CHEPSTOW AND DISTRICT AMATEUR RADIO SOCIETY NEWSLETTER

August 2011

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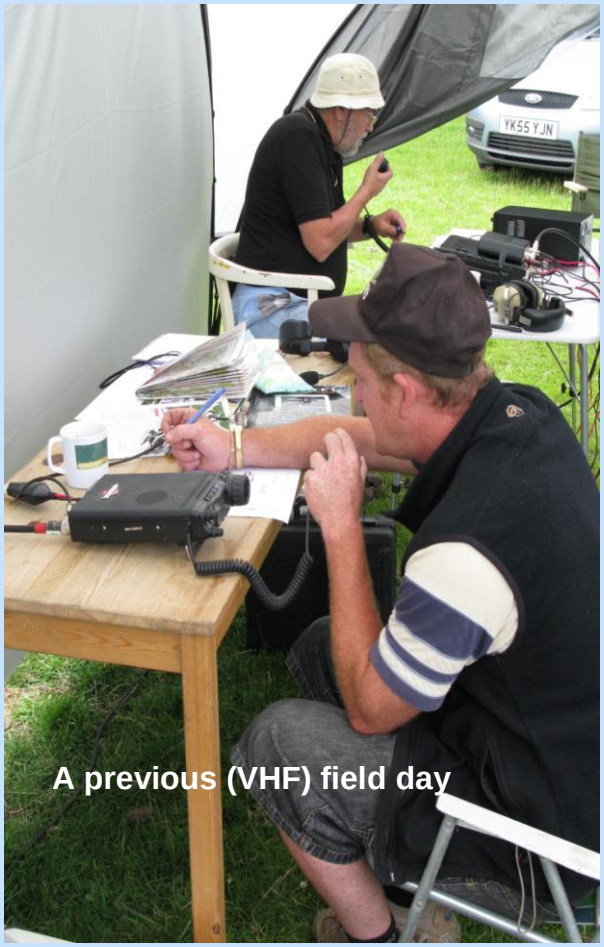
Diary dates for 2011

Tuesday 16th August Informal club night – Bring some kit and play
Saturday & Sunday 3rd & 4th September HF SSB Field Day
Tuesday 6th September Talk – Optical Communications (TBC)
Tuesday 13th September Informal club night – Bring some kit and play
Sunday 25th September Railways On The Air (ROTA) at Dean Forest Railway Norchard station

RSGB NEWS. Earlier in the year the RSGB undertook a survey of members, the results are available here: http://www.rsgb.org/survey/docs/questionnaire-analysis-advisory-group-radcom.pdf

HF SSB Field Day update:


A previous (VHF) field day

Detailed planning is underway for the HF Field Day over the weekend of the 3rd and 4th of September. Dan is our project leader (although he'll probably deny it if you ask him!)

Presently two locations are being considered in the Caldicot area. We will send out details to all members once the specific location is confirmed. The actual competition stars at 1300UTC on the Saturday and runs through until the same time on Sunday. (Although it's unlikely we will be running all through the night, any volunteers?) We are planning to start setting up from 9am (local) on the Saturday.

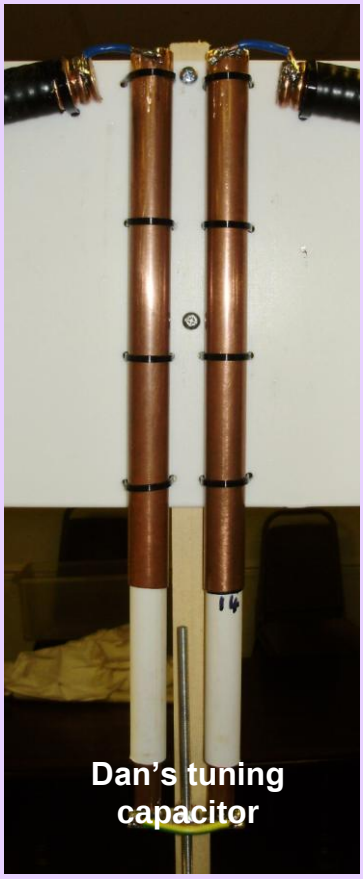
Please come along and support even if it is only for an hour or so either setting up, operating (training is provided) or even making the tea or bacon butties. We are not expecting to win the competition this year (if ever!) because there are some very professional and experienced teams out there. We just plan to have some fun playing radio in the field and gain some experience contesting.

So if you do not have space for an HF antenna in your garden now is your chance to work some new countries.

Mag loop antenna design - calculations by Paul M0SSJ

Prompted by Dan Taylors experiments with magnetic loop antennas and not having a lot of space at my QTH for HF wire antennas I thought I would have a go at making a loop myself. Although I enjoy making and playing with antennas I must admit it is mostly copying other peoples designs so there is nothing original here, just my practical experience of doing the calculations to build a mag loop. There are a multitude of references on the Internet if you search on magnetic loops – the one Dan highlighted is **http://www.aa5tb.com/loop.html** which provides a lot of background information and a mag loop calculator on which you can play around with the various parameters.

Using the loop calculator aa5tb_loop_v1.22a.xls and trying different inputs you will see that a "small" loop, generally agreed to be less then 1/10 wavelength circumference, which is good for nulling out local noise is not very efficient. So for example at 14.25MHz the diameter needs to be 2.2 feet to have a circumference of 10% of the wavelength but it then only has an efficiency of 41%. This is with a conductor of 0.9 inches cross section. We use 0.9 inches because it is the cross section of one of the larger sizes of commonly available heliax cable. (As an aside I bought my heliax second hand on e-bay in a 12 metre length, subsequently Steve has given me another length so if you are interested in building one yourself get in touch). Back to the loop calculator once more; if we increase the loop diameter to 4 feet you find the theoretical efficiency has increased to 80%, but we presumably compromise the null effect. Another parameter worth playing with in the model is the conductor diameter which has a big effect on the efficiency so back to our first example with a loop circumference less than 10% of the wavelength, if we were able to increase the conductor cross section from 0.9 inches to 2 inches the efficiency increases from 40% to over 60%. (You can start to get a bit of a fixation with this and you wander round looking for things in everyday life which have a large cross section diameter that could be formed into a circle). The other thing to observe in the calculator output is that it gives you an indication of the tuning capacitance and also the magnitude of the voltages present easily 4kV in many cases, which is why if you are using a traditional variable capacitor the vanes need to be widely spaced.
So for my example for the 14MHz band I ended up choosing a 4 foot diameter loop, this being a compromise between a reasonably manageable size and reasonable efficiency and accepted it wouldn't be so good for nulling out noise. From this you can then determine the spread of tuning capacitance required by running the spreadsheet at both ends of the frequency range you wish to cover.

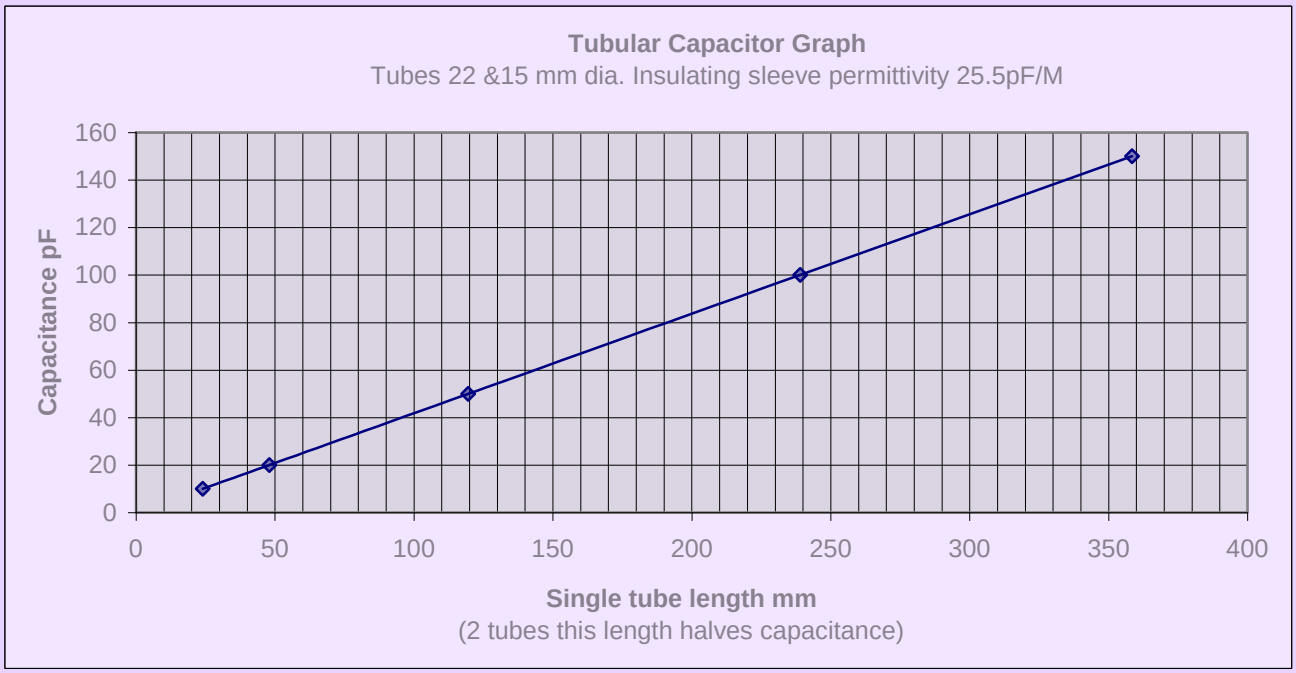


Dan's tuning capacitor

Dan's design uses two cylindrical (trombone) capacitors in series for tuning (see picture) so we now need to work out the lengths required. The basic design, made from readily available materials, is to use an inner conductor of 15mm copper pipe, an outer conductor of 22 mm copper pipe with an insulating sleeve made from overflow pipe or plastic conduit. In my case I used plastic conduit which I had lying around. This was a close fit in the 22mm pipe and had clearance around the 15mm pipe which allows for some mis-alignment as the 15mm pipe moves in and out. I tested a length in the microwave (when the XYL was out) together with a beaker of water and found the water heated up but not the plastic conduit so I thought it was OK to use for the capacitor. The following link provides a calculator for cylindrical capacitor dimensions
http://www.ajdesigner.com/phpcapacitor/cylindrical_capacitor_equation.php
Firstly scroll down to the "solving for length" formula, reset the units to whatever you find most convenient, pF and millimetres in my case. The parameters we are interested in are the required capacitance, the diameter of the inner and outer conductors, 15 and 22mm, and the permittivity of the insulating sleeve. Using these we can then calculate the length of tube to achieve the required capacitance. Remember this is for one tube, we have 2 capacitors in series which halves the overall capacitance.

Mag loop antenna design calculations continued...

The only input parameter we do not know is the permittivity of the sleeve. I guessed the plastic conduit was PVC and searching on the Internet I came up with quite a wide range of possible permittivity figures so I decided a different approach was required. I took some spare lengths of copper pipe and plastic conduit assembled them as a tubular capacitor and measured the capacitance with the inner 15mm copper pipe at various distances inside the 22mm pipe, with the PVC sleeve in between. I then put these figures into the tubular capacitor calculator and determined the permittivity. I tried it a few times and got quite consistent results. We can now calculate the lengths of tube to give the required capacitance for our specified frequency range. Having played with the calculator I realised the relationship was linear (should have spotted this earlier!) so taking a few points I was able to produce a graph of length versus capacitance, so then it was just a matter of reading off the required length for a given capacitance. Note - this is only valid for the insulating sleeve I used with a permittivity of 25.5pF/M



So we now have the basic dimensions for our mag loop - we have determined the loop diameter for our required frequency, calculated the tuning capacitance required, determined the permittivity of our chosen sleeve material and finally calculated the length of tubes required for our tubular capacitor - now go and build a mag loop.

The picture shows checking capacitance of the assembled capacitor.

(Note the upper left hand lead from the capacitor tube is not connected to the Heliax for these measurements).

In this case the maximum capacitance was 53.8pF with the tubes fully engaged and the minimum capacitance was 19.7pF with the 15mm pipe almost fully out.

Any mistakes in this article are entirely my own fault, if you spot anything wrong please let me know so I can correct it! Paul M0SSJ

The June CDARS newsletter included the picture below which shows the Shirehampton RAE class of 1979. The question was can you spot Steve Trott and Nick Gleed?

I know some CDARS members are into serious home building. Rod recently highlighted the following youtube video which shows the Gingery Coil Winder at work. http://www.youtube.com/watch?v=FlOocMoRsYQ
Even if you don't have need for one it is a delight to watch, and all those cogs and cams appeal to me as a mechanical engineer. (You have to remember I trained in an era when gas turbine fuel control systems were all hydro-mechanical with levers, pistons, bellows, cams and not an electron in sight! – I know you cannot see electrons)

Recently I reported that Christopher Dempster passed his Foundation exam, he now has his new callsign allocated – M6F0D. Chris is one of the new generation of club members (he is under 20) and once he has some kit sorted out he is keen to get on the air.

This months featured website is that of Chris G0SDD:

http://myweb.tiscali.co.uk/g0sdd/ham_radio.htm

Chris is a member of the Forest of Dean Amateur Radio Society and joined in, together with other FODARG members, at last years CDARS ROTA day at the Forest of Dean Railway.

We hope to have more joint CDARS and FODARG activities over the coming months.