

**Chairman:** Derek Gillett G3WAG • **Treasurer:** Rodney Archard M0JLA • **Secretary:** Duncan James M0OTG  
**Committee:** Nigel Hancocks G4XTF; Dave Porter G4OYX; Bob Bowden G3IXZ; Matt Porter G8XYJ Contest Captain; Richard Langford G4FAD; Mike Bush G3LZM; Tim Bridgland-Taylor G0JWJ; Geoff Wilkerson G8BPN

## Editorial

Since the last issue of the *Journal*, two complete volumes of the 2016 issues have been neatly bound and given to the Hereford County Library for their *Reference Section*. Surprisingly a volume numbers 70 pages and contains many interesting articles.

How to get the younger members interested in radio and become members of our club? Many clubs organise a DF sport known as the **Fox & Hounds**. Read about the events on page 4. Perhaps our strong Contest hierarchy could be interested in helping to organise such a “hunt” in our glorious countryside. Publicity is a “must”.

*Ed*



## Drones...

The regulatory authority Ofcom sometimes receives enquiries from those wishing to operate drones using Amateur Radio bands for telecommand, telemetry, or First Person View’ (a pilot’s-eye view of the flight). As the powers permitted by the exemption regulations are limited, some users seek to take advantage of the higher transmit powers permitted under the UK Amateur Radio License. This is not the purpose of Amateur Radio and Ofcom does not permit this use.

*Ed*

## IL4 Course Results

There were two candidates for this “fast track” amateur radio Intermediate Level 4 qualification on the 17th of June; Stephen Bunting and Keith George. Both club members passed the exam which means that HARS has a 100% no-fail record. Well done everybody.

Special thanks to Dave Porter G4OYX and thanks to G4XTF and G4HQB for tuition/ invigilator support. Also, many thanks to Geoff G8BPN for the use of the Hill House facilities.

Keith’s call is 2E0OKG, Stephen (2E0MUU) went on to get the full license after passing the Advanced course and is now M0MUU.

*Well done....Ed*

## STOP PRESS!

Joe Thomas M6XJT

The Hereford Amateur Radio Club is so proud to have helped Joe to pass his Radio Licence Foundation Course; especially so, because Joe is our youngest ever member being only 10 years old!

His achievement was rewarded with the presentation of a Morse key from Sheila Tomlinson G4PSA, (ex SOE and BBC film editor).

*Thanks Sheila...Ed.*

“No doubt instruction will continue when Joe visits his very proud grandfather’s shack”, says Dave Thomas, G4OGW.

*Well done Joe...Ed.*

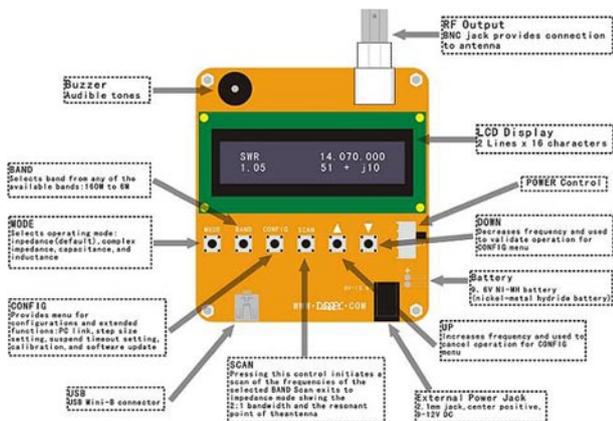


## Club Night 7th July.

Unusually high turn out in spite of the tennis on BBC. The attention of the membership was held by our Chairman Derek (G3WAG) who began by telling us that the VHF NFD at Brown Clee Hill was a great success in that the results indicated that the club operating as G3YDD/P were high up the list of top scorers. All bands from 6m to 23cms were in use with 2m showing up some fine contacts deep into Europe. (*Well done...Ed*).



The main feature of the evening was Derek's talk on the Icom 7300 TX/RX. This rig will operate on all bands up to 4m but this band operating frequency has to be keyed in. On your chosen band you can see all of the received signals spread out in panoramic form when the rig "spectrum analyser" mode is selected. If you are an RTTY enthusiast, this rig is for you. The antenna auto-match will cycle and select the correct match even though you may change frequency and band. Particular to SDR, the Waterfall feature allows you to see the signal you have selected using the cursor, in the form of frequency versus time. As you would expect, you can operate the rig in "remote" by connecting your laptop to the USB port. Listen..., this 7300 has everything! The finest noise blander and auto CQ option, and it is yours for £1100.



During the evening, Dave Hart, G1DRW introduced the MR100 antenna analyser which he bought for £35 including delivery. Now this

is a most useful piece of kit for the shack and for the home-brewer. All of the amateur radio bands can be selected up to 60Mhz. This will measure SWR and a host of other parameters as described in its most comprehensive User Manual available on [www.LXQQFY.com](http://www.LXQQFY.com) The MR100 will even generate a signal (2vpk/pk) which is especially useful when you are testing that receiver you have cooked up.

*A wonderful evening...Ed*

## SOTA

### Summits On The Air

This is an amateur radio award program launched in the U.K. In 2002. The program requires that amateurs operate from accessible summits using portable equipment mostly using batteries and possibly solar power. Generators of any kind are not allowed.

The summit operators are known as "activators" and the shack-based operators are known as "chasers". There are reputed to be 104,000 summits registered and an award, the Mountain Goat, is given when the



*GW1YBB/P, one of Steve's SOTA locations.*

# Submarine Communications using Quantum Mechanics

With sincere thanks to:  
Dr Jacqueline Romero  
Queensland University (VK4)

## Trying to understand the physics!

Ordinary objects behave in an obvious way. Imagine a red ball and a blue cube each enclosed in separate boxes. In Hereford, one box is given to James and the other box is given to Sally. James then goes to Worcester and Sally goes to Gloucester. They know that their box contains either a red ball or a blue cube but they cannot open their boxes until they reach their destinations. James then opens his box and sees a red ball. Without any communication with Sally he knows that her box will contain the blue cube. Similarly when Sally opens her box she sees the blue cube and

activator achieves 1000 points. The shack-based operators, the chasers, can also achieve an award called Shack Sloth when they claim 1000 points gained by multi-QSO's with the portable activators.

The rules state that points can also be gained when two activators are in contact and, when two activators and a chaser are in contact together. SWLs are also able to take part.

The Mountain Goat award is a handsome piece of engraved glass showing the activator callsign. See [www.sota.org.uk](http://www.sota.org.uk)



without any communication with James, she knows instantly that he has the red ball.

Let us now repeat the experiment and replace the ball and cube with “*entangled*” objects.

Quantum physicists like to talk about the “state” rather than the objects. For ordinary objects the “state” is really a list of its properties such as shape and colour. In Quantum physics the objects do not have a “state” in the ordinary sense.

Strange as it may seem, the “state” of quantum objects is not determined **UNTIL** an observation is made. The objects in the unopened boxes are both a red ball and a blue cube at the same time. The situation is now fundamentally (and very strangely) very different.

Apparently the observation of a red ball in one location “*depends*” on the observation of a blue cube in another location. The properties of one object can no longer be separated from the other. Hence the term “*entanglement*”. When you know the one object is a red ball then you know the other object has **BECOME** a blue cube. (*Keep thinking...Ed*)

## The Submarine.

Entanglement is routinely established experimentally and the peculiarities herald new technologies some of which are already being used, such as in banking and other areas requiring security of information.

A US defence firm has come up with a method for guaranteed secure communications technique called *Quantum Key Distribution* (QKD). The technique employs the use of quantum properties of photons which are polarised in two different ways to encode “0”s and “1”s to generate and exchange a key.

If anyone attempts to intercept the photons, the properties get disturbed and an alarm is raised. With QKD, after the key has been exchanged, a submarine can be submerged for as long as possible and can communicate with guaranteed security, by laser-to-satellite from 100m below the surface.

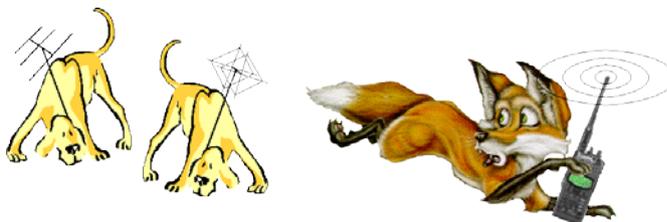
(*Thanks Jacqui...Ed*)

## Fox and Hounds Radio Events

Foxhunting involves several groups of radio amateurs participating in a tracking exercise. One of the group is designated to be the foxes, and their role is to hide themselves within a six mile radius of a given location area such as a town or village, or local landmark. General information is circulated to all participants before the event day and operation is usually on 80m.

The foxes, there could be more than one, prepare in advance. The criteria is that the "hides" shall be publicly accessible via roads, footpaths or bridleways.

On the event day at a specific time, each fox team will transmit for one minute continuously, in consecutive fashion, at five minute intervals. Generally, all foxes will be found within a two-hour period. Foxes are not allowed to move location although they can vary their power and transmission mode (generally not CW) within reason to try to confuse the hounds. Foxes have been discovered in the most unlikely of locations such as prickly bushes, up trees and even in rivers.



The fox transmitter used will generally be a handheld perhaps with a variety of aerials and of course the fox needs a watch so that transmissions can be properly scheduled.

### The Hounds

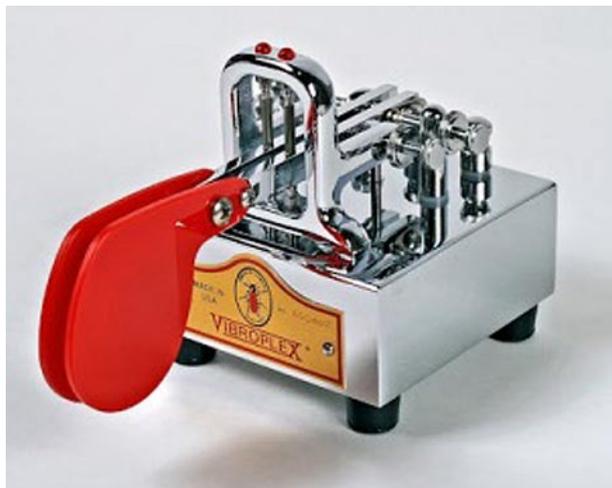
At the outset, six miles away, the hounds work out the location of the foxes by first of all taking bearings against a map, using directional aerials. This soon becomes a matter of detecting the signal strength as the hunt develops which then becomes a matter of listening to the fox harmonic at the closing-in stages.

The hounds need not be licenced radio amateurs and can be SWLs of all kinds out for some sport!

*Reynard Rules!...Ed*

## Vibrocube Delux – Twin Paddle Keyer

This lovely key from Vibroplex measures 3.5 x 3.5 inches with and is 1.5 inches high. For absolute table-top stability it weighs in at six pounds and has jewelled movement. Top speed will depend upon the keyer but whether operating fast or slow, precise operation is guaranteed.



## Articles Wanted!

Please think about submissions/projects you might like to send in or see.

General topics and key words are listed below.

Members projects	Events	Training
Members station	Notices	QRP/QRO
Construction	Help	Illustrations
Items wanted	News	Photographs
Items for sale	DX	Early radio
Hints and kinks	Militaria	Restoration...

... or anything else that you think might be of interest to HARS members. If you have an idea for a submission, but don't know how to present it, feel free to ask for advice.

Please submit anything and everything to [topix@hars.wagnet.co.uk](mailto:topix@hars.wagnet.co.uk) or talk with Mike at the Club meetings.

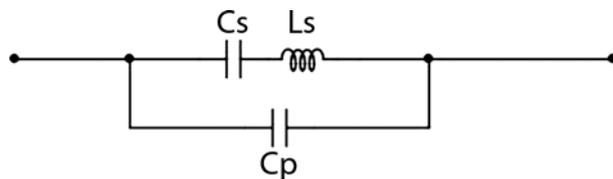
*73s es GDX, G3LZM  
Mike Bush (Editor)*

# Ever Tried a VXO?

By Bob Bowden G3IXZ

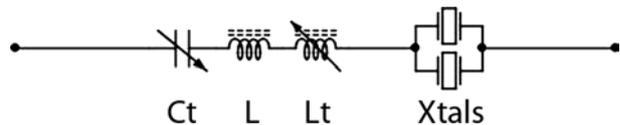
In these times of digital synthesis, very few consider any simple routes to provision of stable variable frequency oscillators. Synthesizers are heavy in active components however and with their inevitable digital display, demand a lot of current from (say) a SOTA operator's battery.

VXO stands for Variable Frequency Crystal (Xtal) Oscillator; 50 years ago this phrase would be labelled an "oxymoron" because then, the quartz crystal was the only *stable* frequency device in the shop. We even called them "rocks" to emphasize their immovability in frequency. Anyone digging deep into the theory of piezo quartz crystals can develop a serious headache and it is safer to hold back on the physics; accept that they are usually "AT cut" and consider them to be a very Hi-Q resonant circuit in a small enclosure. They of course bear no *physical* relationship to this circuit concept. See Fig 1:



The crystal consists of a theoretical series resonant circuit comprising  $C_s$  and  $L_s$  (and a small resistance – which I have ignored) with an overall parallel capacitance element,  $C_p$ , formed by the attachments to either side of the quartz plate. If the conductance of the device is measured against frequency, there are two significant nodes one of series and parallel resonance. These are very close together and it is essential to measure these if an attempt is made to quantify the apparent values of  $L_s$  and  $C_s$  in the quartz ( $C_p$  can be measured by using a capacitance bridge/meter across the crystal pins). This is important if the crystal is being used in a filter but not particularly so if being used as an oscillator. Increasing  $C_p$  with an external variable capacitor will give a small change in oscillator frequency, but increasing this capacitance value by more than a small amount usually causes the crystal to stop oscillating.

In order to make significant changes in the frequency of oscillation it is essential to increase the series inductance by external addition to its value using  $L_t$ . Varying the inductance is not a particularly convenient way to "tune" a VFO (although companies like Collins made an art-form of it 50 years ago) so introducing a series capacitance,  $C_t$ , provides a better way of tuning our VXO once  $L_t$  has been set. See Fig 2:



With  $C_t$  at its minimum value, the circuit usually oscillates at just **above** the frequency marked on the crystal case. As  $C_t$  is increased in value, the frequency drops until at Max  $C_t$ , the frequency value is at its minimum. At this point an increase in  $L_s$  will push this minima down further. However, as  $L_t$  is increased and the frequency departs downwards more and more from its "natural" frequency (based upon the dimensions of the quartz slab), the frequency stability begins to suffer and the device begins to emulate a standard transistor VFO. Since the circuit series inductance is now very high, the  $L/C$  ratio is also high and this is not recommended for a stable VFO configuration. **So what use is a VXO if it cannot be made to cover a wide range of frequency change with the high stability characteristic of a quartz crystal?**

**Well, think about it?** Most of our frequency bands are sliced into activity areas- right? Close to the home-brewers heart is simple QRP, often with a portable station. Each band has its own QRP (cw and phone) calling frequencies and all qsos take place within a few kHz of this.

Digi-modes also have their own recommended slots in which to operate – and this ensures responses from appropriately equipped stations. The same applies to the suite of small signal programs devised by Joe Taylor –WSJT, as well as for PSK31.

My point is, most radio "home brewers", particularly if they are CW fans, are happy to use small sub-bands for the equipment they are making. A range of 10 kHz will usually suffice and 20 kHz will be a luxury. Such frequency

swings should be relatively easy with a VXO. To complete the concept, have a look at Fig 3, a graph of Series Inductance ( $L + Lt$ ) against Freq Swing in kHz:

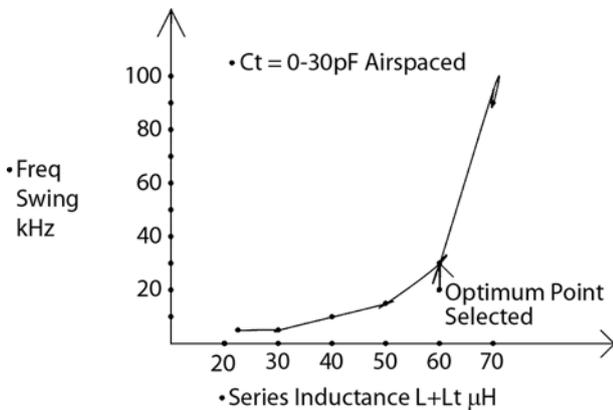


Fig 3; Looking at the graph, it can be seen that, initially, the frequency swing with the increase of inductance is small. As one approaches a critical point, the swing changes very rapidly with increasing  $Lt$  and the crystal can begin to lose control. It appears important to avoid trying to swing the frequency down too far with inductance alone. If necessary, bigger swings can be produced by increasing the maximum value of the tuning capacitor  $Ct$ . This, will pull the frequency further down

without producing the very large  $L/C$  ratio which can produce instability. However if a capacitor with linear change of value with rotation is used, the tuning can become very non-linear with a large change of frequency crammed in at the high capacity end.

**Using the findings of my experiments with a breadboard VXO design, I have tried to produce a practical, repeatable, prototype VXO, with RIT, for 40m..**

This has necessitated designing and fabricating a PCB from scratch which I have populated, mainly with SMD components. I am keen to use surface mount devices wherever possible these days, as they tend to have inherently increased reliability. However standard “wired” components are perfectly acceptable. Inevitably, much of the quantitative work has been empirical.

My fundamental criteria for VXO work can be summarised as follows:

1. Use good quality, new, components wherever possible,
2. Use transistors with a high  $Ft$  in the VXO circuit.

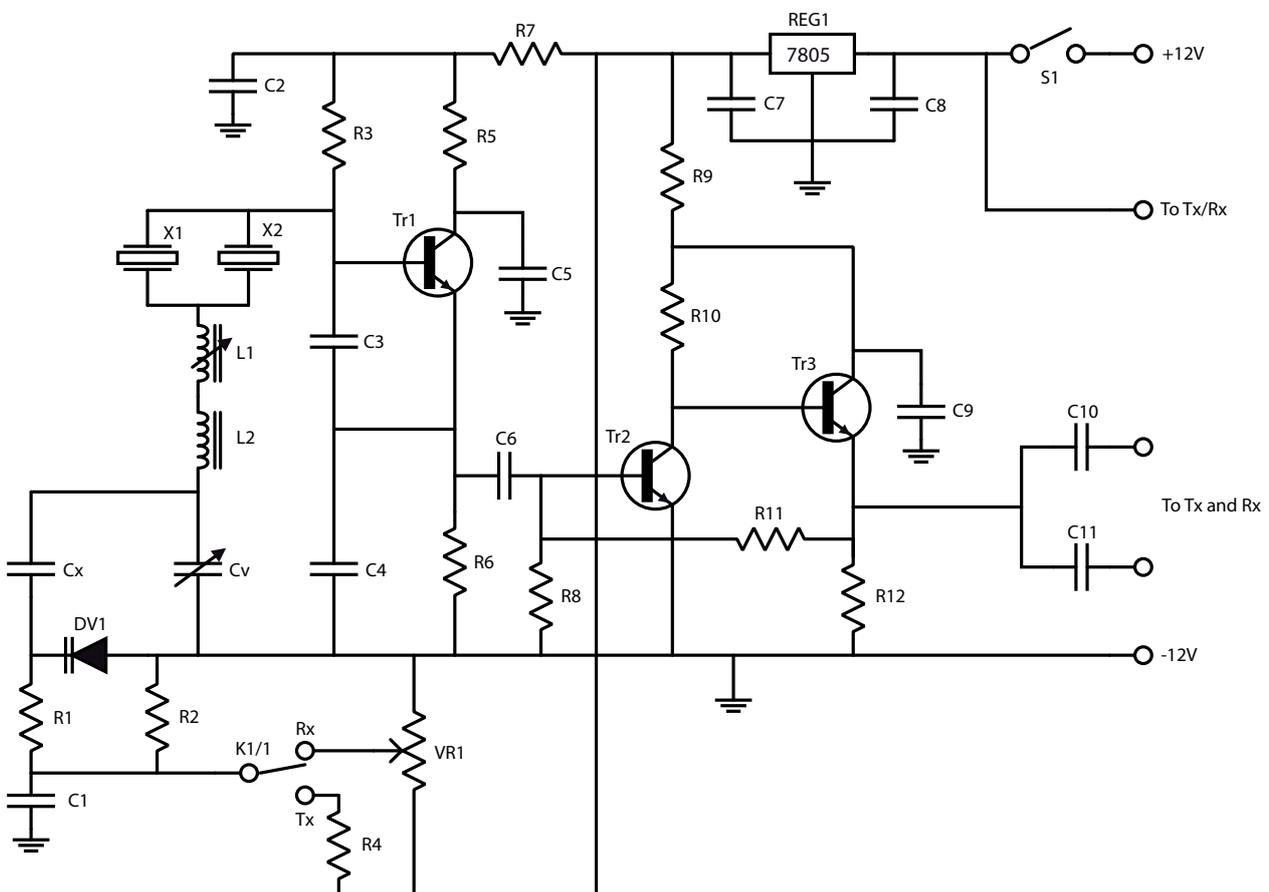


Fig. 4

3. Use at least TWO identical crystals in parallel – this greatly increases the frequency swing possible.
4. Do not try to get very large swings by using large value variable capacitors for Ct.
5. Good frequency swings on the low bands are difficult, but at 7 MHz and above, are fairly easily achieved.

### Final Circuit Design.

This is shown in Fig 4, together with a list of components used in my own prototype device. The BC817 transistors used are very small (SOT23) but like most components in this category, extremely cheap. They have an Ft of about 100 MHz and operate adequately at 7 Mhz.

### Component List

Resistors (SMD): R1, R3, R11: 82k; R2, R4: 4.7k; R5: 100R; R6, R10: 1k; R7: 220R; R8: 10k; R9: 47R; R12: 470R

Capacitors (SMD): C1, C2, C5, C9, C10, C11: 10nF; C3, C4: 100pF; C6: 68pF; C7, C8: 100nF; Cv: 30 pF Variable; Cx: 10pF (wire legs, not SMD).

Inductors: L2: 20 uH; Variable (Non SMD)  
L1: 47uH Toko or similar, slug tuned

Misc: X1, X2 Xtals 7040 kHz HC49U;  
K1: DPCO Miniature relay (Contact 1);



Fig 5: First prototype of 7 MHz VFO (Board 1.5 x 3.6 inches)

VR1: 10k Lin; DV1: MVAM109;  
REG1: 78L08; Tr1, Tr2, Tr3: NPN (SMD)  
BC817 used in prototype; S1: SPST switch  
(part of separate volume control for Tx/Rx)

Note: K1 can be replaced with a miniature SPCO toggle switch for test purposes. The contacts are normally part of the T/R switching of an associated transceiver to enable RIT on receive.

My prototype board was fabricated using a home-made PCB which is sized to permit its use in a Direct Conversion transceiver, currently under development. I will report on the completed project in a future issue of the *Journal*. Meanwhile, I hope this piece has been helpful to anyone contemplating QRP, home brew who wants stability and simple design for a suitable oscillator, at low cost. Fig 5 shows my first prototype.

## Foundation Course 9



Candidates and Lead Instructor Dave Porter at the latest Foundation Licence Course at HARS.

L to R: Joe Thomas M6XJT, John Simmonds M6JVO, Paul Higgins, Elliott Walker, Dave Porter, Peter Goillau M6PJT, Ryan Ing

## Contest Corner

May and June have seen continued club success in the UKAC series. HARS won the June 50MHz session despite Sporadic E skewing the results. HARS also comfortably won the June 144MHz session which was memorable for some pretty dire weather for the portable stations. We fielded 15 entries in the June 144MHz which is great. We have really closed the gap on Sheffield and pulled away from 3<sup>rd</sup> placed Worksop. This is a great achievement for a new kid on the block.

We came 2<sup>nd</sup> in the May 70MHz and are still waiting for the June results to come out.

On 432MHz we came 2<sup>nd</sup> in both May and June, so close to winning June. This has moved us to 2<sup>nd</sup> placed club in 432MHz!

Notice on the 4 mains bands we are 2<sup>nd</sup> in all!

We managed a very good 3<sup>rd</sup> in 1296MHz with only 5 members active.

Dave continues to fly the SHF flag alone but will have some support shortly.

Overall, we retain 3<sup>rd</sup> place but are within striking distance of taking 2<sup>nd</sup> from Bolton.

HARS is now 18<sup>th</sup> in the 80m CC series, with Rich setting new records in CW and myself able to take part in one SSB section and gained about 90 places over last time achieving 13<sup>th</sup> place!

Some brilliant results, keep it up team!

*73 Steve G1YBB*

Upcoming Contests		
144MHz UKAC	01-Aug-17	1900-2130 (UTC)
432MHz UKAC	08-Aug-17	1900-2130 (UTC)
50MHz UKAC	10-Aug-17	1900-2130 (UTC)
1.3GHz UKAC	15-Aug-17	1900-2130 (UTC)
70MHz UKAC	17-Aug-17	1900-2130 (UTC)
144MHz UKAC	05-Sep-17	1900-2130 (UTC)
432MHz UKAC	12-Sep-17	1900-2130 (UTC)
50MHz UKAC	14-Sep-17	1900-2130 (UTC)
1.3GHz UKAC	19-Sep-17	1900-2130 (UTC)
70MHz UKAC	21-Sep-17	1900-2130 (UTC)

RSGB UKAC Overall Local Club Standings 2017								
	Club (33 clubs total)	50MHz	70MHz	144MHz	432MHz	1.3GHz	SHF	Total
1	Sheffield & DWS	1000	1000	1000	1000	1000	529	5529
2	Bolton Wireless Club	462	465	635	615	464	1000	3641
3	Hereford ARS	896	512	912	750	300	103	3473
4	Worksop ARS	522	554	721	717	283		2797
5	Trowbridge & DARC	198	229	493	340	186	534	1980
6	RAF Waddington ARC	474	357	377	410	288	15	1921
7	Parallel Lines CG	168	223	124	137	144	325	1121
8	Coulsdon ATS	246	247	179	232	149		1053
9	Cheltenham ARA	118	11	72	83	129	508	921
10	Southport & DARC	156	136	244	184	110	79	909

Club Band Standings (top 10 shown)										
	50MHz (27 clubs)		70MHz (25 clubs)		144MHz (30 clubs)		432MHz (29 clubs)		1.3GHz (21 clubs)	
		Total								
1	Sheffield & DWS	35329	Sheffield & DWS	27324	Sheffield & DWS	45649	Sheffield & DWS	36374	Sheffield & DWS	27820
2	Hereford ARS	31666	Hereford ARS	14971	Hereford ARS	44769	Hereford ARS	27297	Bolton Wireless Club	12901
3	Worksop ARS	18458	Worksop ARS	14594	Worksop ARS	33675	Worksop ARS	26083	Hereford ARS	8351
4	RAF Waddington ARC	16737	Bolton Wireless Club	11260	Bolton Wireless Club	29224	Bolton Wireless Club	22352	RAF Waddington ARC	8020
5	Bolton Wireless Club	16337	RAF Waddington ARC	9955	Trowbridge & DARC	24325	RAF Waddington ARC	14900	Worksop ARS	7880
6	Coulsdon ATS	8675	Coulsdon ATS	6241	Triple B ARCG	18374	Trowbridge & DARC	12376	Martlesham RS	6000
7	Trowbridge & DARC	6980	Trowbridge & DARC	6086	RAF Waddington ARC	17546	Vecta CG	10828	Trowbridge & DARC	5164
8	West Kent ARS	6423	Parallel Lines CG	5989	Vecta CG	15277	Coulsdon ATS	8427	Northampton RC	4223
9	Parallel Lines CG	5947	Telford & DARS	4299	West Kent ARS	11945	Itchen Valley ARC	6796	Coulsdon ATS	4151
10	Guildford & DRS	5635	Southport & DARC	4274	Southport & DARC	11588	Southport & DARC	6693	Parallel Lines CG	4000

## HARS radio equipment available for loan to Club members

The following list of equipment is available for loan to Club members. The loan period is 3 months and members wishing to use the equipment will have to sign a simple agreement which covers the loan terms. If you wish to borrow then please contact Duncan (Hon Sec) M00TG.

Grid Dip Meter MFJ-201

Pixie 7MHz QRP kit. Needs assembling.

Buddipole 10-40M portable antenna with tripod and carrying case.

Baofeng UV-5R 70cms/144MHz hand-held complete with accessories.

Yaesu FT450 All bands to 50MHz. Needs a 12V PSU

*Go portable with the Buddipole! Ed.*

# Generating Pulses From A Switch Action

Have you ever wanted to have a single pulse generated from a changeover switch action or a push button action. The circuit shown will produce a 65mS pulse at C/10 or at D/11 when the switch moves from one state to the other. The pulses do not appear at the same time.

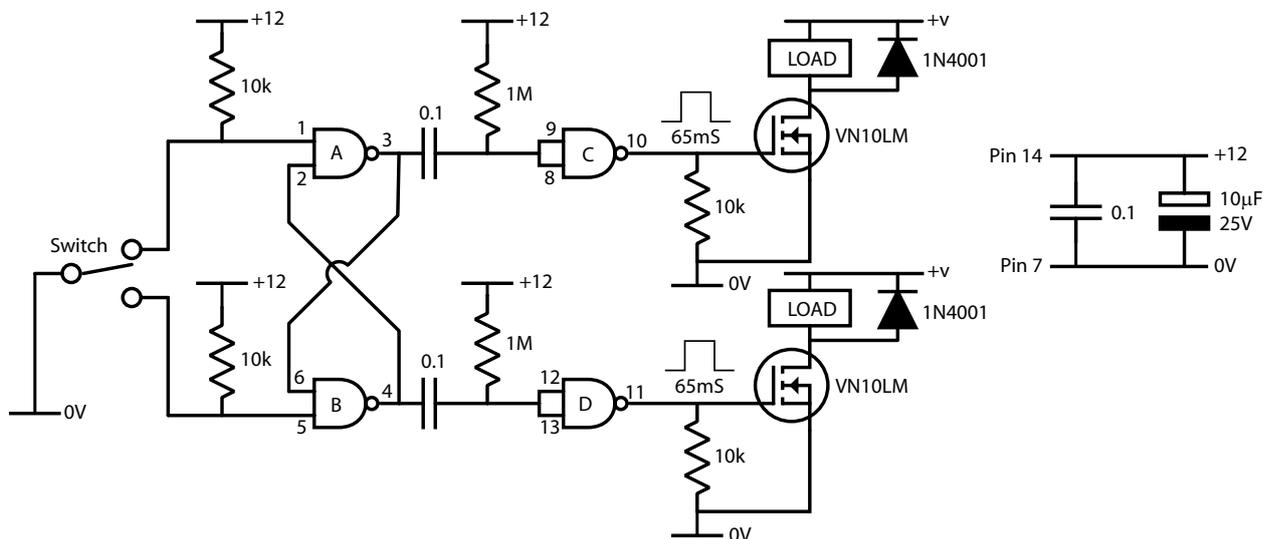
This circuit uses the quad NAND, 14-pin DIL integrated circuit type HEF4001B which is a CMOS chip taking only 8mA. It may be operated with a 5V to 18V power rail. The 0.1uF capacitor and the 1Megohm resistor are the “time constant” components. Changing the 0.1uF to 0.2uF, for example, will double the pulse width.

The pulses each drive a MOSFET type VN10LM with the load to be driven, connected in the device “drain”. The load itself may be connected to V+ which may be up to

60V and the load current may be up to 300mA DC. In fact, for pulses, the VN10LM will handle up to 1A.

You could drive a magnet-assisted, pulse driven, 24V Coaxial Transfer Switch to transfer between the rig high output power and the antenna, and receiver/antenna with very high isolation and very low insertion loss. A transfer switch typically requires 15mS pulses so the pulse length developed with this circuit is ample.

*Feel the pulse...Ed*



## ATV (Amateur Television)

It is now generally known that the “drone” equipment Tarot 5.8GHz FM TV transmit and receive modules available as a set on eBay for £26, can be legally used on the 6cm amateur band. This band is under review and it is rumoured that even “C” band might eventually go over to mobile traffic. Even-so, at this price, the Tarot presents an opportunity to operate ATV for very little money. It is reported that the transmitted picture quality is subjectively better than with the Comtech modules.

The original use of the Combo is to provide First Person Video (FPV) cockpit video from drones which, in spite of their tiny size, have reasonable FM-TV performance.

At the Club, we are considering whether or not to have a HARS TV “Beacon” covering Hereford, using the TX section of the Combo. The power available is 600mW but this could be boosted to 2.5/3.0W with the addition of an RF amplifier priced at £22 from the same source. Club test cards would be transmitted and it would create the opportunity for TV-ers to investigate the TV aspect of our hobby and interest.

*Let us have your comments...Ed  
mike.bush@microlabrf.com*

### *How to:*

## Pick the best microSD card for your phone.



It's the time of year when flagship smartphones and tablets are being released. Unfortunately, many of these products come with limited or insufficient storage to accommodate all of your pictures or videos.

This means you'll likely need to invest in a microSD card... but which one?

## The difference between micro SDHC and SDXC...

Probably the first thing you'll notice is that cards are either called micro SDXC or SDHC. If these acronyms mean nothing to you, don't worry, you're not alone! Basically this just reflects the storage capacity of the card.

**SDHC**  
UP TO 32GB

**FROM £4.49 (EX VAT)**

*view all*

**SDXC**  
64GB +

**FROM £19.95 (EX VAT)**

*view all*

SDXC (Secure Digital Extended Capacity) can handle 64GB and above, whereas SDHC (Secure Digital High Capacity) only stores up to 32GB.

## What does 'Class' mean?

The 'class' relates to the minimum data transfer speed of a card – something that's important if you don't want to slow down your new device. Aside from the capacity, this is probably the most important thing to consider.

**SDHC and SDXC speed classes include 2, 4, 6 and 10.**

## CLASS 10

10MB/s Transfer Speed

**FROM £5.45 (EX VAT)**

*view all*

## CLASS 4

4MB/s Transfer Speed

**FROM £4.49 (EX VAT)**

*view all*

The 'class' is the same as the cards minimum write speed (Class 10 = 10 MB/s for example). For HD recording, Class 10 should be the preferred choice.

## UHS cards, what are they?

After 'Class 10', things get a bit tricky. In 2009 a standard called UHS was introduced, which allowed cards to achieve higher transfer and write speeds (up to 312MB/s).

Although these cards can achieve much higher performance rates, you are only likely to reach minimum transfer speeds listed above because very few devices support the upper limits at present.

## UHS-1

Min Speed 10MB/s

**FROM £5.45 (EX VAT)**

*view all*

## UHS-3

Min Speed 30MB/s

**FROM £10.55 (EX VAT)**

*view all*

UHS-1 has a minimum performance speed of 10MB/s, and UHS-3 has a minimum performance speed of 30MB/s – making it ideal for 4K video recording.

## Will a good microSD card really speed up my phone?

The short answer is, yes. If you intend to store pictures, videos or apps, then the microSD card you choose will affect the speed at which your phone can access or store the relevant data.

## Recommended brands:

Apacer®

integral™

SanDisk®

SAMSUNG

Verbatim.

hama.

## Club Personalised Merchandise

For availability and prices contact Mike G3LZM  
(mike.bush@microlabrf.com).



**£6.99**

### T Shirt

The printed T shirt has your callsign on the front plus your club details.

**Latest Prices!**  
(Vistaprint)  
**STANDARD DELIVERY £3.99**



**£7.62**

### Cap

The printed cap has your callsign on the front plus your club details.



**£6.43**

### Mug

This is available printed front and back with your callsign and club detail.

An exotic China version is available.



### Illuminated Plaque

This is available with your callsign engraved. A 12V DC supply is needed. You will be able to select Green/Red/Blue by means of a small switch at the rear.