CPREC

G2LW

Palace Pulse

The newsletter of the

Crystal Palace Radio & Electronics Club

Affiliated to the Radio Society of Great Britain

Established January 1956

Meetings are held on the first Friday of each month.
The room opens at 7:30pm for an 8pm start at:
All Saints Parish Church,
Beulah Hill, London, SE19 3LG
(opposite the junction with Grange Road).
Visitors are always welcome.

Web sites:	Club Admin:	http://cprec.btck.co.uk/
	Club Technical:	http://cprec.btck.co.uk/OurTechnicalSite
Email:	cprec.g2lw@gmail.com	
Club Net:	Each Wednesday at 20:00 on FM on 145.525MHz (S21) ± QRM Experimental net each Saturday at 20:00 on FM on 51.55MHz	
Twitter	@BobFBurns or www.twitter.com/bobfburns	

Next meeting: Friday 5th April 2019

Construction Evening - The Pixie QRP Transceiver

In this issue: *Future Meetings & Events, Recent Event News, Laptop Refurbishment by Nick Stapley, Technical Snippets, Members News, Miscellaneous, Noticeboard, Diary of External Events, News from other Clubs, Local Training Courses and Club Contact Information.*

See page 8 for club contact information

Dear Reader

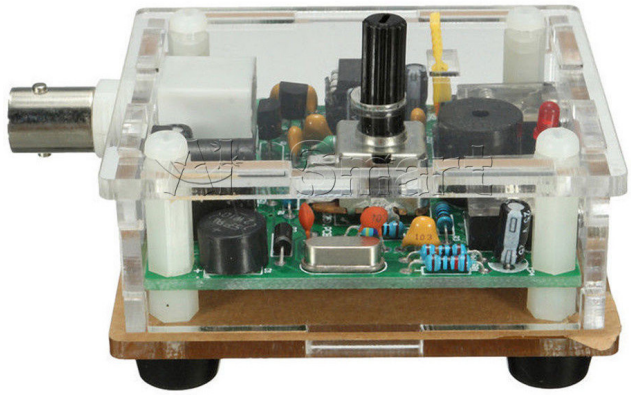
Future 2019 Club Meetings and Events

05 Apr	M	Construction Evening - The Pixie QRP Transceiver
03 May	M	CW Evening and Pixie Test & Maintenance
11/12 May	E	Mills on the Air
07 Jun	M	On Air HF Noise Reduction Systems by John G8MNY
05 Jul	M	TBA
02 Aug	M	Summer Social and On the Air

C = Contest, CM = Committee meeting, E = External event, M = club meeting, R = Rally, T = Training course, V = Visit.

05 April 2019 - Construction Evening - Pixie QRP Transceiver

April's club night will be a construction evening. The club has purchased a number of Pixie kits and members will have the opportunity to construct this "mini" 40m CW transceiver. A number of members have already reserved kits but I'm sure there will be enough to go around. The cost of the kit is £5 and you will need to bring along a soldering iron and some tools.
Hopefully your completed kit would look something like the picture below:



Alan G8NKM

11/12 May 2019 - Mills on the Air

Full details will be published in the next newsletter but please let us know when you can provide some help.

Situation Vacant:

Your scribe has tendered his notice for the position of Newsletter Editor having held the post since 1992. A new volunteer is therefore required by the end of 2019 at the very latest. This might suit more than one person in order to ease the monthly production tasks so please have a think about it. Ideally a handover period should be implemented.

Most newsletters are sent via email and the remaining few are printed and posted. This publication is currently produced using Serif Word Plus X8 but it can be produced using Microsoft Word or the word processor in Libre Office which is free and for which newsletter templates are available.

Please contact your scribe or a committee member to discuss the options.

Recent Event News

01 March 2019 - Fundamentals of Amateur Digital Radio by David How G0PAR

David covered the development of data modes in both amateur radio and commercial applications from the earliest days of CW to the current day. His talk was divided into a number of sections:

Amateur Radio:

Amateurs have the privilege to experiment with new ideas in radio communications; as a knowledgeable person having received instruction, passed exams, licensed and are in a process of ongoing self tuition.

Amateur Radio Technologies follow the sequence of commercial practice: CW, AM, FM, SSB, PSK.

Land Mobile Radio:

- Radio to meet Commercial goals, in a mobile environment i.e. Communications 'One-to-Many' (not telephony 'One-to-One'), operated by people who are not interested in radio. It is a tool to aid the job.
- Voice Procedure: Polite (Listen before talk), Impolite (talk regardless)
- Commercial use of radio: Security, Safety, Co-ordination of: People, Resources, Materials.
- Commercial Radio Network Topologies: Mobile Station (MS) to Mobile Station (MS), Base Station (BS) to Mobile Station (MS), Multi-Base Station/Multi-Base Station Trunked
- Regulation to control use of PMR (Not, free for all nor a free-for-all)
- Managed use of spectrum through licences to use a frequency(s) in a location at a certain power.
- Commercial Pricing - Self funding – Government Revenue.
- Efficient use of Scarce Resource – Spectral Efficient. (Do more in less bandwidth).
- Spectrum Re-planning. 625 line TV, 3G, 4G sale.
- Licence Free. (Blue Tooth/Wi-Fi/446MHz/etc)
- International Co-existence.
- Interference Compatibility – Change Analogue to Digital PMR.

Terminology:

Difficulties in terminology and acronyms refer to different things: a Market, a technology, a radio standard.

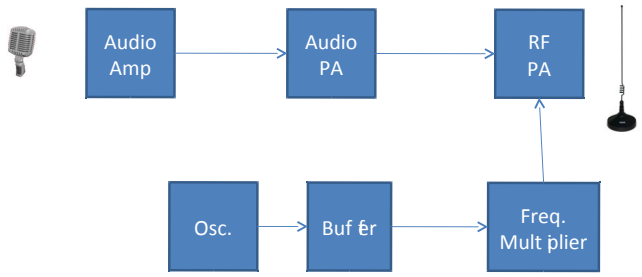
PMR	Private Mobile Radio	Market
DPMR	Digital Private Mobile Radio	Technology
dPMR	Digital Private Mobile Radio	ETSI Standard
DMR	Digital Mobile Radio	ETSI Standard

CTCSS Continuous Tone Control Signalling System

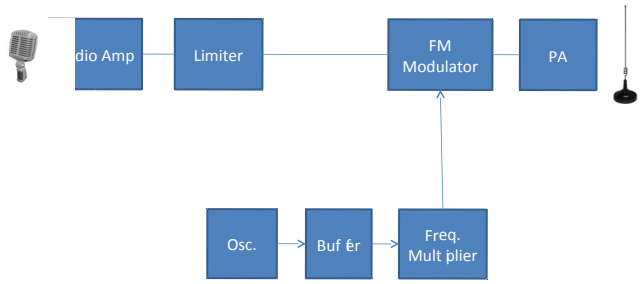
'Private Line'	Market Motorola
'Channel Guard'	Market GE
'Quiet Channel'	Market RCA
MS	Mobile Station
BS	Base Station
Up-Link	Frequency (MStx = BSrx)
Down-Link	Frequency (MSrx = BStx)

Variant A type of Digital radio technology (i.e. Fusion, D-Star)

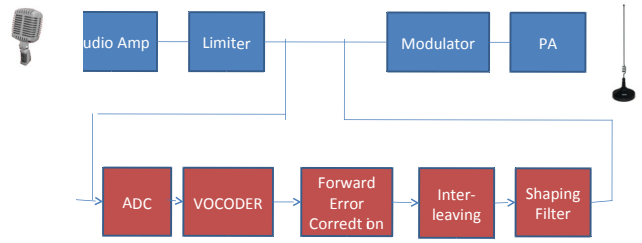
AM Transmitter Block Diagram:



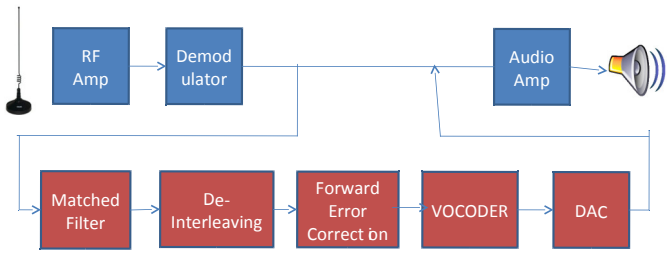
FM Transmitter Block Diagram:



Digital Transmitter Block Diagram:



Digital Receiver Block Diagram:



Forward Error Correction: is a mechanism for sending information using an error correcting code so that the receiver can make limited corrections in noisy or poor communication environments without requesting a resend.

Seven Layer OSI Model: The OSI (Open Systems Interconnection) Model is a conceptual model that characterises and standardises the communication functions of a telecommunication or computing system without regard to its underlying internal structure and technology. Its goal is the interoperability of diverse communication systems with standard protocols.

The model consists of the Apppication layer, Presentation layer, Session layer, Transport layer, Network layer, Data link and Physical layer.

Digital Radio Variants: these include ETSI, APCO, JARL (Fusion), Yaesu (D-Star), Icom and Kenwood (NRON). Most of these are not compatible with each other.down one line or channel.

Variant	Standa rd	Vocod er	Symbol Def	Modulat-ion	RF Ch Width	Transm iss-ion
DPMR	ETSI	AMBE +2	01 +1050Hz 00 +350Hz 10 -350Hz 11 -1050Hz	C4FM	6.25KHz	FDMA
Fusion	Propriet -ary Yaesu	AMBE +2		C4FM	12.5KHz	FDMA
P25 Phase1	ACPO	IMBE		C4FM 4FSK (CQP SK)	12.5KHz	FDMA
P25 Phase2	ACPO	AMBE +2			12.5KHz (2 slot)	TDMA
DSTAR	JARL	AMBE +2 (see GSM)		GSMK	6.25KHz	FDMA
DMR	ETSI	AMBE +2	01 +1.944KHz 00 +0.648KHz 10 -0.648KHz 11 -1.944KHz	4FSK	12.5KHz (2 slot)	TDMA
NXDN	Propiet-ary ICOM/ Ken-wood	AMBE +2		4FSK	6.25KHz	

Trunking:

In telecommunications, trunking is a method for a system to provide network access to many clients by sharing a set of lines or frequencies instead of providing them individually.

The talk concluded with a question and answer session.

Laptop Refurbishment by Nick Stapley

Theorist is away again. I met him by chance on the tube during the recent hot spell wearing his usual characteristic sombrero, and on his way to a conference in Colorado on 'the End of the Cosmic Dark Ages'. He asked if I would fill in for him and I agreed.

I guess many people will have an old spare laptop lying around somewhere and the question is what to do with it. I have an old DELL laptop (not too old – circa 2012) and for some time after getting a more powerful machine I maintained it every now and then. It was originally a Windows 8 machine, and it definitely slowed down in terms of booting up when I installed the free upgrade to Windows 10, and subsequent Win10 updates. Another problem was that as the machine was only turned on infrequently everything tried to update at once, and it took a long time for the machine to become properly usable again.

One particular Win10 update – one of the main April/October updates - took so long that I got fed up with

it and decided to convert it to a machine running the Linux operating system (OS). I have been interested in Linux for a long time. If you have never used it before there are many different variants or 'distros' as they are called. Almost all distros are free, and since about 2008 or thereabouts the Ubuntu variant has been popular and reasonably well known, although I personally don't much care for its quirks.

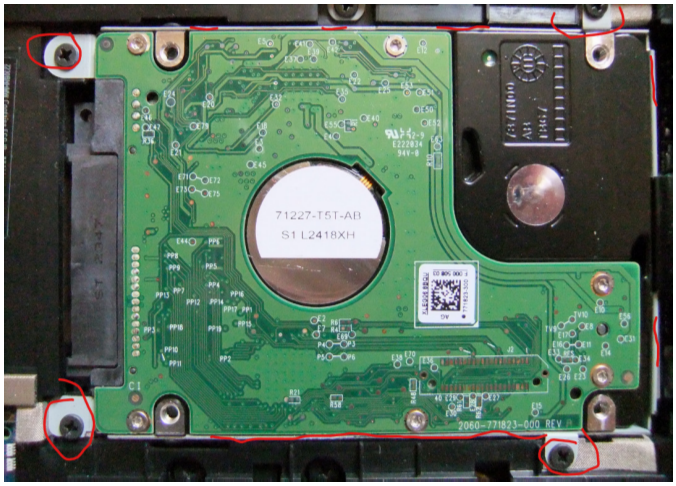
A program called 'Oracle VM VirtualBox' (or simply VM Box) enables you to test the various distros without directly installing them. What VM Box does is enable you to create a virtual computer on your hard drive. It creates a software emulated version of a computer as a file on your real machine, and into which you can install any OS you want. I installed Windows 98SE using an original installation disc from 1999 once just to remind myself what it was like. The virtual machines are sandboxed by the way, so that any malware you happen to pick up is isolated and contained within the virtual machine.

I often play around with VM Box to see what other operating systems look like, and in that way found what I think is the best Linux distro, namely Mint Linux (Cinnamon version). I have used this a lot and installed and used it on a much older desktop with success. In fact I dual booted it with Windows Vista, meaning that on start up I could select Windows or Mint. Because all Linux OSs are 'light' in terms of requirements (and the footprint they leave on your computer), they boot much faster and are a lot less bother than Windows. Also Linux updates typically do not require a reboot, unless a new kernel is being installed, and are under your control.

So the DELL became a Mint Linux machine for a while, and what a refreshing experience it was. However, reading a computer magazine recently I noticed that there was a recommendation for a really cheap SSD. The price of SSDs has been falling considerably of late and the drive recommended was a 240GB Crucial CT240BX500SSD1Z, on sale at Amazon for £33.50. This has the connections to replace a laptop SATA HDD and does not use the modern M.2 connection used for the latest SSDs/motherboards. The review claimed that this was an exceptionally speedy drive for the price, with the only possible downside being the comparatively low guaranteed figure of 80 TBW (80 Terrabyte writes) before failure. SSDs also use less power than HDDs, an advantage running on battery.

Anyway I got one and before it arrived used the Windows media creation tool to create a Win 10 installation USB. This took ages to download and set up, even using my main i7 laptop. On arrival I opened up the DELL with the usual difficulties of opening anything involving plastic and lots of screws. Fortunately the HDD was clearly visible and accessible mounted in its own chassis (indicted in red lines on the photo) and held in place by four screws (circled). Once removed the chassis slid out and the actual drive could be removed from the frame – another four fiddly tidy screws and not the same size as the four red circled screws, but sufficiently close to confuse when I put the SDD (also pictured – note the connections) back into the chassis and then back into the laptop.

On reboot the computer found the installation USB without my having to go into the UEFI [new BIOS equivalent] to tell it to boot from the USB, and immediately started to install Windows. I had my Windows product key to hand but it was not needed. The installer recognised my machine as having a valid licence for Windows and the whole installation was really very quick – no more than 15 or 20 minutes if that, including the time to respond to questions. An upside to the long time to create the installer in the first place.



How well does it work? The immediately obvious thing is the extremely rapid boot. About 10 seconds from pressing the power button to the login screen. The advertising blurb for the drive claims a x3 speed increase over an HDD, but boot is at least 5 times as fast as it was. Overall performance running programs seems similarly fast.

I haven't really used it enough yet to be able to characterise all the overall benefits, but the real test will be with the next big Windows update in April. If that goes smoothly and quickly the decision to go back to Windows will be justified.

Members News

a) New member: We welcome Gareth Evans G4XAT who joined in February.

b) Subscriptions: A small number of members have not renewed for 2019 and will deemed to have resigned at the end of March if their subs remain unpaid.

c) Club Net: We have been running an experimental net on 51.55MHz each Saturday evening commencing at 20:00 with variable results. Steve M0PEL and myself can

barely hear each other despite having no problems communicating on 145.525MHz - reason unknown to date. All other net members ar 5&9.

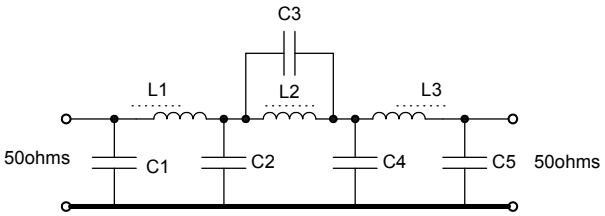
Considering the number of licenced club members the net attendance is very small.

Technical Snippets

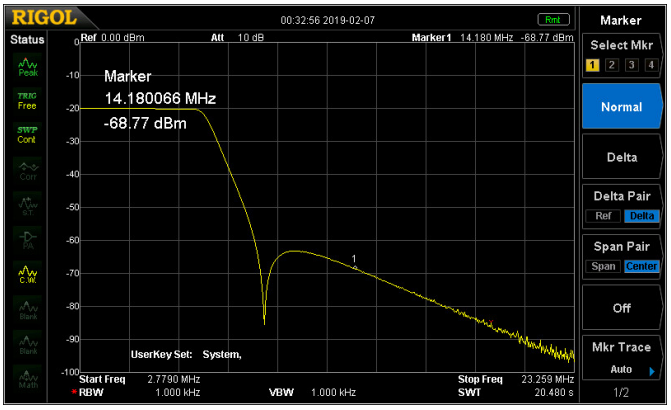
a) Low Pass Filter: m-derived:

By changing one section of the three section filter published last month to an m-derived format the transition into the stop band may be made steeper with an attenuation notch as shown below.

Values are shown in the circuit below for an operational frequency of 7.2MHz and m = 0.6. The notch can be moved up in frequency by increasing the value of m.

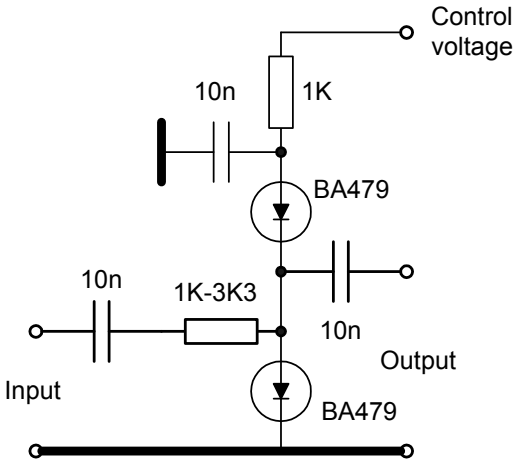


Values:
7.2MHz: C1 = C5 = 354pF, C2 = C4 = 566pF, L1 = L3 = 1.84uH
L2 = 1.06uH, C3 = 186pF



b) PIN Diode Attenuators / Switches:

PIN diodes may be used in series or shunt attenuators or switches or a combination of the two formats in order to increase the attenuation. Applications include AGC, ALC and T/R switches with appropriately rated devices.



The circuit above may be used for AGC or ALC applications and will provide a typical attenuation range of 0-30dB depending on the control voltage. It has the advantage that the signal voltage across the diodes does not increase significantly once the attentuation action has commenced.

At zero control voltage, the insertion loss due to the resistor in series with the incoming signal depends on the frequency, input impedance of the following stage and the output impedance of the previous stage. Ideally the signal source impedance should be significantly less than the 1K-3K3 resistor and the load on the output of the attenuator should be high impedance and low capacitance - a JFET or MOSFET would be preferred. The minimum operational frequency should be about 10MHz for the BA479 so 9MHz should not be a significant problem.

PIN diodes with longer delay times are available for lower frequency operation and the 1N4007 has a PIN structure but the reverse recovery time is not specified so no guarantees of consistent performance.

c) Power Supply Daiwa PS120M:

For the second time in a few months this PSU failed and unfortunately took the above 50/80W power amplifier with it - thankfully the output devices are fairly cheap.

I have re-engineered the PSU to use an L200 integrated circuit power regulator driving two MJE3055 (plastic 2N3055) current amplifiers which provides an output voltage of 3 - 15V at a maximum current of 10amps. Additional internal circuit protection has been provided.

The L200 five pin voltage regulator is very easy to use, reasonably cheap and has a maximum output current of two amps without any external current amplifiers so is a good basic regulator on its own. It requires a minimum of 2.5v between pin1 and pin 5 at all times.

The revised circuit of this power supply is shown on page 8 of this publication.

d) 50/80W PA Kit:

I purchased and assembled this amplifier following problems with my own 20W amplifier where the output transformer runs too hot. Unfortunately it failed when the Daiwa power supply failed and there is no easy way to determine which failed first so now that the PSU is repaired I will replace tthe output devices and try again.

The kit, which is described as a Mini PA Kit, cost about £20 including post and packing and has a well designed PCB and set of wideband transformers. There are a number of suppliers in different parts of the world on the popular auction site. Constructors are advised to check the position of the very small bias control before switching on as it rotates continuously with no stop.

Miscellaneous

The Royal Horticultural Society gardens at Wisley are undertaking a major development of the 240acre site with a new entrance and Welcome building and a new National Centre for Horticultural Science and Learning. It will be opening up parts of the existing Laboratory building with its Arts and Crafts facade to enable visitors to see some of the work undertaken

by horticultural students, apprentices and scientists. The photo over the page shows some of the new equipment involved in a mechanised water control system with a massive water storage tank on the left.

Some of the new facilities are due to open in Spring 2019. The gardens are well worth a visit and located close to the junction of the A3 and M25 with plenty of free parking. You can also get the 715 bus which travels from from Kingston to Guildford via Wisley and Kingston is reachable from Clapham Junction station. For more information see https://www.rhs.org.uk/gardens/wisley

Notice Board – Wanted and For Sale

The Notice Board is for all club members to use so if you have one or more items that you wish to buy or sell then please send in the details. Some of the current list of items may be viewed at:
http://cprec.btck.co.uk/SaleofClubEquipment
All excl P&P.

For Sale

CPREC has a large bank of fundamental and overtone quartz crystals, from 1.0 – 99.91MHz. The list, which is on the club website as a downloadable PDF file. Prices are £1 each to club members and £2 each to non members, excluding P&P. Contact Bob on 01737 552170 or g3oou(at)aol.com.

Dell Inspiron Laptop with charger and spare battery, USB ports, WiFi, serial and VGA ports. Ubuntu Linux and Libre Office installed, £25. Bob G3OOU on 01737 552170 or g3oou(at)aol.com.

73

G3OOU

Diary of External Events

14th April 2019 - West London Radio & Electronics Show

Kempton Park Racecourse, Staines Road East, Sunbury on Thames, TW16 5AQ. A talk-in station will be on air. Car parking is free and doors open at 10am with disabled visitors gaining access 10 minutes earlier. There will be trade stands and a Bring & Buy as well as special interest groups and lectures. Catering is available on site. More details from Paul, M0CJX on 08451 650 351 or info@radiofairs.co.uk.

11/12 May 2019 - Mills On The Air

This UK wide activity will take place during the weekend of 11/12 May and a considerable number of stations are expected to be active.

17-19 May 2019 - Dayton Hamvention

Greene County Fairgrounds and Expo Center, Dayton, Ohio.

19 May 2019 - Dunstable Downs National Amateur Radio Car Boot Sale

Stockwood Park, Luton LU1 4BQ

9 June 2019 - East Suffolk Wireless Revival (Ipswich Radio Rally)

Kirton Recreation Ground, Back Road, Kirton IP10 0PW (just off the A14). Open 9.30am, entry fee £2. Free car parking. Trade tables are from £10. Trade stands, car boot sale, Bring & Buy, SIGs, GB4SWR HF station and an RSGB bookstall. Catering on site. Contact Kevin G8MXV, 07710 046 846. [www.eswr.org.uk].

News from other Clubs

Club Secretaries – please ensure that your future meeting details are present in your newsletters, on your websites or sent to our newsletter editor Bob G3OOU. Palace Pulse is published about ten days before our club meeting which is on the first Friday of each month and closes for editorial contributions a few days before publication. Due to differing publication dates and short lead times it is getting increasingly difficult to include other clubs' events although we will endeavor to do so if advised in time. If we are regularly unable to obtain the information then that club entry will be removed from this newsletter.

Readers - If you plan to visit one of these club meetings please check with the club concerned in case of any last minute changes.

Bredhurst Receiving and Transmitting Society
Meet on Thursday night from 8:30pm at the Parkwood Community Centre, Long Catlis Road, Rainham, Kent, ME8 9PN. Contact secretary@brats-qth.org or http://www.brats-qth.org/brats/

04 Apr	3D Printers by Charles G4VSZ (TBC)
09 May	AGM
06 Jun	Unexplained Mysteries and Cover Ups by Andy Thomas

Bromley & District Amateur Radio Society
Meets at 19:30 on the third Tuesday of each month at the Victory Social Club, Kechill Gardens, Hayes, Bromley,

BR2 7NH. Contact Andy G4WGZ on 01689 878089 or enquiries(at)bdars.co.uk. Web: www.bdars.co.uk

19 Mar Fix-it Night
16 Apr Exam Syllabus: What's Next?
21 May Compact HF Aerials by Bob G3OOU
18 Jun Direction Finding by Steve M0PEL
16 Jul Mini HF Antennas Construction

Chelmsford Amateur Radio Society (CARS)

19:30 on the first Tuesday of each month at Oaklands Museum, Moulsham Street, Chelmsford, Essex, CM2 9AQ. Contact: secretary(at)g0mwt.org.uk Web: www.g0mwt.org.uk

02 Apr A Canal Journey by Vic Rogers G6BHE
07 May TV history and the Museum's Collection by Andy Fremont
04 Jun Beam Building by Dave Cutts M0TAZ
02 Jul Three Short Talks including OFDM and All That by Phil Pearson G0UIB and Marine Radio by Tony Gilbey G4YTG
06 Aug Constructors Competition

Coulsdon Amateur Transmitting Society (CATS)

8:15pm on 2nd Monday each month. Contact: Andy Briers G0KZT on 07729 866600 or secretary(at)catsradio.org. Web site: http://www.catsradio.org/

08 Apr The Anderson Powerpole
13 May Construction Evening
10 Jun Annual DF Hunt
08 Jul Operating Evening
12 Aug Club Annual BBQ

Crawley Amateur Radio Club (CARC)

Every Wednesday 20:00 – 22:00, every Sunday 11:00 – 13:00. Formal events are on the fourth Wednesday of the month, 7-30pm for 8pm. Phil M0TZZ on 07557 735265 or secretary(at)carc.org.uk or Web: http://www.carc.org.uk/

24 Apr The Drake R4C Receiver by Keith G3VKW

Cray Valley Radio Society (CVRS)

Meets at 8pm on the 1st and 3rd Thursday of each month at 1st Royal Eltham Scouts HQ, Rear of 61 - 71 Southend Crescent, Eltham, London, SE9 2SD. Contact: Richard on secretary[at]cvrs.org .Web www.cvrs.org

04 Apr Small Transmitting Loops by Mike G3LHZ
13/14 Apr GB4DFI – to commemorate the Cray Valley life of Owen G4DFI
18 Apr AGM

Dorking & District Radio Society

Meetings at 7.45pm. Contact: David Browning (M6DJB) at djb.abraxas(at)btinternet.com. Web site: http://www.ddrs.org.uk

26 Mar Logger 32
23 Apr Element Interactions in Antennas by Garth Swanson
28 May Protecting Earth from the ravages of the sun by Colin Forsyth
25 Jun Morse code by Mary Ashdown

Echelford Amateur Radio Society

Meetings on 2nd and 4th Thursdays of each month at the Weybridge Vandals Rugby Football Club. Enquiries to Phil at m1gwz(at)icloud(dot)com. Web site: http://www.qsl.net/g3ues/index.htm

25 Apr Annual General Meeting

Hastings Electronics & Radio Club

Meetings held at the Taplin Centre, Upper Maze Hill, St Leonards on sea, TN38 0LQ, 7pm for 7:30 on the fourth Wednesday of each month. Information from Gordon Sweet M3YXH on 01424 431909, email: sionet3344(at)hotmail.co.uk
Web: http://herc-hastings.org.uk/

27 Mar Video Presentation
26 Jun Video Presentation
28 Aug Construction Contest
25 Sep Photos Presentation by Alan Harding

Horsham Amateur Radio Club

meets on the first Thursday of each month at the Guide Hall, 20 Denne Road, Horsham, West Sussex, RH12 1JF. NRQ TQ172304 at 20.00hrs local time. Contact Alister Watt G3ZBU at g3zbu(at)hotmail.com or http://www.harc.org.uk/

04 Apr 50 Years of computer Programming - Jon M0TWM

Mid-Sussex Amateur Radio Society (MSARS)

Meet most Fridays in the Millfield Suite, Cyprus Hall, Burgess Hill, RH15 8DX from 7.30pm till 10.00. Contact Stella on 01273 844511, M6ZRJ(at)msars.org.uk or www.msars.org.uk

29 Mar Radio Night and Table Top Sale
05 Apr Surplus Equipment Sale
03 May HF Propagation by John G8JBJ
14 Jun Foxhunt
21 Jun Windmills Evening

North Kent Radio Society

Meets at the Hurst Community Centre, Room 15, Hurst Place, Bexley, Kent, DA5 3LH. Doors open at 8PM. More information from Stephen G8JZT on secretary@nkrs.info or 07985 753370 evenings or weekends.

02 Apr Antenna modelling by Ian Keyser G3ROO
21 May Morse PRactice Night (TBC)
18 Jun The AOR DV1 by Ian G7PHD
16 Jul Members talk on their favourite software

South East Essex Amateur Radio Society (SEARS)

Contact Mark Callow 2E0RMT on 07842 336444 or secretary(at)southessex-ars.co.uk or http://www.southessex-ars.co.uk/
Meetings: 7pm 2nd Tuesday each month at The White House, Kiln Road, Benfleet, Essex, SS7 1BU.

09 Apr "Our friends against scams presentation". Toni Baptiste from Natwest Bank will be telling us all about banking scams and how best to not become a victim of this increasingly worrying trend.

Surrey Radio Contact Club (SRCC)

7.30 for 7.45pm on 1st. and 3rd. Mondays every Month. Contact John Kennedy G3MCX on 020 8688 3322 or secretary(at)g3src.org.uk. Web: http://g3src.org.uk/

01 Apr Annual General Meeting

Sutton & Cheam Radio Society

8pm on 3rd Thursday every month. Contact Chris Howard at info(at)scrs.org.uk Web: http://scrs.org.uk/. SCRS run a practical group most Monday evenings at the Bandstead Scout Hut.

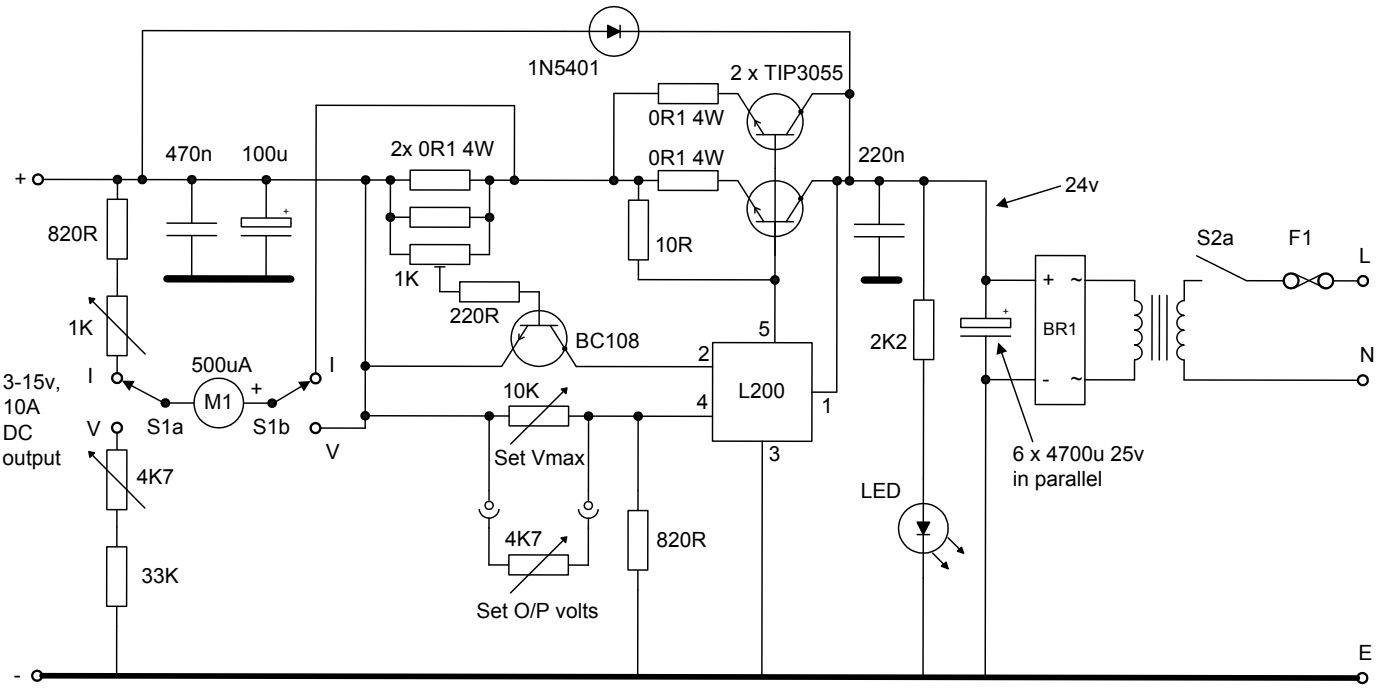
18 Apr 999 Emergency! Public Safety Communications, Past, Present and Future by Steve Shorey G3ZPS

09 May Annual General Meeting and construction competition

20 Jun Highlights of Dayton 2019 by Chris Howard M0CTH

15 Aug Heil Sound by Bob Heil, K9EID

Please replace the (at) with @ when using any email addresses shown in this newsletter.



Notes:
1. Bridge rectifier BR1 and TIP3055 devices mounted on a separate heatsink
2. L200 has a small PCB mounted heatsink

Crystal Palace Radio & Electronics Club is a member of the South East Tutors training group.

Local Training Courses

Licence Level	Dates	Location	Club Provider	Format	Further details
Foundation	23, 24 & 30 Mar	7th Bandstead Scout HQ	Sutton & Cheam	3 days (Sat/Sun)	Martin@m1mrb.co.uk
Foundation	8 & 22 June	Crockenhill Village Hall	Darenth Valley	2 days (Sat)	http://www.darenthvalleyrs.org
Please note that a new syllabus will apply for all exams from July 2019.					
Foundation	22 Sep - 6 Oct	Bromley BR2 7NH	Bromley & District ARS	2 days (Sun)	www.bdars.org
Full	07 Oct - 30 Nov	Eltham, SE9 2SD	Cray Valley RS	TBA	www.cvrs.org
	= course commenced				

CPREC Committee Information		
Officers:		
Chairman:	**Secretary:**	**Treasurer:**
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