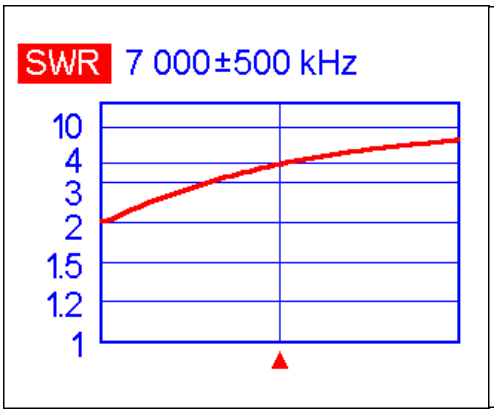
Take an example of my 10m fishing rod vertical. Actually, it's about 10.5m long and a short distance off the ground, so, say about 11.5m to the tip. If I wanted to use it monoband, I could cut it so that it resonated at 40m, but it is what it is, and an unknown impedance. Connecting the analyser to the antenna alone and resting the instrument on the ground, the result is that it is high impedance and capacitive at 40m. This shows the effect of the analyser's poor 'ground' in series.

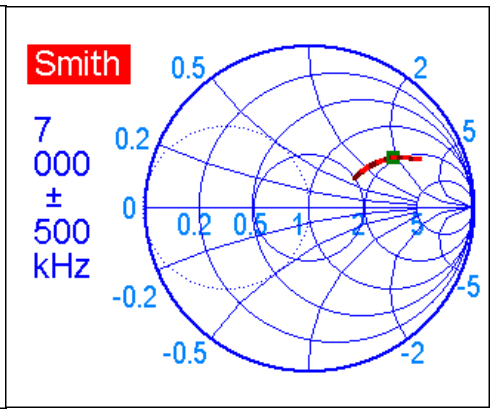




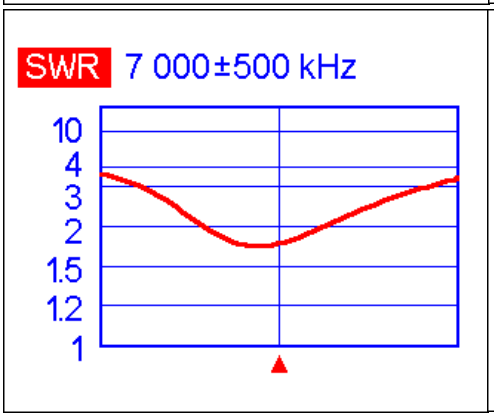
Connecting a piece of wire of similar length to act as a counterpoise, we get the data at left, which says that it is still capacitive, but slightly lower impedance. This suggests that the counterpoise is all but useless.

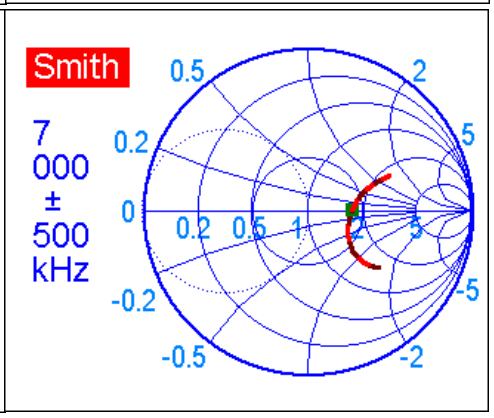
The Ae.wire is too long and so should be looking inductive, so is the counterpoise too short?





Now connecting the counterpoise to the ground system, which comprises 8 metposts holding up my pergola and daisy chained in a "U", the result is as left; here, the ground is overriding the counterpoise and revealing the true antenna length as being inductive. So far, so good, but still Hi Z...





And finally, connecting a series capacitor to the antenna wire, we get the sort of impedance we would expect from the vertical wire. It ain't perfect, of course, with the ground impedance in series, but the present environment will not allow perfection anyway. We don't actually know what the ground impedance is, and all the rain we've had recently will have helped lower the Z, but you can bet your sweet bippy that it will change (a lot) in the summer! Of course, the ATU will just attempt to match whatever impedance it 'sees', but this shows that what the analyser is measuring against, has a significant bearing on the results you will obtain and shows a good reason why attempting a calculation is at best optimistic and, often, pointless. ***Ed***.

Galleywood gathering II

I went along to the Horse and Groom on 17th Jan to meet the folks who seem keen to make the Galleywood event a regular occurrence. It's one of those things that could grow on you—especially when the weather is warm enough to allow (encourage) sitting outside with radios and portable antennas. Unfortunately, the group was split across two tables, but it was nice to while away a couple of hours or so in an informal social environment and talk about various radio issues. Discussion was lively and (sometimes) opinionated and I'll look forward to the next time. ***Ed***.

Slim Jim antenna modelling?

I have recently been playing with the MMANA-GAL and 4NEC2 programs. I had been made aware of these some time ago and, apart from a quick curiosity-based dabble, had essentially dismissed them as not being applicable to me.

Recently, however, I got a bit more interested in them owing to the fact that I had experienced difficulty in tuning up a Slim Jim that was based upon 450Ω ribbon feeder, such as those that are constructed at Skills nights. I had made one based upon dimensional information I had found on the interweb and it proved incredibly difficult to match a) if at all and b) consistently. I found that it was very much affected by proximity effects (not totally surprising, perhaps) and difficult to get a 1:1 match.

If you look at the antenna, it is a $\lambda/2$ radiating element with a $\lambda/4$ matching stub that is essentially unbalanced, in that the radiating element is only connected to one side of the stub with the coax outer soldered to the other. The 'theory' is that to obtain a match to 50Ω coax feeder, the feed point is adjusted some way up from the shorted end of the stub and that position is somewhere between $\lambda/40$ and $\lambda/20$ up from the short.

The fact that you are connecting an unbalanced feeder to an antenna that is also unbalanced (but to a lesser extent) is the subject for much debate out there in interland. The arguments for and against a choke balun are many and varied and I guess there could be merit in them all. I may have my opinions, I'm not really qualified to pronounce on them, but I come off the fence on the side in need of a balun. I found that the usual 10 turns on a 50mm former would do nicely, but replaced that with a bank of ferrite sleeves that I salvaged from an unwanted TV-PVR coupling coax and covered in heat-shrink.

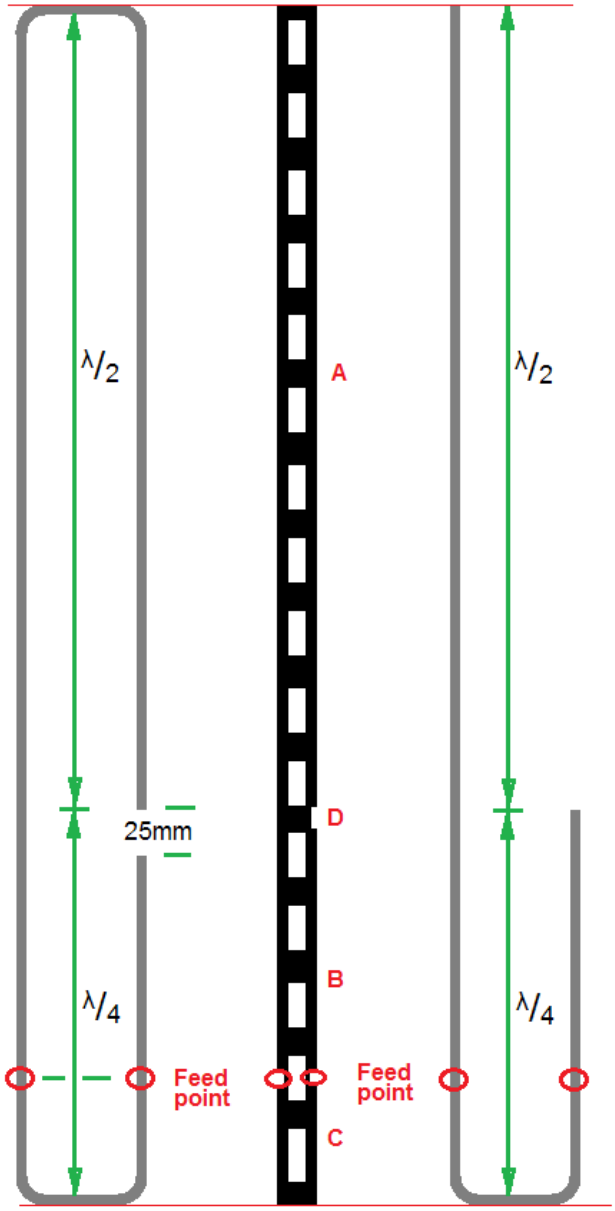
The work

I took a 2m length of feeder and measured the V_f in open air. I did this by suspending the feeder from my antenna analyser and holding it in such a way that it was as clear of nearby obstructions as I could manage. I had to stand in a stairwell or on a garden table to get it clear of the ground and walls. Measurements of V_f came to about 87-88%, which is not a million miles removed from the "nominal 91%" you will see bandied about, but still very measurably different.

Secondly, having wrestled with the feeder wriggling and flapping about all over the place as I tried to work with it, I wanted to tame the accursed thing and put it inside a plastic pipe - PVC or similar - just as others have done.

As luck would have it, one of John, G8DET's famous clear-outs had previously donated a couple of lengths of Wickes 16x25mm rectangular PVC trunking of the type that you can snap a lid over after installing cables. This was particularly lucky, as I have looked at this sort of thing before in B&Q and found that the feeder would not quite fit. This was a Goldilocks product, with the inside dimension being just right for the job. Re-measuring the V_f inside the trunking gave a V_f of ~ 83% in the clear. Laying it flat on a carpeted surface over floorboards it was reduced further to ~ 81%, so it was still sensitive to other adjacent objects, but I now had a starting point. Now here's a wonder: If a piece of PVC trunking can change the V_f by so much, then how is it possible that people can make and tune these antennas and then stick them in a pipe with no apparent ill effect? Dunno, Guv.

Before I get on to the modelling, I ought to say at the outset that I have used simulators of various flavours for several years, be they fluid dynamics (airflow, thermal etc.) or nodal analysis (Spice, Saber, analogue, digital etc.) and whatever type is used, one principle ***usually*** holds good. You may not be able to represent the real world exactly (in fact you never really can) but you can at least get close to a good theoretical



G2BCX Slim Jim, 450R ladder line feeder and J-pole antennas for comparison

(mathematical) approximation and if you can't solve your problem in theory, then the chances are that you won't be able to solve it in the real world.

I ought to say also, that nothing I have done here will not have been done by others - probably *lots* of others - and that it will win no prizes for innovation.

The antenna simulators are very similar in some respects but differ in others. MMANA-GAL is much easier to use than 4NEC2 but doesn't have the flexibility or graphical abilities. 4NEC2 seems to have better error handling (good for the likes of me and my ageing brain) and significantly better optimisation capabilities. It allows insulated wires to be modelled (individually if required) and it also has the ability to handle named parameters, or symbols; this has proved invaluable.

So what is the ribbon feeder Slim Jim based upon? The JIM comes from the **J I**ntegrated **M**atching stub and was originally published By F.C.Judd G2BCX in which he described the antenna, made principally from aluminium tubing, as a folded dipole. Granted it is an offset folded dipole, but a dipole nonetheless, with an unconventional feedpoint. In this, it differs from the original J pole antenna, which also has the matching stub, but looks as though it ought to be a monopole even though, technically, it isn't.

The feedpoint in the original article is given as about $\lambda/20$ in round numbers, so why the difference between that and the $\lambda/40$ that you (sometimes) see used for ribbon feeder? Who knows? And there have been designs published for very high frequency J-pole antennas where the feedpoint is an even smaller fraction of the design wavelength and the gap is a lot smaller than normally used - as I have discovered for myself.

Looking at the graphic, there are four sections marked A, B, C & D and these represent the positions (lengths) of the sections that represent the "radiating" part, stub matching, feed point and gap sections respectively. I put the "radiating" section in quotes as significant current flows in the stub matching section (B) also.

Now it is possible to define these as absolute lengths (A=990mm, B=400mm etc.) or relative lengths, e.g. freq = 145.5, lambda=300/freq, stub=lambda/4, match=lambda/40 etc., etc.

This has the great advantage of being able to specify the element lengths in terms of these variable and then allowing the program to optimise these numbers parametrically, individually or in combination, within certain constraints to arrive at a desired solution. So that is what I did.

Taking for granted that the spacing of the J (or ***is*** that a gamma?) matching section is irrelevant and can remain constant, there are only really three variables associated with the J antenna—the radiator length, the stub length and the feedpoint position. With the twin feeder equivalent, there is the added complication of the gap between the radiator element and the matching stub - a 25mm gap is very significant at VHF & UHF, potentially making the radiator too long or the stub too short. And what happens to the currents in

the radiator 'parasitic' element (as I shall call it)?

One has to be careful with allowing the software to do its thing, as it is possible for the optimiser to get carried away and produce silly results. For example, it may be necessary to decide whether to restrain the optimiser to maintain the relationship between the radiator and stub to 2:1, or to allow it to adjust the lengths individually to allow for end effects, etc. The MK 1 eyeball will help keep it on track when results are examined.

It is generally accepted that the V_f for any wire is less than unity and this is hinted at in the analyses. Firstly, I just modelled the open wire structure with no account being taken for the V_f and set the parameters to the figures that I had previously found. The result was disappointing, but it was soon to be (partially) resolved. I allowed the optimiser to juggle the numbers and it decided that for the open wire construction with f_0 = 145.5MHz, the whole antenna length should be cut with f_0 corresponding to 146MHz.

This about stacks up with the V_f for wire being less than unity in open air (~99%). My V_f was measured at ~88% so I cut the feeder accordingly (0.99 x 0.88 ~=0.87) and it came up pretty much on the nose (much to my relief). The feed point was optimised at about $\lambda/40$ and that also stacked up with work done elsewhere, so it gives a measure of confidence. None of this takes into account the effects of nearby objects or surroundings and that would be hard to model but, if this is accepted, the tools are not really hard to learn and very educational.

The next point of interest was to attempt modelling of a 70cm Slim Jim. Several people had made these either at, or to bring along to Skills night so that they could be set on frequency or have the match evaluated. Unfortunately, this was not successful, with SWRs in the region of 2:1 being the best we could achieve.

So how do these things work, and how can we guarantee better results? I have only been able to find vague references to a $\lambda/2$ radiator with a $\lambda/4$ twin wire matching section (so no surprises there, then) and the statements that the $\lambda/4$ section should be tapped to match the coax, but have been unable to make either MMANA or 4NEC2 provide me with a solid 1:1 resistive match. If we leave aside the fact that at 145 & 433 MHz the leads connecting the coax to the antenna are longer than we would like, the best match I have been able to come up with for the 2m version is ~1.2:1 at a feedpoint about 50mm from the shorted end and about 2:1 for the 70cm version. Bear in mind also, that the model is entirely stand-alone and takes no account whatever, of feeder imbalance - either that inherent in the antenna, or of the combined antenna and feeder.

Now, I guess it is possible to come up with a tapping point that exhibits net capacitive reactance to offset the net inductance of the long coax pigtails that are commonly used, but I would like to see good reason why it is difficult to find a general common impedance solution that would respond to either mathematical or standard method-of-moments analysis.

There is a UK patent 467,102 dating from 1936 that offers a solution (at an example frequency of 30.1MHz) by grounding a 54Ω coax at the centre of the shorted stub and tapping up the (***is*** this now a gamma?) match by 15". This translates to 0.038λ, which is within the range of 0.025-0.04λ often quoted on the 'net. The patent still, however, only goes so far as to say that the SWR is reduced. They also use and apply a 490Ω twin feeder in the same way and mention that the feed must be much higher up the arm, the feedpoint impedance being consistent with the feeder but, again, are not specific.

The closest I have been able to come to a reasoned argument about these antennas, and the closest to my own experience is to be found here: http://www.hamradio.me/antennas/slimjim-vs-traditional-j-pole-antenna.html wherein the differences between the antenna configurations are modelled and discussed, but still no maths to back it all up, although the author points to a reference by Cebik (W4RNL?) that would have to be purchased. I wouldn't mind that, but unless I can see it first, I wouldn't know if it will be suitable for my purposes. Anyone out there gonna help me with a worked solution? ***Ed***.