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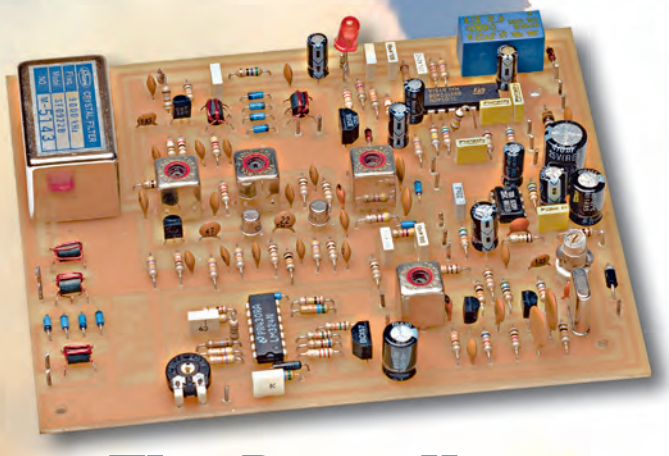

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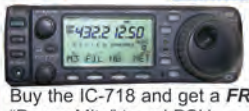

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**Freq range 144-146MHz, 430-440MHz Tx*
**55/50W (3 pwr steps each band)*
**Wideband Rx 118-173, 230-549 & 810-999MHz*

£215 D

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2m / 70cm 100W Base station all - modes with option for 23cm module (**UX-910 £359**)

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Dual Band 2m & 70cm with detachable front

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**High power 50W 2m /40W 70cms*
**Wide receive inc. civil & military air-band *CTCSS & DCS with direct keypad mic.*
**Detachable front panel *1000 memories plus five one-touch*

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*2m FM Mobile transceiver * High power 65W * Capable of VHF wideband receiver

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£189.95 C

- 144-146MHz Tx/Rx: FM
- 430-440MHz Tx/Rx: FM

Up to 6W out with Li-ion battery and **"scanner" style coverage from 100kHz to 1300MHz** including SSB on receive! This is a great radio to have at all times when you are on your travels.

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What the Reviewers say:

Practical Wireless
"I've not heard filter performance like this on any rig"

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"will extract weak and difficult signals where others fail"

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"third order IMD is up there with the best radio we have ever measured."

RSGB Radcom:
"selectivity - I have never achieved this on any other radio except perhaps the TenTec Orion. - the receiver performance rates with the very best - more and more radios will engineered in this way in the future - the available features and functions is awsome and comparable to top end radios and more"

For more quotes and full reviews, please check out www.flex-radio.com

Key Specifications

Rx - 12kHz to 65MHz
Tx - 1.8MHz to 52MHz (Ham)
Power - 1W - 100W (500mW 6m)
IMD - 99dB
MDS - 130dBm (14MHz 500Hz)
Modes - SSB CW AM FM

*Realtime Panadapter
*Click on Spectrum Display Tune
*Filter shape factors 1.05:1
*No ring filters down to 25Hz
*AGC after brick wall filter
*Graphic Equaliser & Compander
*Variable bandwidth Tx filter
*Iambic Memory Keyer

Prices

SDR-1000 100 Watts	**£995.00**
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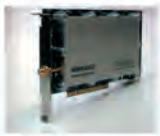

Choose from internal PCI slot module or external module.

"i" = internal model
"e" = external model

WR-G303 Features

Real-time spectrum analyser; Plug and Play installation, 2nd IF totally SDR; Easily updated, Simple USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Triple AGC speeds or manual; Extensive memory feature; Dual real-time spectrum scopes; Bandwidths of: 0.5, 2.5, 3, 4, 6, and 12kHz; SSB sens. typically: 0.3uV; AM Sens: 0.9uV.

Specification

Mode: AM AMN AMS SSB CW NFM
Tuning steps: 1Hz **Image reject**: 60dB
IP3: +5dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 5dB **RSSI Sensitivity:** 1uV
Scan Speed: 40chs per sec
IFs: 45MHz; 12kHz **Stability:** 10 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12VDC Unit or PCI

WR-G305 Features

Real-time spectrum analyser; Plug and Play installation, 2nd IF totally SDR; Easily updated, Simple USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Dual Loop variable speed AGC; Manual IF gain; Unlimited memory; Audio filter: Dual real-time spectrum scopes; Multifunction squelch; Graphi hit count; Bandwidths of: 0.5, 2.5, 3, 4, 6, 12 and 220kHz; SSB sens. typically: 0.3uV; FM Sens: 0.7uV.

Specification

Mode: AM AMN AMS SSB CW NFM
Tuning steps: 1Hz **Image reject**: 60dB
IP3: 0dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 5dB **RSSI Sensitivity:** 1uV
Squelch: Level, noise, voice, CTCSS, DCS
Scan Speed: 60chs per sec max
IFs: 109.65 MHz;12kHz **Stability:** 10 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12VDC Unit or PCI

WR-G313 Features

Real-time spectrum analyser; IF Shift & Notch Filter; 2nd IF totally SDR; IF spectrum record, USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Triple AGC speeds or manual; Extensive memory feature; Dual real-time spectrum scopes; Noise Blanker; Test & Measure features; Bandwidths variable 1Hz - 15kHz; 600 Ohms line output; SSB sens. typically: 0.25uV; AM Sens: 0.9uV.

Specification

Mode: AM AMS SSB DSB ISB CW NFM
Tuning steps: 1Hz **Image reject**: >70dB
IP3: +8.5dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 2dB **RSSI Sensitivity:** 1uV
Dynamic Range: 95dB
Scan Speed: 40chs per sec
IFs: 45MHz; 16kHz **Stability:** 0.5 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12VDC Unit or PCI

WR-G315 Features

Real-time spectrum analyser; IF Shift & Notch Filter, 2nd IF totally SDR; IF spectrum record, USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Dual Loop variable speed AGC; Manual IF gain; Unlimited memory; Audio filter: Dual real-time spectrum scopes; Multifunction squelch; Nise Blanker; Bandwidths of: variable 1Hz - 15kHz; SSB sens. typically: 0.25uV; FM Sens: 0.5uV.

Specification

Mode: AM AMS SSB DSB ISB CW NFM
Tuning steps: 1Hz **Image reject**: 60dB typical
IP3: 0dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 5dB **RSSI Sensitivity:** 1uV
Dynamic Range: 90dB
Squelch: Level, noise, voice, CTCSS, DCS
Scan Speed: 500chs per sec @1kHz steps
IFs: 109.65 MHz;12kHz **Stability:** 0.5 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12V DC or PCI

Prices

WR-G303i	HF PCI module	£385.95	**WR-G313e**	HF External USB	£809.95
WR-G303e	HF External USB	£454.95	**WR-G3133e180**	HF External USB	£999.95
WR-G305i WFM	HF-UHF PCI module	£469.95	**WR-G315i WFM**	HF-UHF PCI module	£1499.95
WR-G305e WFM	HF-UHF External USB	£539.95	**WR-G315e WFM**	HF-UHF External USB	£1699.95
WR-G313i	HF PCI module	£699.95	**WR-PDO**	Pro demod software	£69.95
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Cover subject

Satellite communications are not as far out of reach as you may think. **Peter Perera G4AJG's** article demonstrates just how easy it is to work into space. Also this month, you can continue building the *PW* Poundbury project and find out about the Kenwood TK-90.

Design: Steve Hunt
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features

regulars

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rob mannion's keylines

Rob Mannion G3XFD

Recently, readers may remember that I expressed my fears (in Topical Talk) regarding the near hysteria regarding radiation from cell 'phone masts, etc. I was concerned that non-technical media hyped sensational news reports (often regarding cell 'phone mast on schools) were getting out of hand. At the same time, it seemed to me that parents were unwilling, or unable, to stop their children literally clamping 'phones to their heads!

Unfortunately, the problems for our hobby may now be closer than ever. Fortunately for us in the UK, the problem may have started in Israel where there are many Amateurs. We have every reason to be concerned for our fellow enthusiasts in this far away country. Although there is now some doubt regarding the origins and authenticity of the announcement of strict new rules regarding radio equipment/radiation levels that led to the concerns that appeared on several news outlets.

Several of our readers in Israel contacted me to ask if I'd heard the reports of the new regulations. I hadn't and the first mention of it in the UK was on the **Southgate Club** website a few days later,

Popular In Israel

Amateur Radio is a popular hobby in Israel and their are a number of *PW* subscribers there. They keep me updated and I often feel very close to our friends as the Tel Aviv beacon **4X6TU**, is one of the most reliably received beacons on the International Beacon Project system at my Bournemouth QTH. In fact, whenever the 4X6TU beacon is peaking RST599 on 14.1MHz there's a good chance I can work an Israeli station.

As I understand it, the situation (thanks to Israeli readers), is that new radiation level regulations were drafted in the last year. However, none appear to be in force as yet. So, it seems to me that the best thing we can do is to wait until the story is clarified.

In the meantime, all Radio Amateurs must be prepared to 'keep their ears open' in their own countries, feed the information gained to their national societies who will then keep the International Amateur Radio Union (IARU) informed. By working together we can ensure only the most accurate information ends up appearing in the non-technical media.

Finally, on this topic - I'm bearing in mind the current Middle East situation and don't wish to become political - the original story surprised me greatly. Why? In answer, I suggest this because our hobby has a very high profile in the USA and many modern Israeli families originated from America.

I've only ever visited Israel on three occasions and at first I was surprised to hear strong American accents until Israeli friends told me that they had emigrated from the USA. However, the reason for venturing on to this boggy political ground is to make the point (remembering that 'Ham' radio is much valued in the USA) that with the help of the American cultural influence the immigrants brought with them, any storm will be weathered. Despite this, Amateurs everywhere must stay alert and as I've already suggested, pass on 'scare stories' to their national societies and the IARU.

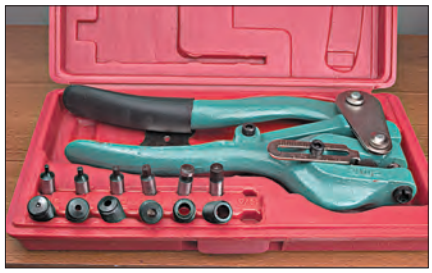
Good News For Hole Punchers!

Earlier this year, in the March Radio Basics column, I described a hole-punching tool that was proving useful on my shack workbench. The **Rev. George Dobbs G3RJV**, kindly purchased one for me in the USA during his trip to the Dayton Hamvention. The cost was only around $US20 but it's a heavy item and George was very kind to bring it back for me.

I undertook some research on behalf of *PW* readers to see if the punch could be obtained directly, rather by personal import or with the help of friends. They were, but as is often the case here in the UK, the price had escalated steeply to over £110 plus P&P, etc!

To the rescue came **Kevin Cornmell M3KCO**, who gave me the details of the **Middlesex University Teaching Resources** website containing interesting education equipment.

http://www.mutr.co.uk/prodDetail.aspx?prodID=478



From MUTR the punch costs £37.48 plus P&P. Incidentally, MUTR is a self-funded organisation that started as a support to technology and design teachers. They stock other items of interest to hobbyists and can be contacted at **Unit 10, The IO Centre, Lea Road, Waltham Cross, Hertfordshire EN9 1AS. Tel: (01992) 716052**.

My thanks go to Kevin M3KCO for his valuable help. **Rob G3XFD**

practical wireless services

Just some of the services *Practical Wireless* offers to readers...

Subscriptions

Subscriptions are available at £33 per annum to UK addresses, £41 Europe Airmail and £50 RoW Airmail.

Components For *PW* Projects

In general all components used in constructing *PW* projects are available from a variety of component suppliers. Where special, or difficult to obtain, components are specified, a supplier will be quoted in the article.

Photocopies & Back Issues

We have a selection of back issues, covering the past three years of *PW*. If you are looking for an article or review that you missed first time around, we can help. If we don't have the whole issue we can always supply a photocopy of the article.

Placing An Order

Orders for back numbers, binders and items from our Book Store should be sent to: **PW Publishing Ltd., Post Sales Department, Arrowsmith Court, Station Approach, Broadstone Dorset BH18 8PW**, with details of your credit card or a cheque or postal order payable to PW Publishing Ltd. Cheques with overseas orders must be drawn on a London Clearing Bank and in Sterling. Credit card orders (Access, Mastercard, Eurocard, AMEX or Visa) are also welcome by telephone to Broadstone **0870 224 7830**. An answering machine will accept your order out of office hours and during busy periods in the office. You can also FAX an order, giving full details to Broadstone **0870 224 7850**. The E-mail address is **bookstore@pwpublishing.ltd.uk**

Technical Help

We regret that due to Editorial time scales, replies to technical queries cannot be given over the telephone. Any technical queries by E-mail are very unlikely to receive immediate attention either. So, if you require help with problems relating to topics covered by *PW*, then please write to the Editorial Offices, we will do our best to help and reply by mail.

A new initiative has been launched which is designed to help you obtain your favourite magazines from newsagents. Called **Just Ask!** its aim is to raise awareness that newsagents can stock, order and in some cases even home deliver magazines.

We will be including the **Just Ask!** logo in the pages of this and future issues and have included a newsagent order form to help you to obtain copies.

So keep a look out for the logo and next time you visit your newsagent remember to **Just Ask!** about obtaining copies of your favourite magazines.

amateur radio waves

Sitting On A Special Bench!

● **Dear Editor**

I read with interest your remarks in Keylines on page 6 of the September issue of *Practical Wireless* (regarding publicity and public relations on behalf of Amateur Radio). I recently spent a pleasant afternoon sitting on a bench by the ancient church at Bosham Harbour in West Sussex. It overlooks the harbour and is a very fine spot! The bench in question bears a plaque to the memory of the late **Gerald Marcuse G2NM** and contains the logos of the **Radio Society of Great Britain** and the **Radio Amateur Old Timer's Association** (RAOTA). I tried to interest several visitors who also came to sit on the same bench, in the story of G2NM and his pioneering Empire broadcasts on the short waves, the first of which took place in 1927.

Some people were interested, some were not but I endeavoured to point out that in these times - when we take so much for granted - that is good to remember the pioneers who made it all possible. Incidentally, there's also a sundial dedicated to G2NM's memory in the churchyard but it's too much in the shade from trees to indicate the time nowadays!

I also suggested to some visitors who showed some interest, that they should visit the **Amberley Chalk Pits Working Museum**, near Arundel in West Sussex. The museum has an exhibition of vintage wireless equipment, including some of G2NM's gear.

When this exhibition was opened by the then *PW* Editor **Geoff Arnold G3GSR**, I was invited to go along by **Ron Ham** of Storing, a well know columnist for *PW* of that era. It was a good day out.

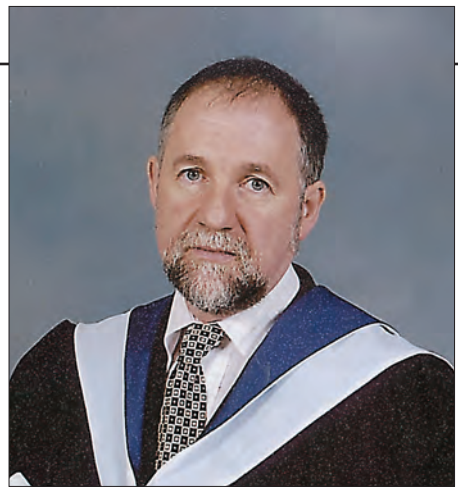
Often when I wear my Royal Air Force Amateur Radio Association (RAFRS) or RSGB ties, people come up to me to ask about them. I have had a good many chats as a result and hope I interested them a little in Amateur Radio. I really think ties can tell you a lot about people!

Keep up the good work. Good wishes to everyone at *PW*.

Colin Dawson G4UZS
Portsmouth, Hampshire

You're obviously working hard to promote the public image of our hobby yourself Colin. I congratulate you on your efforts. I too have sat on the same bench commemorating G2NM. However, whenever I drive by the former BBC high power transmitter (now operated for the BBC by a specialist provider) and see the incredible antennas arrays I think of Gerald's pioneering work. Unfortunately, in the book BBC Engineering History 1922 - 1972, the author, Pawley makes only a short, brusque, mention of the work of Radio Amateurs in the h.f. broadcasting field. Despite this omision, the book is superb and I recommend it to readers if they can find a copy. The section covering short wave broadcasting to the then 'Empire' is fascinating. Personally, I think of G2NM every time I re-read this truly invaluable book. The various Internet bookstores/websites seem to have plenty of copies of this book, which has been out of print for many years. **Editor**

Eamonn Gibson EI9DUB Silent Key



● **Dear Rob**

In a recent edition of the magazine, you asked to be informed about any Silent Keys. Well, sadly I have one and it's **Eamonn Gibson EI9DUB**. My very good friend, passed away on Sunday 23 July. Eamonn was based in Dublin but spent a lot of his free time in County Mayo in recent years, in fact, we first met you at the radio rally there a few years ago.

He said radio reception was much better in County Mayo than in Dublin! Eamonn was just 50 years of age and died after a very short illness. His lifetime passion in radio was the Broadcast bands Radio Australia in particular and listening to VK and ZL stations in early morning in winter time.

On the transmitting side he was active on the 50 and 144MHz bands. He loved to talk and I think that was why I could never convince him to learn Morse! Eamonn only became active on h.f. in the last year when the regulations in the Irish Republic were changed (in the same way as the UK) and the DX bands were open to him.

Eamonn was a member of the **Terenure Radio Club** for a number of years and the last radio rally he attended was Enniskillen in Northern Ireland a couple of months ago.

Eamonn's wife Therese, sons Eoin (25), David (23) and his daughter Ruth (19) loved him very much. He will also be very much missed by all who knew him for his love of radio, his enthusiasm and loyalty as a friend. Regards to everyone at *PW* and thank you for caring.

Dermot Fagan EI5HT
County Mayo, Ireland

Thank you for contacting us so quickly Dermot and I was very saddened to hear of Eamonn's sudden death. I was privileged to have met and known yourself and Eamonn through my other good friends at the ***Mayo Radio Experimenters Network (MREN)****. We both shared an interest in broadcasting - particularly on the h.f. bands. I wrote to Eamonn's family expressing my sympathies and received a letter back with the photograph published with your letter. After an interesting and varied career, Eamonn latterly devoted his life to working in professional child care, and is photographed on his graduation, receiving a Degree in Social Care, November 2005. Often, it's only because of the actions of kind people such as Dermot EI5HT, that we hear such news, quickly enough to respond in an appropriate manner.* **Rob EI5IW/G3XFD**

Back On The Air Thanks To PW!

● **Dear Rob**
After a gap of a couple of years, both transmitting and reading *PW*, I picked up a copy of the latest issue yesterday, 14 August. Since moving down to east London, from Milton Keynes, I was off the air for a while. But I'm now back with a lovely Yaesu FT-897 and I've realised *PW* is a 'must read' for all Radio Amateurs!

Encouraged by numerous articles by you, over the years, extolling the virtues of portable operating, my XYL and I strung up a dipole just 15 feet above ground, outside our block of flats. Amazingly, with just 30W of s.s.b. we worked four Welsh stations within about 10 minutes! So I've now got the taste for portable activity and hope to get out and about again before winter sets in. Keep up the good work with *PW,* I think you have the right balance between technical articles and less taxing things like equipment reviews. 73 to everyone.
Jonathan Kempster M5AEO
East London

Jonathan is within antenna rigging distance of the Canary Wharf Tower. If he succeeds in getting permission for a wire to be slung from the top - PW readers will be informed! Welcome back Jonathan. **Editor**

Publicising & Promoting Amateur Radio

● **Dear Rob**
Whilst driving in London some 18 years ago I was chatting to two local Amateurs - Dennis and Lawrence - on the GB3NL repeater. We had chatted many times before but had never met. Realising that we were within a mile of each other on this particular day, we decided to meet-up for an 'eyeball' across the road from Billingsgate Fish Market.

We had only just met-up and were all sitting in one vehicle, when we noticed a police officer (sporting a full-set beard) coming rapidly towards us. In what must have looked like a 'Battle of Britain Scramble', we all headed hastily for our own vehicles, trying desperately to avoid a parking ticket.

However, the officer was more interested in our antennas than the yellow lines we were parked on. He joined us in our vehicle and expressed a keen interest in obtaining an Amateur Radio Licence. We gave him as much information as we could and Dennis offered him his 'phone number to act as a back up for further help. Some nine months later, Dennis received a phone call from him informing us that he had, in fact, gained his licence!

It was pure chance that we were all there at the time that policeman appeared. Had we have not been there, we might have lost another Amateur Radio recruit. But it was just that - pure chance that we helped to launch him into the hobby.

We desperately need a better method to get information to those who are interested in getting into the hobby, so they get the help and advice needed. I fully support your views on this subject Rob. Best wishes.
Richard Brunton G4TUT
Enfield
North London

A great story Richard! Let's hope that the Amateur involved will recognise the story and contact us. Incidentally, it's worth pointing out that Richard runs the superb ***Southgate Amateur Radio Club*** *website* ***www.southgatearc.org*** *This site is an everyday 'must' for news and stories on our hobby. It's very professional and operates in an unbiased, ethical fashion. I recommend it to PW readers. I now invite readers join me on the Topical Talk pages for further discussion on Richard's topic.* **Editor**

Letters Recieved by e-mail. A great deal of correspondence intended for 'letters' now arrives via E-mail, and although there's no problem in general, many correspondents are forgetting to provide their postal address. I have to remind readers that although we will not publish a full postal address (unless we are asked to do so), we require it if the letter is to be considered. So, please include your full postal address and callsign with your E-Mail. All letters intended for publication must be clearly marked 'For Publication'. **Editor**

amateur radio rallies

Radio rallies are held throughout the UK. They're hard work to organise so visit one soon and support your clubs and organisations.
Look out for representatives from *Practical Wireless* and *RadioUser* at rallies printed in bold.

September 24
Plymouth Radio Rally
Contact: **Frank Russell**
Tel: **(01752) 563222**
E-mail: **frank@foxonezero.fsnet.co.uk**
The Plymouth Radio Club will be holding their next Radio Rally at the Stoke Damerel Community College, Plymouth PL3 4BB in Devon. There will be over 300 car parking spaces with lots of indoor stalls selling everything you might want that is even slightly radio related! Refreshments vans, indoor rest and natter areas, disabled toilets, Bring & Buy and demonstrations. Doors open at 1000. Talk-in on S22.

October 1
Telford Hamfest
Tel: **0121-288 5970**
Website: **www.TelfordHamfest.co.uk**
The Telford Hamfest will be held at Enginuity World Heritage site in Coalbrookdale, Telford, Shropshire TF8 7DQ. Admission is £2. Enginuity is a fantastic 'Hands on Technology' Centre, which invites visitors of all ages and interests to roll up their sleeves and get involved!

October 15
Rusty Radios Rally
E-mail: **info@rustyradios.com**
Website: **www.rustyradios.com**
The 2nd Rusty Radios Rally will be held in Cottered Village Hall, Cottered near Buntingford, Hertfordshire SG9 9QP located on the A507 between Baldock and Buntingford (A1M J10 and the A10). Doors open at 1000 and entry is £1, concessions for under 16s. Refreshments and snacks will be available and there is a car park.

October 15
The Blackwood and District ARS Rally
Contact: **George**
Tel: **(01495) 724942**
The Blackwood and District ARS are holding their rally at the Newport Centre, Newport, South Wales NP20 1UH, which is one mile from junction 25a of the M4 (junction 26 when travelling from the west). Doors open 1030 for disabled visitors or 1045 for other visitors. Entry is £2, children free.

October 22
Galashiels and District ARS Radio & Computer Rally
Contact: **Jim**
Tel: **(01896) 850245**
E-mail: **gm7lun@qsl.net**
Galashiels and District Amateur Radio Society will be holding their Annual Radio and Computer Rally in The Volunteer Hall, St John's Street, Galashiels, Scotland TD1 3JX. Doors open 1100 and admission is £2. There will be traders, a Bring & Buy and refreshments.

If you're travelling a long distance to a rally, it could be worth 'phoning the contact number to check all is well, before setting off. Look out for representatives from *Practical Wireless* and *RadioUser* at rallies printed in bold.

amateur radio news & products

A comprehensive look at what's new in our hobby this month

New QSL Manager

The QSL Manager for the **International Short Wave League** (ISWL) has changed from Alan Loveridge to: **Herbie Yeldham, BelleFleurs, 18 Wade Reach, Walton on the Naze, Essex CO14 8RG**. All QSL cards to members should be sent direct or to the new address E-mail: **iswlburo@yahoo.co.uk**

In Stock Now!

If you're a fan of our sister publication, *RadioUser*, then you'll be pleased to hear that we now have available binders to keep your issues in. The smart black binders with the *RadioUser* logo on both the spine and front are a must if you want to keep your collection tidy, safe and to hand for easy reference. To order your *RU* binder for **£10 plus P&P** please use the order form on page 61 of this issue or call **0870 224 7830** today!

Island of Mull Activation

The **Sands Contest Group** (M0SCG) will be activating the Island of Mull (EU-008) during the week of 23rd to 29th September. All the h.f. bands will be activated and modes used will, hopefully, include s.s.b., RTTY, PSK31 and maybe c.w.

Operators during the event will include, **Ian G0VGS, Kev (the hat) G6FKE, Mark M0DGK, Chris M0DWK, Bex 2E0BEX** and **Andrew G0LWU**. The equipment they will be using will include a Yaesu FT-920, Kenwood TS-2000 and Elecraft K2 and a Ranger 811 amplifier. The antennas will include a 3-band Spiderbeam and dipoles for each band and it's hoped to also load the main mast as a vertical.

The contest group will also hopefully be activating Iona as well, weather permitting. Several of the members will be attempting to activate Ben-More (SI-003) for SOTA and WAB information will be available.

The members of M0SCG hope to work as many operators as possible during their stay. Further information on the Sands Contest Group can be found at **www.gb7mbc.net/sands/**

Receiving ISS SSTV Pictures

The astronauts onboard the *International Space Station* (*ISS*) are all Radio Amateurs and they have recently completed commissioning the SpaceCam1 Amateur Radio Slow Scan TV (SSTV) system developed by MAREX-MG. It will be used by *ISS* crews for SSTV image communications with Amateur Radio operators world-wide.

Some of the first pictures from the newly commissioned system were received by Chelmsford Amateur Radio Society (CARS) member, **David Worboys M0ZLB**. On Saturday 12 August during the 2335UTC pass, he successfully received two SSTV pictures from the astronauts on 145.800MHz.

David received the pictures using his Icom IC-706MkIIG with a Maldol GHX-510 tri-band vertical antenna. The decoding of the SSTV picture was done using the free *MMSSTV* software and he used *Nova* for the satellite predictions.

Further information on SpaceCam1 and how to receive SSTV can be found at **www.marexmg.org** The site also has some of the pictures already received from SpaceCam1.

If you'd like to chat to David M0ZLB about his 'pictures from space' experience, go along to one of the Chelmsford ARS meetings on the first Tuesday of each month. Meetings are held at the **Marconi Social Club (MASC), Beehive Lane, Great Baddow, CM2 9RX**, doors open at 1910 for a start at 1930 start.

For further information on CARS contact the club secretary:
Martyn Medcalf G1EFL
Tel: (01245) 469008
E-mail: info2006@g0mwt.org.uk
Website: www.g0mwt.org.uk/

MARS Moves

The **Midland Amateur Radio Society**, known locally as MARS, is celebrating its 75th anniversary this year, having been founded on 16 June 1931. Over the years, the society has seen many changes and the latest is a move to new premises.

Members of MARS now meet at the **Selly Park Baptist Church, 1041, Pershore Road, Stirchley, Birmingham B29 7PS**. Club nights are held every Wednesday from 1900.

The club serves both licensed Amateur Radio enthusiasts and Short Wave Listeners. There are currently have over 60 members of MARS, who are predominantly from the Birmingham area but there are also a few out-of-town members from all over the UK, Europe and Australia!

If you're interested in joining MARS please contact:
Ron M0WSN
Tel: 0121-742 1808
Website: www.midamradio.co.uk

Send all your news and club info to
Donna Vincent G7TZB
at the PW editorial offices
or E-mail pwnews@pwpublishing.ltd.uk

New Address

Langrex Supplies, suppliers of valves, tubes, semiconductors and integrated circuits have moved. **Michael Rhodes** of Langrex, says although they have moved to a new venue, customers can still be assured of the same quality service as they've had over the last 40 years.

Military enthusiasts will be interested to know that Langrex also specialise in Military parts including many obsolete items

The new address for Langrex Supplies is:
Daux Road
Billingshurst
West Sussex
RH14 9SJ
Tel: (01403) 785600
FAX: (01403) 785656

New Look Kenwood UK Website

The new look Kenwood Electronics UK website recently went live. The website has undergone a complete overhaul and the web designers at Kenwood have been working very hard to create a complete database of all the models, their features, functions and specifications, which can be accessed by customers and dealers alike as a detailed product resource.

As with any website it's always a 'work in progress' and so will be modified and updated all the time. Take a look for yourself at **www.kenwood-electronics.co.uk**

Jamboree on the Air

The annual Jamboree on the Air (JOTA) event takes place over the weekend of 21st/22nd October with Radio Amateurs set to share the fun and excitement of the hobby with youngsters throughout the world. To help Amateurs prepare for this year's jamboree, the Radio Society of Great Britain (RSGB) is offering a special JOTA pack featuring a list of participating GB stations and details of countries that permit third party greetings messages. To get a pack just send a stamped addressed envelope to the Amateur Radio Department at **RSGB HQ, Lambda House, Cranborne Road, Potters Bar, Hertfordshire EN6 3JE.**

Jamboree on the Air participants using a GX or similar prefix call instead of GB are urged to contact the Amateur Radio department no later than 6 October so that their details can be included in the pack. The department's E-mail address is **ar.dept@rsgb.org.uk**. Applications for a GB callsign can be obtained on Ofcom's website or by phoning Ofcom Amateur Radio Licensing on **0207-981 3040**.

Analogue Radio Sales Tuned-out

One hundred years after what is widely considered to have been the first audio radio broadcast, **Dixons**, the leading UK e-tailer of consumer electricals, is discontinuing the sale of analogue radios. The decision follows substantial growth in the sale of digital radios and expansion in the number and range of digital transmitters. Digital radios are now outselling analogue radios by 30:1 at **www.dixons.co.uk**

The time-line below shows just how much radio has changed in the past 100 years:

December 1901: Marconi made the first radio transmission across the Atlantic from Poldhu, Cornwall to Signal Hill, St Johns, Newfoundland, Canada by sending the letter S in Morse Code, using a large antenna suspended from a kite.

24 December 1906: Reginald Fessenden used an Alexanderson alternator and rotary spark-gap transmitter to make the first radio audio broadcast, from Brant Rock, Massachusetts.

October 1922: The UK government granted the British Broadcasting Company a licence to operate and November 14 1922 saw the official opening of the BBC London station 2LO on a wavelength of 369 metres from Marconi House on The Strand. On 15 November 1922 the BBC was registered and the BBC Manchester station 2ZY was officially opened on 375 metres transmitting from the Metropolitan Vickers Electricity works in Old Trafford. On November 16th BBC Birmingham opened with 5IT transmitting from the General Electric Company works at Witton using 420 metres. BBC Newcastle, 5NO, was the last station to open in 1922 from a transmitter at Eldon Square using 400 metres. These 'main' stations broadcast with a power of 1.5kW.

February 1924: The Greenwich Time signal (The Pips) was broadcast for the first time on BBC radio.

1995: The BBC turned on its first DAB radio services.

2002: The First sub-£100 DAB radio went on sale.

2006: Dixons tunes out of analogue radio sales.

Despite the changes in technology, Amateur Radio shows that radio is not just about going digital and that there is still a lot enjoyment to be gained from building and using your home-brew radio equipment! (Editorial staff).

Taunton & District ARC

The **Taunton & District Amateur Radio Club** has moved to new premises at **St. Augustine of Canterbury School, Lyngford Road, Taunton TA2 7EF.** Meetings are held every Wednesday, doors open at 1930 for a 2000 start. Visitors are always given a hearty welcome and a tea and biscuits break is held at meetings.

The Club is a certified Examination centre for the Foundation, Intermediate and Advanced licences for which training is also given at the club. The Club station consists of an Icom IC-735 and SGC-230 Smartuner. The current antenna is a Carolina Windom 160, which will be replaced by an 80m (3.5MHz) doublet fed with 450Ω ladder line. There is also a v.h.f. station.

For more details on the Taunton & District ARC and their activities take a look at: **www.qsl.net/g3xzw/**

George G3ZQS Founder of FISTS Silent Key

George Longden G3ZQS, founder of the FISTS c.w. club, died on April 24 2006 aged 78. In the extract below (from a longer obituary) his son Paul, kindly provides us with an appreciation of his father's interesting life.

My Father **Eric (George) Longden G3ZQS** was born on January 20 1928, the son of Albert and Ellen Longden. He was a rebellious child by all accounts and was, (even at the most tender age) a staunch believer in a system of 'alternative education'. He never attended school and was constantly pursued by teaching staff and officials. School was never his favourite pastime!

As the Second World War was drawing to a close, with the help of forged documentation and parental consent forms, my father joined the Royal Navy. Thankfully he was never to see any wartime action. This was his education and his initiation to the world of Morse code. I remember well, as my father sat with a look of contentment as he recalled memories way back in his mind as he expressed his fascination for a language of Morse tones and clicks. However, this was soon to become an obsession.

The other great love of this time was Ceylon, now Sri Lanka. He was serving aboard HMS *Belfast* when the warship arrived in Ceylon he instantly fell in love with the country. It was to him a paradise, which he always classed as 'home' and his one wish (never achieved) was to return there. Here his rebellious nature was to rear its head again as he missed the departing ship (accidentally of course). He would spend a good few years in his paradise, with a menagerie of animals, birds, snakes and a lot of very wary locals who he had befriended. Finally though, he had to return to reality and his education aboard HMS *Belfast* continued.

A leap forward in time to the 1960s brought renewed interest in Morse. My father studied after work, taking exams to achieve his treasured Radio Amateur Licence examination. His first shack was actually the dining room, which it has to be said, caused a little friction! On the air he started to use the name George as he had in his Navy days. His callsign G3ZQS was to become a well known on the bands and it wasn't long before he joined the prestigious ranks of the **First Class Operators Club** (usually referred to as FOC). I attended many FOC functions with my father and it never ceased to amaze me at his popularity, with a story for every occasion he commanded huge respect and was very popular.

Unhappy with certain aspects of radio clubs and their the administration, he decided to form his own. As a results, the Fists c.w. club (aimed at promoting the use of Morse) was born. And, in all honesty, if he were here today he would say that the success of Fists had dumfounded him.

I often recall with fondness his sometimes less than 'politically correct' humour and opinions on world and local affairs. These opinions were often put into his monthly newsletter, *Keynote*, which was always worth a read.

There was as always a public face and a private face to this great man. He was a loving father and a very caring man, ready to help in any way he could. My Father George G3ZQS, is greatly missed and hopefully will never be forgotten.

Paul Longden

Everyone on PW extends their sympathies to Paul and his family. George G3ZQS was an Internationally famous Amateur Radio 'character' who devoted himself to the Morse mode. **Editor**.

Book Review

Discover DXing 3rd Edition By John Zondlo
Published by Universal Radio Research, Ohio, USA

Rob Mannion G3XFD writes: At first appearance this book will give the impression it's aimed only at the American radio enthusiast. However, when you look into the slim, 95-page, booklet you soon realise that there's a great deal of valuable information for everyone.

Certainly, the lists of American Band II v.h.f. (often referred to as 'VHF FM' stations) will only prove useful when you visit the USA. On the other hand, the medium wave stations (often referred to as the 'AM Band' due to the fact amplitude modulation is employed) will prove useful. This is because - very early in the morning during winter - it's possible to hear American stations. As there's no real frequency planning in the USA (medium wave stations in Europe are spaced 9kHz apart) you can receive an amazing clutter of different stations. The rule in the USA is find a clear frequency and apply for a licence provided you don't cause interference to an existing station!

There are many interesting little tit-bits of information in the book, along with a guide on 'foreign' (non-american) DXing. This book is a delightful start to guide the beginner, while at the same time providing extremely useful information on American stations for the European listener. I'm very keen on listening to short wave broadcast stations, and when the medium wave stations are heard, I know that there's a good chance of working American Radio Amateurs at the top end of the 3.5MHz (80m) band.

It's well worth sending a reception report to an American station, they will send a QSL card and technical information too. If you ever visit the USA you'll see forests of transmitting masts around every city. With this book you can identify the broadcaster. It's an ideal reference book for the listener and keen radio enthusiast.

Available now from the *PW* Book Store for **£6.95 plus P&P**. To order please use the form on page 61.

amateur radio clubs

Keep up-to-date with your local club's activities and meet new friends by joining in!

Club Organisers: please include your event's full address, including its postcode, with any news item sent to us for publication.

BRISTOL
South Bristol ARC
Contact: **Len Baker**
Tel: **(01275) 834282**
Website: www.sbarc.co.uk
Meetings of the South Bristol Amateur Radio Club are held weekly, on Wednesday evenings, at Whitchurch Folkhouse, East Dundry Road, Whitchurch, Bristol BS14 0LN. Doors open at 1930 and you'll be assured of a warm welcome. Future meetings include: **September 20**: 'Old domestic radios - working!'; **27th**: On the Air evening; **4 October:** Workshop - Attending radio rallies and **11th**: Autumn table-top sale.

NORTHERN IRELAND
Antrim and District ARS
Contact: **David GI4FUM**
E-mail: **david@gi4fum.net**
Website: **www.gn4siw.co.uk**
The Antrim and District Amateur Radio Society (GN4SIW) meets in Greystone Community Centre on the Ballycraigy Road in Antrim on the 2nd Friday of each month at 1930. Forthcoming meetings include:
October 13: "Vintage and Military Radios" - speaker to be confirmed; **November 10:** "All about repeaters" - speaker to be confirmed and **16th:** AGM and club dinner at Massereene Golf Club. Guests and new members are very welcome to attend the meetings.

STAFFORDSHIRE
Stafford & Districts ARS
Contact: **Graeme Boull G4NVH**
Tel: **(01785) 604534.**
E-mail: **graeme.boull@ntlworld.com**
Website: **www.g3sbl.org.uk/**
Stafford & Districts Amateur Radio Society meet on Thursday at 2000 The shack is located in the AREVA T&D UK Ltd. Factory in St. Leonards Avenue, Stafford ST17 4LX. If you fancy going along to a meeting, here's what's coming soon:

September 14: Cannock Chase History Talk - G0RLA/Steve - Castle Ring; **21:** Shack Night and Committee Meeting and **28th**: Winter Construction Project Kick-off - **G4NVH** and Guest.

TYNE & WEAR
Tynemouth ARC
Contact: **Tony Regnart G8YFA**
E-mail: **tonyregnart@blueyonder.co.uk**
Website: **http://www.gx0nwm.co.uk/**
The Tynemouth Amateur Radio Club (TARC) meets at St. Hilda's Church Stanton Road, North Shields, Tyne & Wear NE29 9QB. on Friday evenings at 1900.They welcome new members and visitors, so why not go along? **September 22**: Operating Night and Morse, **29:** Data Modes Workshop - **Glen G0SBN**; **October 6**: Operating Night and Morse and **13th**: Working with Microwaves - **Stuart G8CYW**.

Keep your club news coming to **pwnews@pwpublishing.ltd.uk** and **please remember** to include full details of your club, E-mail and telephone contact details and the **postcode** of your meeting venue - it helps potential visitors to find you!

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(MTD-5 is a crossed di-pole with 4 legs)

ALL PICTURES ARE FOR REFERENCE ONLY

Technical

FOR THE TERRIFIED!

This month, Tony Nailer G4CFY takes a detailed look at the superhet system. If you're a newcomer you may ask. "What's a superhet? Why do we use it"? Read on and find out as Tony explains all!

You may have wondered why radio receivers are so complicated and why we adopted the superhet system, short for supersonic heterodyne. To understand how we arrived at this it is necessary to look at the history of radio broadcasting, which forced the evolution of radio receivers.

Initially, transmitters were few and well separated across the long wave spectrum. Early receivers were just crystal sets driving headphones and produced very low level audio output. Selectivity was provided by a single tuned circuit and adequate signal was provided by long wire antennas.

The next step was to include a valved audio frequency (a.f.) amplifier. Then a valved radio frequency (r.f.) amplifier was added. This was the classic early radio for home use and comprised a tuned input and tuned output r.f. stage, tuned with a dual gang capacitor. It earned the name tuned radio frequency (t.r.f.) receiver. The arrangement is shown in **Fig. 1**.

Circuits became available in experimenters' magazines - including *PW* and its predecessors. As ready built receivers were expensive, many of these radios were home built from parts sold at hardware stores.

The low voltage for the heaters and high voltage* for the anodes were provided by banks of accumulators. These could be recharged at the local garage or hardware store and topped up using distilled water available from the same source.

** The usual terms in the early days were low tension (l.t.) and high tension (h.t). **Editor.***

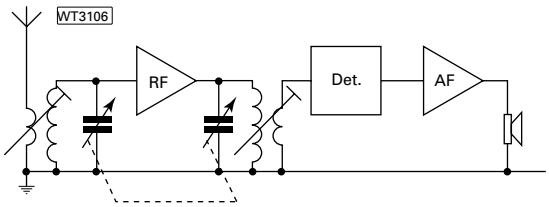

Fig. 1: Block diagram of a typical tuned radio frequency (t.r.f.) receiver.

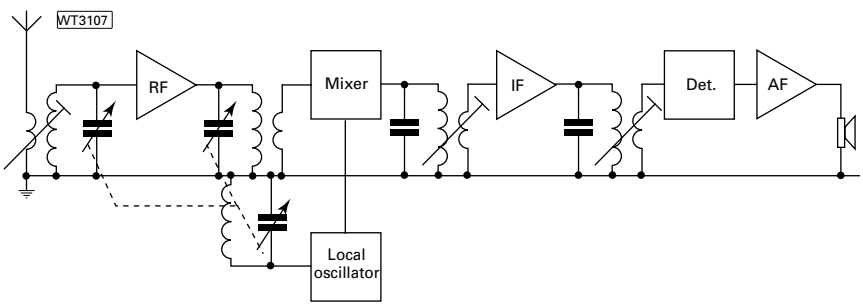

Fig. 2: Block diagram of a simple superhet receiver, using the mixer oscillator technique to produce a fixed intermediate frequency (i.f.).

Gain & Instability

Experimenters and early manufacturers of radios soon found that trying to get too much gain from any amplifier stage caused instability and horrible noises resulted. They also found an interesting effect, that as an r.f. stage was brought close to oscillation its gain increased tremendously.

Designs soon developed to control feedback of the signal from output to input to bring the stage close to oscillation. Thus was born the regenerative detector receiver.

As radio receivers, both the t.r.f. and regenerative detector increased in popularity, so more transmitting stations came on the air, both in Britain and elsewhere around the World. Initially, this was quite exciting to tune to stations around Europe but soon having so many stations created its own problems!

The performance of receivers was not adequate to 'choose' only one station at a time. This ability to 'choose' one station at a time is called selectivity, or '*Q*'.

At the same time, it became difficult to listen to a weak station in the presence of a strong station on a nearby frequency (Often referred to as 'adjacent channel' problems). One solution was to employ two or even three r.f. stages with tuned input, output, and interstage networks. This provided much better selectivity but was complicated, quite expensive and only gave temporary relief from the problems.

Intermediate Frequency

A better solution was to use a number of stages, all on an intermediate frequency (i.f.) with high *Q* tuned circuits. The fixed frequency chosen was above audio frequency thus supersonic, but below the lowest r.f. signal. This narrow band amplifier was capable of selecting just one signal at a time and rejecting the others. This then required a mixer and an oscillator to convert the wanted signal to the new intermediate frequency (often called the frequency changer). The arrangement is shown in **Fig. 2**. Choice of intermediate frequency is determined principally by *Q* factor.

Now *Q* is the ratio of the operating frequency (f) and bandwidth (bw) of a tuned circuit, $Q = f/bw$. Then $bw = f/Q$. A tuned circuit with an operating frequency of 500kHz and a *Q* of 100, will have a bandwidth of (500kHz/100) or 5kHz.

For a reason (which eludes me as I write!) broadcast receivers usually had an i.f. of 465kHz*, with pairs of i.f. tuned

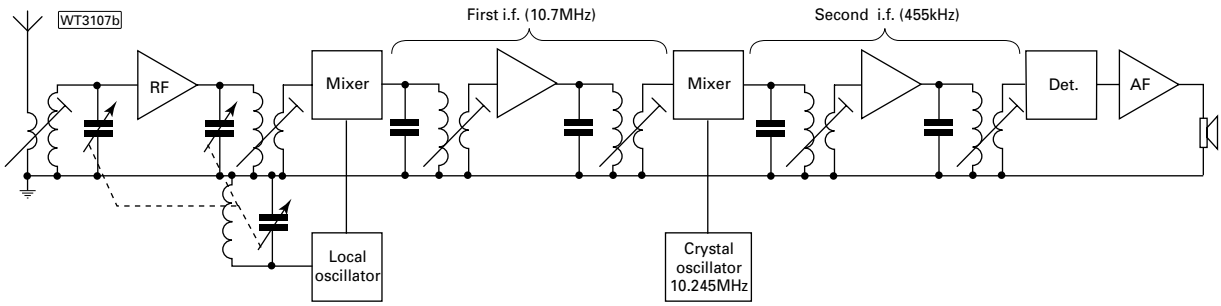

Fig. 3: Block diagram of a double conversion superhet. In many early design for home construction this type of receiver often used a 1.6MHz first i.f., followed by a 465kHz or 85kHz second i.f..

circuits critically coupled. This coupling caused the sharp peak of the response to be flattened, the bandwidth to increase, and steepness of the 'skirt' (or sides) increased.

Note: Military equipment, such as the Racal RA17, had an optional 100kHz i.f. unit. This presumably had a bandwidth of around 1kHz and would be particularly suited for high selectivity continuous wave (c.w.) Morse reception.

The superhet system using a supersonic intermediate frequency solved the selectivity problems inherent in t.r.f. receivers. As with any engineering solution it also introduced some problems! For example, local oscillators for valved mixers are quite high powered and can radiate and cause interference to other receivers.

Another problem is that mixing two signals together will produce at least two products, the sum and the difference. This means that there are two signals which can 'mix' with a local oscillator to produce i.f. signals.

Let's now look at the problems. We'll consider the situation of receiving 1MHz (300m) medium wave on a receiver using a 465kHz i.f. In this design I'll suggest that the oscillator, following normal practice on medium and long wave receivers, is tuned to operate 465kHz above the received frequency. So the local oscillator will be on 1.465MHz, producing the required 465kHz 'difference' i.f. signal.

Unfortunately, an r.f. signal at 465kHz above the local oscillator (1.465+0.465MHz), will also mix with the l.o. to produce an i.f. signal. This r.f. frequency is called the image frequency and is usually counteracted by the the r.f. tuning stage.

Fortunately, at low frequencies the image is not usually a problem. The front end tuned circuits of the receiver are specifically there to attenuate out-of-band signals - including the image. However, at high receiver frequencies the image does become a problem.

***** *Lower frequency i.f.s were convenient, but care had to be taken to avoid the 500kHz marine frequencies. I general, Europe chose 465kHz, 455kHz in USA and its colonies/dependencies. Despite this, Morse signals could often be heard on domestic superhets!* ***Editor****.*

Communications Receiver

Let's now consider a communications receiver with a number of bands covering 1-30MHz, using the same 465kHz i.f. With this design, when the 1MHz band is selected the local oscillator could be operating on either 535kHz or 1.465MHz (1465kHz) depending whether the local oscillator was operating below or above the wanted signal. The image frequencies would be 70kHz for the first case and 1.930MHz for the second. These would be easily rejected by the front end coils.

Now let's look at the problem with a wanted signal at 30MHz. Here the local oscillator could be 29.535 or 30.465MHz (again depending on choice of l.o. operation). Even with a front-end coils with a *Q* of 100 the bandwidth will be 300kHz, this is 29.850MHz to 30.150 at the -3dB points. if the *Q* of the r.f. circuit is lower then this bandwidth will be even wider.

You can probably visualise that the image frequencies – being only 930kHz away from the received frequency – may not be attenuated very much. Signals at the image frequencies are liable to cause unwanted interference if they 'get through' the r.f. filter.

So, in order to give reasonable attenuation to image signals, it is advisable to choose an i.f. of not less than one twentieth the maximum receive frequency. Better still, not less than one tenth! For the receiver example above at 30MHz, this would have an i.f. of at least 1.5MHz, better still 3MHz.

Denco IF Coils

The once commonly available Denco IF Coils were designed for Amateur Radio use, and general coverage receivers, which used i.f.s operating at 1.6MHz. Unfortunately, using a higher i.f. (such as 1.6MHz) to overcome image problems ended up with wider i.f. bandwidth and often worse selectivity.

To achieve the best of both worlds really meant adopting two i.f.s. A first i.f. at the high frequency (1.6MHz in this case) to give good image rejection and a lower second i.f. (often very low, around 80kHz) to give good selectivity, **Fig. 3**.

In Amateur Radio - when single sideband (s.s.b.) began to be used - it somehow came about that, on bands below 10MHz lower sideband (l.s.b.) was employed and on those bands above 10MHz, upper sideband (u.s.b.) was generally used.

The use of s.s.b. meant that an i.f. in the 10MHz region could be used effectively. It could produce images above and below this frequency and would give l.s.b. with the low side product and u.s.b. with the high side product. A classic example is a receiver (or transceiver) with a 5-5.5MHz local oscillator and a 9MHz i.f. than can receive 3.5-4MHz or 14 -14.5MHz simply by switching the r.f. stage coils.

Use of a crystal filter, rather than discrete tuned circuits, at a high i.f. provides both the image rejection and the selectivity required for s.s.b. operation. This meant that a second i.f. stage, with its mixer and amplifiers, is not needed.

Much Wider Bandwidths

On the other hand, amplitude modulation (a.m.) and frequency modulation (f.m.) require a much wider bandwidths. These modes work well with low-cost two or four-pole first i.f. filters at either 9 or 10.7MHz, together with low-cost mechanical filters for a second i.f. at 455kHz. This is the arrangement found in most modern CB radios. **PW**

I hope this has been useful and enlightening and will allow you greater understanding of the insides of your radios! If you wish to correspond regarding this article or previous ones subscribe to the list, by sending a blank E-mail to **pw-g4cfy-on@pwpublishing.ltd.uk** with the word subscribe in the subject box. When you receive confirmation from the server you can then send E-mails to **pw-g4cfy@pwpublishing.ltd.uk** and your comments will be answered by myself or the *PW* team.

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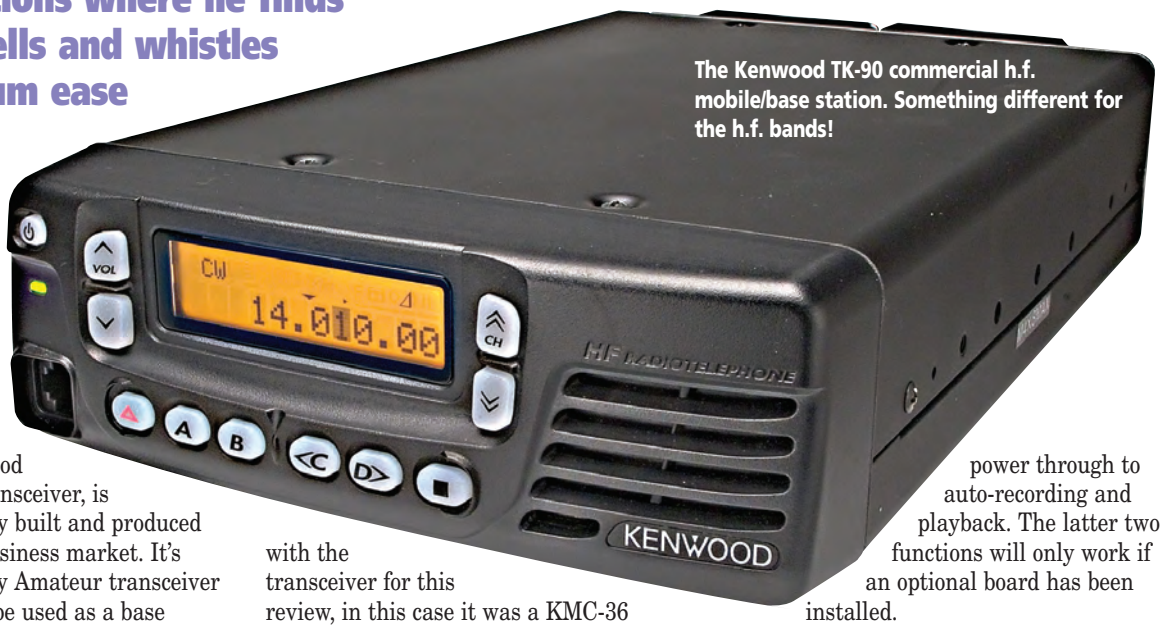
Count on us!

The Kenwood TK-90 Review

Roger Cooke G3LDI has had a unusual h.f. rig on the test bench recently. He's been taking a look at the techniques used in the world of commercial radio communications where he finds minimum bells and whistles and maximum ease of use!



The Kenwood TK-90 commercial h.f. mobile/base station. Something different for the h.f. bands!

The Kenwood TK-90 transceiver, is essentially built and produced for the business market. It's unlike any Amateur transceiver and although it can be used as a base station, it's size and the fact that it runs from a 12V d.c. source suggests that it's mainly intended for mobile use. The *PW* Editor **Rob G3XFD** thought it was something worth looking at on behalf of readers as the rig was so unusual and so I was pleased to take a look for myself.

The transceiver is supplied with a d.c. power cable, two rubber feet and spare fuses. The manual is essentially a driver's manual and there's no circuit or circuit description provided.

Ruggedly Built

The Kenwood TK-90 is ruggedly built and has a 'commercial' look and feel to it, although it's actually based on the TS-480 chassis. It is 300mm long, 850mm wide and 65mm high and weighs just over 3kg (around 7lbs). There's an optional microphone, **Fig. 1**, and one was supplied with the transceiver for this review, in this case it was a KMC-36 keypad microphone. The microphone connector is a J45 (not my favourite) but it's a type that's becoming more common.

The transceiver's rear panel has a connector for an external antenna tuning unit, marked **AT** and an external speaker jack. Also located on the rear panel is the d.c. connector and an SO-239 antenna connector, plus an earth terminal. Two internal fans, **Fig. 2**, are mounted on the back apron for cooling. The photograph, **Fig. 3**, shows an inside view of the transceiver, with the r.f. output stages to the right, adjacent to the cooling fans.

The front panel (see heading photograph) has a **Power** switch, **Up/Down** volume control buttons, a small liquid crystal display (l.c.d.), **Up/Down Channel** buttons and five programmable buttons under the display. It's finished in black and the buttons are light grey with black lettering. The Kenwood logo is at the bottom right.

Fig. 1: The Kenwood TK-90 is ruggedly built and has a 'commercial' look and feel to it, although it's actually based on the TS-480 chassis. There's an optional microphone, supplied for the view.

Functions Programmed

The five buttons can be programmed with 33 different functions. These vary from l.c.d. brightness, scan, and transmit power through to auto-recording and playback. The latter two functions will only work if an optional board has been installed.

The display symbols are described in a table and would probably take a while for Amateur Radio operators to remember but after using the transceiver for a while, it would soon become second nature.

Basic operations are described, although there's no variable frequency oscillator (v.f.o.) available. Instead when selecting a memory channel, it's possible to then enter **VFO mode**, whereby the Up/Down channel buttons enables the user to change frequency. The actual frequency can also be entered using the microphone keypad.

Modes provided on the Kenwood TK-90 include amplitude modulation (a.m.), continuous wave (c.w.), upper sideband (u.s.b.), lower sideband (l.s.b.), data, and frequency shift keying (f.s.k.).

Note: The transceiver is not intended for use on c.w. so, no provision for a key has been made. However, a keying lead can be provided. Break-in operation has to be enabled by the dealer. In fact, several functions have to be set by the dealer.

The transmit power can be set to four levels. These range from low to high.

Selected Or Configured

Many functions are selected or configured using a software controlled menu and using certain buttons to select the required parameters. Scanning facilities are available with a priority channel.

An interesting feature, **Selcall**, is

Fig. 2: Two internal fans are mounted on the back apron for cooling.

Fig. 4: Roger G3LDI on the air and in QSO with Dave G3MPN.

provided on the transceiver. With this, a voice call can be made to a particular station, or a group of stations. This enables the user to monitor a frequency with the receiver squelched and silent, until a Selcall station calls. **Note:** Selcal (with a single L) was featured on radioteletype operation (RTTY) in the 1960s and 1970s.

Another innovation is the ability of this transceiver to automatically send your GPS data. The GPS unit has to be installed in the transceiver in order to do this. If the station receives a polling request, the transceiver then responds with your GPS data.

It's also possible to have a scrambler board fitted so that your conversation will then be private. All others in the group must have a scrambler board fitted too. It does not provide complete privacy, but distorts the audio so that it is not easy to understand. **Note:** The scrambler facility would be illegal on the Amateur bands of course.

Another option I've already briefly mentioned, is to have an external antenna tuner. With this fitted the antenna tuning would become automatic (a.a.t.u.).

If the transceiver is used in a mobile situation and an emergency occurs, there is an **Emergency** button. This essentially enables the transceiver to transmit on a certain emergency channel with bursts of information over a set period of time) this feature is enabled and set by the dealer before delivery).

There's also a voice recorder and four messages can be pre-recorded for transmission. In the same way, four incoming messages can be recorded for later playback. These four messages are limited to 15 seconds each.

Fig. 3: An inside view of the transceiver, with the r.f. output stages to the right, adjacent to the cooling fans.

On Air Performance

Operation on the air is simplicity itself! All I had to do was to select the frequency (the mode is automatically set) push the button on the microphone and talk.

I worked some DX stations on 14MHz band with no problem using the 100W level, even breaking a pile-up on 14.195MHz. I then tried some local tests, **Fig. 4**, with **Dave G3MPN**, who I usually use for critical tests on the air.

Using s.s.b., he reported that the transmission was clean, with no intermodulation distortion (i.m.d.) products to be found but did remark that the audio was slightly lacking in top frequencies. However, my voice was recognisable, and the signal strength was equal to my own FT-1000MP transceiver's signal. Since both transceivers were running at the 100W level, this was to be expected. The received audio was remarkably good, especially from the small speaker mounted in the front of the transceiver.

Using CW Mode

I then tried the c.w. mode. As I've mentioned, there's no specific c.w. key jack provided on the Kenwood TK-90 but **David Wilkins G5HY** at Kenwood UK, had very kindly made up a lead, which plugs into the back AT connector (much appreciated David, thank you). Additionally, c.w. keying on this transceiver has to be implemented by the supplier before delivery.

The rig employs break-in keying. Therefore, between characters, the transceiver reverts to receive again and the resultant noise can be distracting. However, on c.w. the note is T9 and there are no clicks or thumps. I must stress that the transceiver is not really intended for dyed-in-the-wool Amateur Radio c.w. operators, so any further criticism of this mode would be unfair!

Data modes

One mode that would be of interest to the Amateur (or at least this particular Amateur!) is h.f. data operating. Rather than tying up a dedicated Amateur band transceiver, the Kenwood TK-90 would sit nicely on scanned channels operating Pactor II.

However, as no price is mentioned and it is made primarily for the commercial market, I think I would need a lottery win in order to buy commit another transceiver for this dedicated job.

As you can see from the photographs, the TK-90 is a very nicely made transceiver. It's very different from the normal Amateur Radio h.f. base station transceiver, with several functions that would normally not be used. However, basically speaking, "It does exactly what it says on the tin" to quote an advertising slogan! **PW**

Product

The Kenwood TK-90 commercial h.f. transceiver

Company

Kenwood Electronics UK Ltd.

Contact

Sales on (01923) 655284

Pros & Cons

Pros

Operation on the air is simplicity itself! All I had to do was to select the frequency (the mode is automatically set) push the button on the microphone and talk.

Cons

Not certified for use in the EU. Has to be modified for c.w. mode.

Price

Export (to non-EU countries) RRP is $1200 US Dollars. Price in the UK approximately £800 plus VAT (non EU-certified).

Supplier

My thanks go to David Wilkins G5HY, **Kenwood Electronics UK Ltd., Kenwood House, Dwight Road, Watford, Hertfordshire WD1 9EB. Tel: (01923) 655284, FAX: (01923) 655297. Website: www.kenwood-electronics.co.uk**

The PW Poundbury Part 3

The SSB Generator and Receive IF. Project Development and PCB.

Tony Nailer G4CFY rolls up his sleeves, clears his work bench and really gets stuck into the Poundbury project. You'll be on the air soon as Tony has provided printed circuit boards!

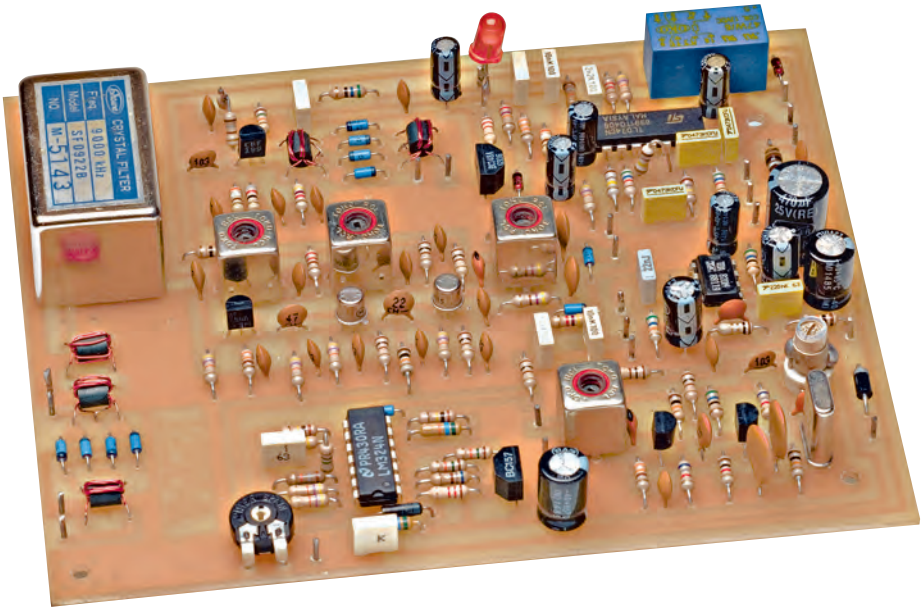
I am now able to provide the printed circuit board (p.c.b.) for this project. The article in the August issue of *PW* showed how this board can be used with other modules to create transceivers from Top Band to 70MHz. Vital pieces for this work were provided in previous articles with the Portland VFO and the Mixer-VFO board.

With hindsight, it would have been better to start the Poundbury series of articles with the one used in August *PW* and then follow it with the circuit and description as published in the June issue. We live and learn!

I include here a list, in **Table 1**, of frequencies for the Mixer-VFO board and Portland VFO when used in conjunction with the Poundbury IF Transceiver. The Classic 3.5MHz and 14MHz rig must use a 9MHz intermediate frequency (i.f.) with a 5.0 - 5.5MHz v.f.o. A rig for 1.8MHz must use a 10.7MHz i.f. together with an 8.7 - 8.9MHz v.f.o.

Band (MHz)	IF (MHz)	LO (MHz)	Xtal. (MHz)	VFO (MHz)
70.0 - 70.5	9.0	61.0 - 61.5	53.1	7.9 - 8.4
	10.7	59.3 - 59.8	51.4	7.9 - 8.4
50.1 - 50.5	9.0	41.0 - 41.5	33.5	7.5 - 8.0
	10.7	39.3 - 39.8	30.5	8.8 - 9.3
50.5 - 51.0	9.0	41.5 - 42.0	34.0	7.5 - 8.0
	10.7	39.8 - 40.3	31.0	8.8 - 9.3
28.0 - 28.5	9.0	19.0 - 19.5	11.5	7.5 - 8.0
	10.7	16.3 - 16.8	8.8	7.5 - 8.0
28.5 - 29.0	9.0	19.5 - 20.0	12.0	7.5 - 8.0
	10.7	16.8 - 17.3	9.3	7.5 - 8.0

Table 1.



The Poundbury project.

Project developments

Let's now look at the development of the project. Having considered the various modules needed for the various transceivers I realised that my Poundbury board should provide switched +13.5V output for receive and transmit instead of the switched +10V shown originally. To this end I changed the single-pole double-throw relay on the original circuit to a double-pole double-throw type.

When I laid out the production prototype board I found that there would be several links. As these are additional work to make, I occasionally cheat and add a resistor to do the job!

The connection from the product detector to IC2b, I have now taken through an additional 100Ω resistor designated R61. Likewise, the +10V receive supply to the i.f. stages I took through an additional 56Ω resistor designated R62.

Note: For those who do not intend to use my p.c.b. these components are not required.

The s.s.b. filter - when tested on a jig - gave best shape when terminated with 500Ω and no parallel capacitors. This means that with this particular filter, capacitors C20 and C21 are not required. The filter spectral display is shown in **Fig. 1**. Carrier crystal frequencies are 27dB down the sides of the characteristic. (Further aiding carrier suppression).

Printed Circuit Board

The first production p.c.b. was printed, etched, drilled and cropped and assembled with components. Initial testing suggested that no mistakes had been made in the layout or population of the board with components.

Tests of receive sensitivity indicated much lower than expected gain. The active devices were checked for operating currents and all seemed in order. No apparent reason could be found for the low gain. The original breadboard was also tested and revealed considerably more gain.

Careful examination of the breadboard revealed that I had incorrectly drafted my circuit of the receive i.f. section. The coupling capacitors from stage one to stage two and from stage two to stage three, had been taken from the hot ends of the i.f. coils, and not from the drains of Tr6 and 7. **Note:** Constructors not using my p.c.b. can connect the capacitors as I did on my breadboard.

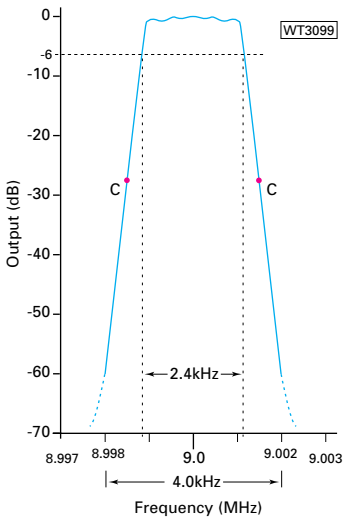


Fig. 1: The filter spectral display.

Post Design Changes

When I cut and linked my p.c.b. (i.f. stages) as in the breadboard, the gain shot up, due to instability when correctly peaked. The reason for this problem is that the breadboard has a more effective earth plane than the p.c.b.

The solution was to have the drain of Tr6, together with C39 connected to the hot end of L2 and C38. The next stage required Tr7 drain connected to the centre tap and C45 to the hot end of L3 and C43.

I also noted that the i.f. coil, L3, was close to maximum inductance adjustment to reach down to 9MHz. A capacitor of 22pF C64 was then added in parallel with the main winding. (This will not be required for a 10.7MHz version). A diagram of the modified i.f. stages is shown in **Fig. 2**.

A test of the performance of the a.g.c. circuit showed that it only had a limited range before saturation. This meant that the reduction of gate 2 bias for Tr7 and 8 was not occurring quickly enough.

I then changed the value of R32 from 10 to 4.7kΩ to double the gain of the a.g.c. amplifier and it now operated with signal inputs well into the millivolt region. It also started coming into action just below 5µV. This means that with a 26dB receive pre-amplifier and 10dB loss in the mixer it will be about 16dB more sensitive. Hence the a.g.c. will start working at about 0.8µV.

Another change was to the emitter resistor R28 of Tr4 from 1kΩ to 330Ω. This increased the carrier oscillator signal level and gave slightly more output from both receive and transmit mixers.

Finally, a trimpot was connected to pin 8 of IC2c and to a pin designated J27 as an S-meter output. The p.c.b. layout was modified for the changed i.f. connections and to include the S-meter trimpot. The final p.c.b. artwork is shown in **Fig. 3**, with a corresponding parts layout.

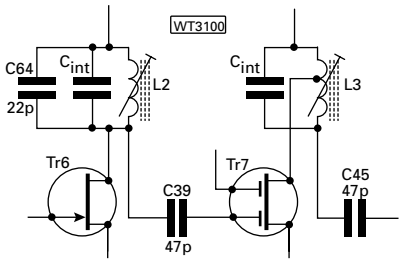


Fig. 2: A diagram of the modified i.f. stages.

Assembling The PCB

If you are not using the crystal filter supplied by Spectrum Communications, you'll need to drill the board and make any changes to the tracks before starting fitting any other components.

It's normal practice to put in the low level components first. Many constructors like to fit the pins first, so they can use a small hammer to drive them home. They fit from the underside and should be hammered (or pressed) into place so the head is in direct contact with the board.

Next, fit all the resistors except R17 and 31 and all the diodes and the choke RFC1. Then fit the integrated circuits (i.c.s) by holding them in position and tacking a pin at opposite corners. You'll then have to lay the board down and solder all the other pins and then re-do the original tacked pins.

Then it will be time to fit the transistors and m.o.s.f.e.t.s, again holding them in position if necessary. Next, fit the ceramic capacitors, splay their leads and solder them all in the same session. Fit the poly-block capacitors one at a time and hold them in place to solder them and fit R17 and 31 and solder them in place.

Fit the relay and hold it if necessary during soldering. Fit all the TOKO coils and solder them as a group. Then fit the trimcap VC1, crystal X1 and trimpot RV1, and hold each in place during soldering. Be careful when holding the trimpot to avoid the exposed metal parts during soldering. Next, fit all the electrolytics, splay their leads and solder them as a group.

Prepare the leads of the toroids T1 to T4 by bending them down ready to fit to the hole positions in the board. Fit them to the board one at a time and solder opposite leads while holding them in place. Then solder all the leads of all of them and re-do the original tacked leads.

Make up a small link to fit next to C62 and fit it and solder it. **Note:** Toroid T5 has a two turn winding of orange enamelled wire and six turns of red enamelled wire. Form the leads to fit the board and fit it so the orange wires are closest to T4, and solder it in place.

Prepare a miniature coaxial cable to link J1 to J19 and J2 to J20. Then similarly for J19 to J14 and J20 to J15. The cables are fitted to the track side of the board and routed to lay flat and avoid other solder joints. It's not necessary to solder the braids to the pins J2, J20 and J15, instead they can be soldered to the convenient earth plane nearby. Finally, fit the filter and fix it with nuts if appropriate and solder its connections.

Checking & Testing

Before applying power to the board it is recommended you check the orientation of the m.o.s.f.e.t.s and the i.c.s. I recommend you should also use a watchmaker's eyeglass to check the solder joints and tracks to ensure all joints are properly soldered and there are no solder splashes.

Proper alignment requires the following test equipment.

1: Signal generator capable of emitting a 9MHz carrier at levels between 0.5µV and 100µV.
2: Frequency Counter working to at least 10MHz with 6 digits to display with an accuracy of ±10Hz.
3: Oscilloscope with bandwidth of 10MHz or higher.
4: Two tone tester, (Oscillator).
5: Bench 13.5V d.c. 500mA supply.

Alignment Procedure

To start the alignment procedure, connect a 100µA signal meter to J27 and 0V. Then, connect a small 8Ω loudspeaker to pins J25 and J26 and connect a 4.7kΩ log potentiometer to pins J5, 6, and 7. Connect a 100kΩ volume control potentiometer to pins J21, 23, and J22. Connect the two tone tester to pins J8 and 9. Then connect short 'tails' of a coaxial lead to the junction of T5 and 6 and the other end to the signal generator.

Connect the positive lead of the bench supply to pin J24 and the negative lead to an 0V pin, say J26. Observe the board for any signs of overheating. If your bench supply has a current meter ensure the board is drawing less than 150mA.

You should then connect the 'scope live probe to J14 and earth probe to pin J15. Adjust coil L1 for maximum envelope. Disconnect the 'scope and connect the frequency counter to the same pins. Adjust the trimcap, VC1, to give precisely 8.9985MHz if you're using an upper sideband (u.s.b.) crystal, or 9.0015MHz if you are using a lower sideband (l.s.b.) crystal. Then remove the probes.

Set the signal generator output to 8µV and adjust the frequency so it is within the filter pass band. Set the volume control to give a low level tone from the loudspeaker. Adjust coils L4, 3, and L2 for maximum signal indicated on the S meter. Adjust trimpot RV1 to give S9 on the meter. When

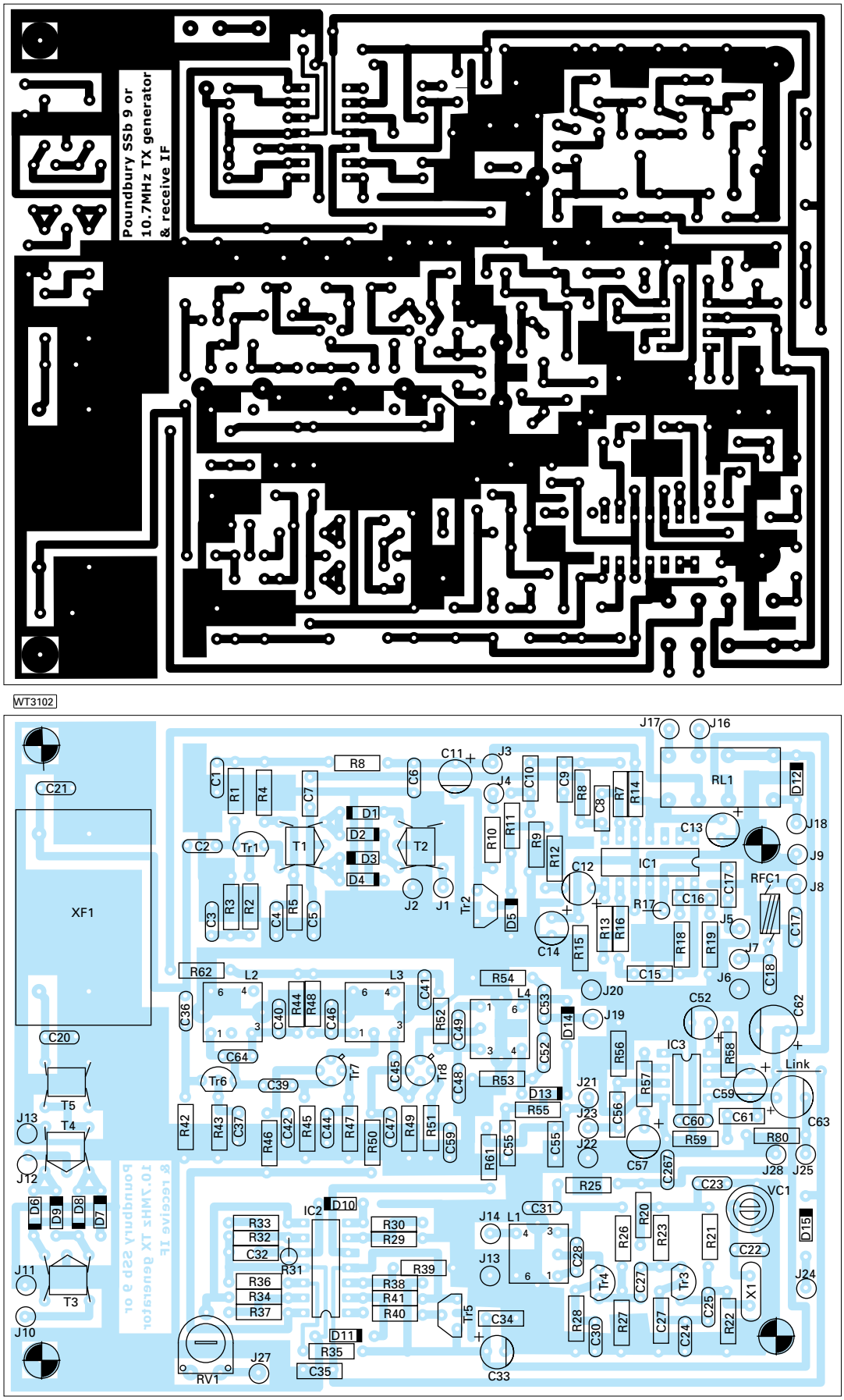


Fig. 3: Final p.c.b. artwork and the component placing overlay.

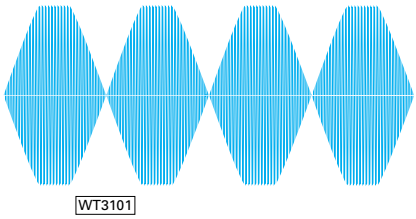


Fig. 4: The perfect two-tone display is what is aimed for when setting the up the Poundbury.

a pre-amplifier of about 26dB gain is added the meter can be tweaked for 50µV signal for S9.

Disconnect the coaxial lead from the signal generator and connect it to the 'scope. Using a crocodile clip jumper lead connect pin J18 (PTT) to 0V, J9. Switch on the two-tone tester with the lower tone only (On my unit this is 1600Hz). Adjust the audio frequency (a.f.) level until the light emitting diode (l.e.d. just illuminates.

Observe the waveform on the 'scope and check there are no signs of instability and the sine wave is pure. Note the amplitude of the envelope. Switch off the low tone and switch on the high tone. (On my unit this is 1800Hz). Provided that the two tones are identical levels the envelope at 9MHz should be the same as before. If they are not then either the high tone is much higher than 1800Hz or the carrier crystal is hundreds of Hertz off frequency.

Switch on both tones and readjust the output level of the two tone tester until the l.e.d. just illuminates. You may have to adjust the timebase and triggering of the 'scope to lock up the classic two-tone envelope, as shown in **Fig. 4**. This envelope should be perfect interlaced sine waves with no evidence of flat topping.

The sinewaves should have peaks at the same height and not displaced. Any displacement indicates carrier feed through. This could be caused by mis-wired toroids in the balanced modulator, or radiation from the carrier oscillator and its connecting cables or also from the carrier crystal not put correctly on frequency.

Work Complete!

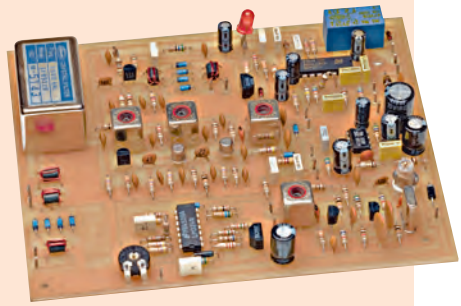
If all is as it should be, the work is complete and the project is ready for use. You just need a suitable local oscillator (l.o.) and maybe a receive pre-amplifier to become operational on the air.

In future articles I'll be developing receive and transmit pre-amplifiers and hope it will stimulate construction and operation on a variety of bands. If you wish to correspond regarding this article or previous ones subscribe to the list **pw-g4cfy-on@pwpublishing.ltd.uk** by sending a blank E-mail with the word subscribe in the subject box. When you receive confirmation from the server you can send an E-mail to **pw-g4cfy@pwpublishing.ltd.uk** and your comments will be answered by myself or the *PW* team. **PW**

Kits & Bits

The Poundbury SSB generator and IF p.c.b cost £20 plus £1 P&P. The complete kit p.c.b. and all components to populate it, including filter and choice of carrier crystal, costs £8 plus £2.50 P&P. Optional external components; 4.7kΩ log microphone gain potentiometer £1.75; 100kΩ log volume control potentiometer £1.75; 100µA signal meter scaled 0-10 costs £9; 8Ω loudspeaker (2.5in diameter) costs £2. P&P on external components £1.

Please make Cheques payable to **A.J.** and **J.R. Nailer** and send to **Spectrum Communications**, **12 Weatherbury Way**, **Dorchester**, **Dorset DT1 2EF**.



Going QRP on Satellites Part 1

Peter Perera G4AJG launches into his introduction to the world of Amateur Radio satellite communications. Peter, who is a dedicated satellite enthusiast, looks at the history, explains the basic procedures and prepares you for the practical satellite operating techniques to be published in Part 2.

You can launch yourself in a new world of Amateur Radio - using the Amateur Satellite Service. In his article, Peter Perera G4AJG demonstrates just how easy it is. His enthusiasm is infectious - read on and see for yourself!

If you wish to move into the exciting, challenging and innovative field of Amateur Satellites Communications then this article is for you! It will open up new areas of knowledge and experimentation, adding a new dimension to Amateur Radio activity. You may find it (as I did) a challenging, rewarding and very satisfying experience. But most of all - it's great fun!

Now, is as good a time as any to get outdoors and go QRP via satellite. Not only would you be able to work the Amateur satellites outdoors from your garden but the equipment is small and handy enough for you to take on holiday. Abroad you could work some of those rare DX stations, which you always wished to work. Interestingly, you can achieve this on a budget of under £375.

The Beginnings

To get things in perspective let's briefly consider the beginnings of the technology and look at how these amateur Satellites came about.

It all began when **Arthur C. Clark**, the celebrated science fiction writer, made his scientific prediction about world-wide communications via satellites in space, in an article he wrote in *Wireless World* magazine in 1945. Since then literally hundreds of communications satellites have been launched into Space.

The first of the pioneering satellites was the *Sputnik* launched by the Russians in 1957, followed by the first US satellite *Explorer 1* in 1958. Then of course there came a satellite we all remember, Telstar in 1962, which demonstrated live television across the Atlantic Ocean from the USA to the UK, via the pioneering Goonhilly earth station on the Lizard peninsula in Cornwall.

While I was still an undergraduate student, I was fortunate enough to be able to witness the monitoring of these early satellite transmissions on my home Island of Sri Lanka (formerly Ceylon), on home brew, transistorised receivers operating on the 144MHz band! The antenna was a 4.5m diameter (15ft) chicken wire mesh dish, mounted and manoeuvred on a pair of bullock cart wheels! The depths of my innovation and experimentation knew no bounds in those days.

Project Oscar

Meanwhile, a group of American Radio Amateurs in California, who had formed Project Oscar, persuaded the United States Air Force to carry ('piggy back' style) the first ever Amateur Radio satellite called *Oscar 1*, during the launch of the US Air Force satellite *Discovery 36* on December 12, 1962. The term OSCAR being the acronym for Orbiting Satellite Carrying Amateur Radio.

Oscar 1 carried a miniature v.h.f. 144MHz c.w. transmitter sending the Morse characters Hi-Hi. The transmitted power was only 150mW, although 570 Radio Amateurs in 28 countries reported receiving these signals on 144.982MHz!

The success of *Oscar 1* was truly a defining moment for all future Amateur Satellites. Subsequently the Amateur Satellite Organisation (AMSAT) was created in 1969 and over the years affiliated AMSAT organisations were formed world-wide. Their tireless, dedicated design and building efforts over the last 36 years or so, have resulted in an impressive number of Communication Satellites, which have revolutionised the Amateur Radio Experience.

The satellite service has spurred Radio Amateurs and equipment designers to develop novel ideas and reliable equipment that can survive in the very hostile space environment and provide reliable radio communications.

Nearly all the equipment on board these satellites are designed and built by Radio Amateurs in their spare time. All costs, including space launch costs, are met by voluntary contributions by Amsat members and other hobbyist radio organisations world-wide.

World Administrative Radio Conference

Recognising the importance of the new form of communication for Radio Amateurs the world over, the **World Administrative Radio Conference** (WARC), the international radio spectrum controlling body of the International Telecommunications Union (ITU), allocated the frequencies for the Amateur Satellite Service. They are; 29 (10m), 145 (2m), 435 (70cm) 1250 (24cm) and 2400MHz (13cm).

Brass Tacks

Now, it's time to look at the basic 'brass tacks' of satellite operating! The question you may well ask first is, "How does a Radio Amateur, or indeed a beginner enter the challenging field of Radio Amateur Satellite Operation without a large budget, loads of expensive gear and complicated antenna arrays?"

The simple answer is you can, if you choose the QRP low power portable mode. You will then be amazed at the ease with which you can experience and enjoy satellite communications on a very modest budget!

Good Starting Point

A good starting point for those who wish to enter the space field, is the latest Amateur Satellite called *ECHO AO-51*, designed and built by members of Amsat North America (NA), which has been operating very successfully since its launch in June 2004. The satellite operates in a variety of modes and frequencies covering the v.h.f., u.h.f. and L and S bands. These correspond to the 144MHz (2m), 70cm, 23cm and 13cm wavelengths.

However, with the beginner in mind, I shall concentrate on the rather easier form of communication made possible using narrow band f.m. (n.b.f.m.) in the v.h.f. and u.h.f bands using a suitable f.m. hand-held transceiver.

Once the beginner gains experience and feels comfortable operating on these frequencies, they can hopefully move up a notch or two to the other modes and bands of operation.

To make this a reality, the basic requirements to be met are:
1: At least an elementary understanding of Amateur satellites and their operation.
2: Access to a satellite tracking Programme running on a PC or Laptop computer.
3: A suitable hand-held v.h.f./u.h.f. frequency modulated (f.m.) transceiver covering 144/430MHz for QRP work (with good weak signal handling characteristics) and a radio frequency (r.f.) power output of up to 6W.
4: An efficient antenna system.

Last but not least, you'll need enthusiasm, time and a desire to experiment (especially with antenna systems). After all that's what Amateur radio is all about!

Low Power Definition

In the context of Amateur satellite communications, a low power QRP station will be defined as a station which can deliver no more than 10W of r.f. power. (To any type of vertical or hand-held v.h.f. or u.h.f. beam antenna

Kenwood Electronics have produced two impressive hand-held f.m. transceivers, the TH-D7E and the TH-F7E, which meet the requirements of QRP satellite operation with ease. I'll be providing an in-depth look at these very useful transceivers in Part 2.

Two Categories

Satellites that are available to Radio Amateurs fall broadly into two categories, the **High Earth Orbit** (HEO) types and the **Low Earth Orbit** (LEO) types. I shall, for the purposes of this article, consider only the LEO f.m. satellites available for use by Radio Amateurs.

The LEO satellites travel round the earth in a circular orbit, at a height of about 800km (497 miles) and at a speed of about 27,000km/hr (16,780m.p.h.). The properties of the orbits are defined according to a set of mathematical numbers called Keplerian Elements that describes their orbital characteristics. These are issued periodically by **USSPACECOM** and give the position and velocity of the satellite at a given instant of time. In effect, it's a sort of snapshot of the satellite in space.

Once the initial set of defined numbers is known, the satellite's position in space at all other times can be accurately predicted, using a Satellite Tracking Programme. **Note:** Don't worry - you need not be a mathematical or physics wizard to do all the complex mathematical computations. The programme does all the hard work for you!

With the aid of the computer and the Keplerian Elements, you'll then know precisely where and when the satellites you want will appear in space closest to you. This will give you the opportunity to receive its transmissions and work through it.

Tracking Programme

In any Satellite Tracking Programme (of your choice) you have to do the following:
1: Enter your station position in terms of Latitude, Longitude and height above sea level.
2: Set the computer time accurately via the internet time check or a Standard Time standard (such as Rugby or the BBC broadcast time pips).
3: Download from the Internet the current sets of Keplerian elements for the chosen set of Satellites. Most tracking programmes enable you do to this automatically.

You'll then be ready to sit back and observe the motions of the satellites in 'real time' on the display screen of your PC or laptop. (Operating systems can be either Windows or for use on Macintosh computers).

Satellite Tracking Programmes

An excellent user friendly programme (available as a free download from the Internet at **www.stoff.pl**) is called *ORBITRON*. The illustration, **Fig. 1**, shows a typical display from this Programme.

The central part of the display is a world map, to its right is a selection of satellites available for tracking. On the bottom of the display is a menu from which you set up the programme to run.

Continued on page 26

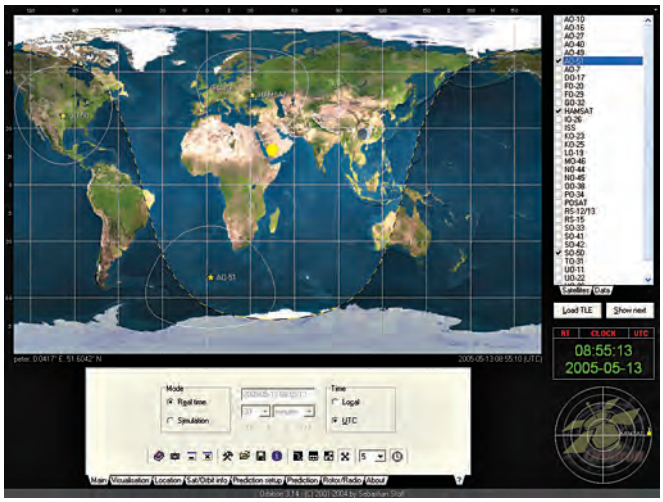
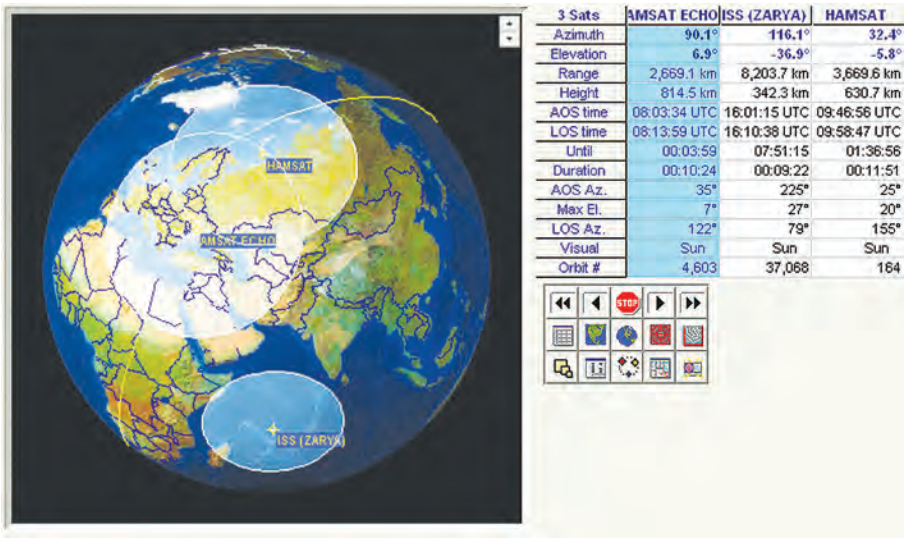


Fig. 1: A screen display from the free download *ORBITRON* program.



3 Sats	AMSAT ECHO	ISS (ZARYA)	HAMSAT
Azimuth	90.1°	116.1°	32.4°
Elevation	6.9°	-36.9°	-5.8°
Range	2,669.1 km	8,203.7 km	3,669.6 km
Height	814.5 km	342.3 km	630.7 km
AOS time	08:03:34 UTC	16:01:15 UTC	09:46:56 UTC
LOS time	08:13:59 UTC	16:10:38 UTC	09:58:47 UTC
Until	00:03:59	07:51:15	01:36:56
Duration	00:10:24	00:09:22	00:11:51
AOS Az.	35°	225°	25°
Max El.	7°	27°	20°
LOS Az.	122°	79°	155°
Visual	Sun	Sun	Sun
Orbit #	4,603	37,068	164

Fig. 2: Screen display from the Nova satellite tracking program.

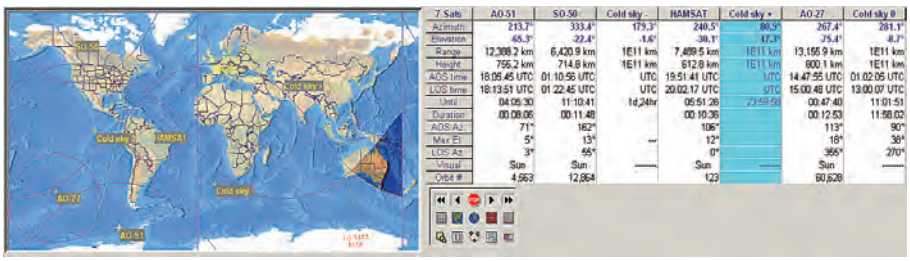


Fig. 3: Another screen shot , achieved by using the *Nova* program.

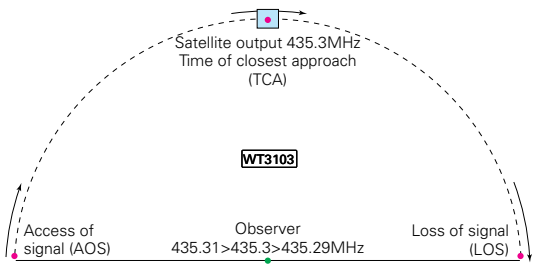


Fig. 4: Diagram illustrating the Doppler effect on an Amateur Radio satellites.

There are other programmes, such as *Winorbit* (also a free download) and many others, such as *Nova*, which can be purchased. Two screen views from *Nova* are shown in **Fig.s 2** and **3**. **Note:** The average time, available to access and operate on the satellite is about 12 minutes horizon-to-horizon.

Doppler Effect

Time to look at the Doppler effect now! It's essential to grasp what the term means as you have to manually correct for Doppler while receiving incoming signals from the satellite. As an example, let's look at the *ECHO* satellite that transmits on a frequency of 435.3MHz.

The Doppler effect is the apparent change of the frequency of the received downlink signal, due to the relative movement of the satellite with respect to your location. As the satellite comes over the horizon its frequency appears higher than 435.3MHz by about five or 10kHz. (So you may initially receive it a 435.310MHz).

When it is at its highest point, the apparent frequency change is least, 435.3MHz and when the satellite just disappears from view on its downward path, the transmission may be at a frequency of 435.29MHz, as shown in **Fig. 4**. This effect is directly proportional to the frequency i.e. higher the frequency the greater the shift and vice versa.

Explaining the Doppler effect: This well known effect is often heard and can be compared to what you hear while standing on a railway station platform, as driver sounds the warning horns, when a train approaches.

Standing on the platform, as the train approaches with its horn sounding, you'll notice that it appears somewhat higher pitched, then the sound lowers in pitch after the train passes you. This is because as the train approaches at high speed the sound waves from the horn are being compressed (the distance between the sound wavelengths is shorter, resulting in a higher frequency sound). As the train passes, with the horn still sounding, the sound waves are stretched slightly, resulting in a longer wavelength and a lower frequency of sound. It's quite dramatic and is the same technique used by the so called 'Radar Speed traps'!

Pilot Tone

To operate on the *ECHO* Satellite and some others, a 67Hz Pilot Tone must be transmitted continuously on your transceiver uplink signal, for your audio to be detected by the satellite repeater. This is done by enabling the Continuous Tone Coded Squelch System (CTCSS) encoding setting on your transceiver and setting it at 67Hz on just the uplink.

On receiving the required tone, the tone decoder in the satellite turns on the down link transmitter and opens the audio path. A signal without a tone won't get through to the satellite's decoder circuitry and the satellite will be transmitting a signal without modulation. If this condition persists for more than 10 seconds, the transmitter will go 'off' until it hears another signal with the correct CTCSS tone.

One of the main advantages of having the CTCSS tone requirement, is that it keeps the satellite transmitter off when not in use and permits the transmitter to operate at higher power levels when it is in use. It's an excellent method of conserving battery power in the satellite's solar power assisted battery system and is being increasingly used in the Amateur service.

Satellite Choice

A summary of satellites available now (and in the future) for Amateur use is shown in **Table 1**. However, I shall concentrate on the *ECHO* satellite, which is the most widely used at the present time.

Satellite *Echo AO-51*: This satellite was launched from the Russian Space Centre in Kazakhstan on 29 June 2004 on board a modified Russian ICBM Space Rocket. This satellite, at only 11kg in weight, has onboard several transponders i.e. a combination of receivers and transmitters and several types of antenna linked to an on-board computer.

The operational mode of the transponders is controlled from a ground command station located in the United States. The transponders enable an uplink on a fixed frequency on the v.h.f. band, to be re-transmitted down from the satellite on a fixed frequency on the u.h.f. band. The r.f. output power varies with the mode used, and ranges from 500mW to 3W.

Other Transponders & Modes

There are other transponders and modes of operation in the L and S bands but in order to keep matters simple for the newcomer I shall refer in this instance only to the 144MHz uplink and 430MHz band downlink modes of operation. Incidentally (and importantly), modes of operation vary from week-to-week and it's best to check the most current schedule posted on the AMSAT web page **www.amsat.org/amsat-new/echo/ControlTeam.php**

A typical schedule for f.m. operation is mode V/U as follows:

V Uplink: 145.92MHz f.m. with 67Hz CTCSS tone enabled.

U Downlink: 435.3MHz on voice and 435.150MHz for telemetry data transmission.

Explaining the terminology: What this means is that you set your transceiver to transmit your voice signal on 145.920MHz, with the CTCSS of 67Hz enabled on your transceiver. You should then listen on the down link on a frequency of 435.300MHz (± Doppler shift).

For receiving telemetry a suitable terminal node controller (TNC), is required. This should be set to operate at 9600Baud.

Satellites Currently Operational

Satellite	Band/Mode **	CTCSS PL Tone	Telemetry
AO-51 Echo	V/U/S FM	*67Hz	9600 Baud
SO-50	V/U FM	*67Hz	-
AO-27	V/U FM	-	
ISS	V/FM	-	Packet/Digipeater
Hamsat	CW/FM/SSB	-	

* To switch transmitter on, an initial CTCSS tone of 74.4Hz is required

** V = 144, U - 430MHz, S = 2.4GHz

Satellites due for launch in 2005/6

SSTI Express USA/European University Students Project

P3E multimode International Amateur Satellite hosted by Amsat DL

Table 1: Currently available satellites.

Experimenter's Day

Another interesting mode of operation is the Experimenter's day (each Wednesday). This day is set apart exclusively for QRP operations.

Note: The daily modes of operation can be viewed on the Echo web page **www.amsat.org/amsat-new/echo/**

Satellite Oscar AO-27

The *Oscar AO-27* satellite is virtually a repeater in the sky and was launched on 26 September 1993, on board launch Rocket *Ariane 4* from Kourou, French Guiana. Its period of rotation round the Earth is about 101 minutes. **Note:** No CTCSS tone is required for its operation.

The *Oscar AO-27* satellite is easily workable on f.m. using the QRP mode. But for a current schedule of operations see the AO-27 website **http://www.AO-27.org**

An important aspect of the satellite's operation is the eclipse cycle. These are the periods during which, it does not receive Sunlight to charge its batteries. This information is also shown on the web page I've mentioned. During these times it's not in operation, so I recommend you look out for it in the daylight hours.

Saudisat SO-50

The *Saudisat SO-50* satellite also operates in U/V f.m. mode and to begin operations, it requires an initial 74.4Hz pilot tone to arm the 10 minute timer on board. You then switch over to 67Hz to operate.

If you already hear another station, then as that station has already opened up the satellite transmitter with their own 74.4Hz CTCSS tone, you can then go ahead and just operate with the 67Hz CTCSS tone enabled. It transmits a strong signal when it's on and is relatively easy to work.

International Space Station ISS

The *International Space Station* (*ISS*) has an Amateur Radio station installed. Voice communications are possible with the Astronauts on board but only at certain times when the they are free to do so (i.e. work loads permitting).

The *ISS* Amateurs operate in standard repeater mode on voice and 1200Baud on packet. The uplink frequency is 144.490MHz using f.m., and the downlink is on 145.800MHz using f.m. **Note:** The packet radio uplink is on 145.990MHz. It also has a digipeater on board; its callsign is **ARISS**. For APRS operations, stations wishing to transmit a position report, must first transmit it on an APRS format, to enable *ISS* to digipeat the signal to the APRS network.

Note: The *ISS* daily crew schedule and more information can be found at **http://spaceflight.nasa.gov/station/timelines/**

Hamsat HM1

The latest Amateur Radio satellite, ***Hamsat HM1***, was launched by the Indian Space Agency on 5 May 2005. The satellite is at present available for Amateur use internationally on 435.25MHz uplink and 145.25MHz downlink on c.w., s.s.b. and f.m.

The satellite's transponders have a 60kHz bandwidth, making it possible for several QSOs to take place simultaneously. Its 1W transmitter is providing RST5/9 reports at present. As I was prepared this article (in 2005), a more flexible schedule is likely in the future when different modes of operation will be available. Further information is available **http://www.isro.org** and **www.amsatindia.org**

In part 2 I will introduce you to the versatile Kenwood transceiver that I recommend to launch you off into extra-terrestrial Amateur Radio and any updates I have for you. It won't be long before you're enjoying using Amateur Radio satellites. Cheerio for now. **PW**

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MMB60 bracket.....£18.95
YSK8900 remote kit.£42.95
MEK2 mic ext.....£29.95
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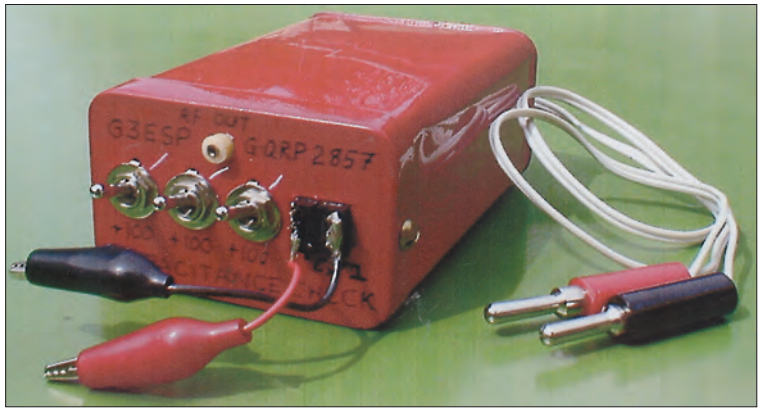
The Puffer



Walter Farrar G3ESP says his project is nothing to do with the Editor's interests! Instead, it's a practical project for evaluating capacitor values.

Let's start off on the right track - **this is not** an article based on the other love of the Editor's life - railways! Instead this 'puffer' is a simple device for measuring capacitance in picoFarads, abbreviated pF and often spoken as 'puff(s)'. Hence the term 'Puffer'.

The Puffer is based on a variable frequency oscillator (v.f.o.) and has a coil in parallel with one or more capacitors. The diagram, **Fig 1**, shows the circuit of such a v.f.o. and is in fact the circuit used for the Puffer.

If the three switches, S1 to S3, are closed, a twiddle on the trimmer C4 will tune it to about 4MHz. If 100pF is then clipped to **Cx** the frequency will drop to about 3.5MHz. Therefore, any capacitance between 0 and 100pF at Cx will give a frequency between 3.5 and 4MHz.

If one of the switches is opened, 100pF has disappeared from the tuned circuit but then if we put capacitors between 100 and 200pF at Cx we cover the same frequency range as before. All told, we can put capacitors from 0 to 400pF at Cx and tune only the one frequency range from 3.5 to 4MHz (3500 to 4000kHz) depending on which switches are open or closed.

Graph Paper

Next, with the aid of an A4 sized sheet of closely-lined graph paper, with all switches closed, a graph can be drawn of frequency against capacitance between 0 and 100pF. To calibrate I used 1% tolerance polystyrene type as follows: 15, 30 (2 x 15 in parallel), 50 (2 x 100 in series), 82 and 100pF.

I could have used also a 68pF but I didn't have one to hand and it's not really necessary. The line on the graph is very slightly curved and if you were to join the points with straight lines there would be only a slight loss of accuracy.

In use, you should apply your unknown capacitor to Cx, note the ensuring frequency and from the graph get the corresponding capacitance. However, it's a bother having to use the graph for this, so I made a chart from the graph, which can be seen in **Fig. 2**.

Using the chart it's then just a case of connecting the unknown to Cx, reading off the oscillator frequency, then (from the chart) finding the corresponding capacitance. For capacitance above 100pF open one, two or all three switches and add 100, 200 or 300 to the chart reading. Incidentally, my frequencies ranged from 4.018 to 3.505MHz.

I first described Puffer project in *Sprat*, the journal of the G-QRP club in 1993 and it's republished here by the kind permission of the **Rev. George Dobbs G3RJV**. We both hope you find it useful!

PW

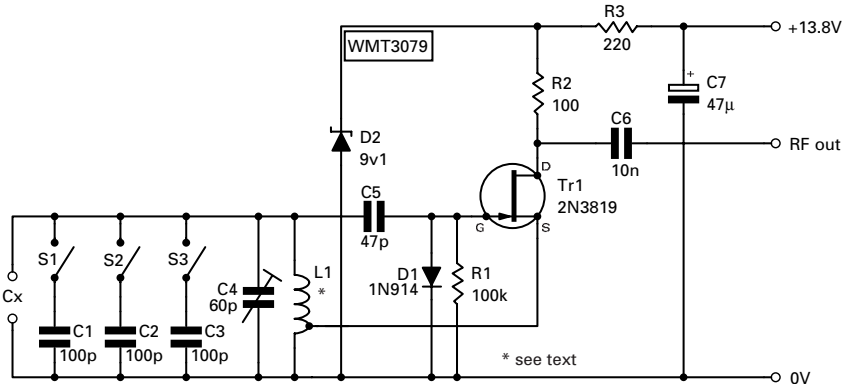


Fig. 1: The Puffer is based on a variable frequency oscillator (v.f.o.) and has a coil in parallel with one or more capacitors.

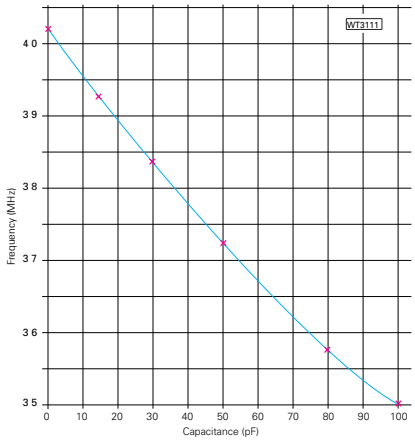


Fig. 2: The calibration chart as originally used by G3ESP, developed from his original graph.

Component List

C1, 2, 3 – 100pF polystyrene.

C4 – 60pF trimmer

C5 – 47pF polystyrene.

C6 – 10µF min, ceramic

C7 – 47µF 25V d.c.

S1, 2, 3 – miniature toggle

D1 – 1N914/1N4148.

D2 – 9.1V zener

R1 – 100kΩ.

R2 – 100Ω.

R3 – 220Ω.

Tr1 – 2N3819 or similar.

L – 4.62µH (34t 2t SWE on T50-6, tapped 9t up).

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Do you think the cover price is:
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What do you think of the overall design of PW?
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RadioUser	❑	❑	❑	❑	❑
Monitoring Monthly	❑	❑	❑	❑	❑
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Do you hold an amateur radio transmitting licence?
Yes ❑ No ❑

What are your other hobbies or major interests?

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How would you rate your expertise in radio and/or electronics?
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None ❑ 1-2 ❑ 3-4 ❑ 5+ ❑

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Amateur Radio Rallies	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Amateur Radio Waves	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
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HF Highlights	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
In The Shop	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
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Valve & Vintage	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
VHF Classics	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
VHF DXer	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

Which ONE item from the above list do you like the most?

.....

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.....

Continued over

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.....

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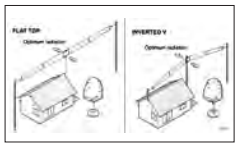

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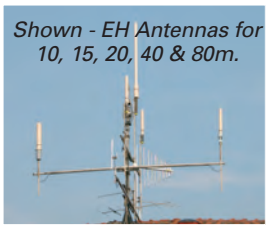

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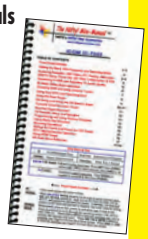

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In the Shop

with Harry Leeming G3LLL

Harry Leeming G3LLL is back at his radio repair bench ready to pass on more handy hints and tips.

The Yaesu FT-290 uses eight 1.2V 2A hour NiCad batteries, a total of 9.6V.

A suitable NiCad charger is normally part of the deal with a new portable rig but often when equipment is sold second-hand this unit has disappeared. A d.i.y. charging system is not over-complicated to build but first you need to understand a few principles.

NiCad batteries are rated in milliAmp (mA) hours, (for example a 1000mA battery should give out 1000mA (1A) for one hour, or say 100mA for 10 hours). When it's completely flat the same battery will need a charge of about the same amount, plus around 30-50% extra to allow for losses. The battery could be 'fast charged' by putting into it a current of 1A for around 80 minutes, or it could be slow charged at 100mA for 15 hours.

When fast charging a battery, it must be monitored very carefully or it may be damaged or even explode! During fast charging two things are important; one is that the battery is not over charged, and two that it does not overheat. The better fast chargers look after these factors but read the instructions very carefully, if they're wrongly used, fast chargers have a reputation for damaging batteries.

The safe way to recharge a NiCad battery is to slow-charge it. The usual way to do this is to charge at about a tenth of its Amp-hour capacity for around 15 hours. Most NiCads can stand a reasonable amount of over charging when they are being slow-charged, so the length of charge is not too critical.

A slow-charger is known as a 'constant current charger', although with most small chargers the current is far from constant. The small 'cheap and cheerful' chargers that come with most rigs are extremely simple, as can be seen in **Fig. 1**. The transformer's voltage is set a little higher than the voltage rating of the battery. The resistor, R1, is selected so that it limits the current to around the correct value over most of the charge cycle.

If you dismantle one of these chargers you may find that the resistor does not seem to be included. A check with an ohmmeter will, however, indicate that the transformer itself includes the resistance, as it's wound with resistance wire.

Having seen the crude way in which chargers are made, a d.i.y. copy seems hardly like rocket science! All you need, as shown in **Fig. 2**, is a direct current (d.c.) voltage somewhat higher than the battery being charged and a resistor. The value of the resistor is calculated from Ohms Law so as to pass the required current at the difference between the supply voltage and the nominal voltage of the battery being charged.

The Yaesu FT-290 uses eight 1.2V 2Ah NiCad batteries, a total of 9.6V. It's usually convenient to charge these from a 13.8V power supply, which is 4.2V higher in voltage than the batteries. To charge them at 200mA (0.2A) requires a resistor that will pass this current at 4.2V R=E/I = 4.2/0.2= 21Ω. This value is not critical and any value around 18- 25Ω would be ok.

The same idea will, of course, work with batteries requiring different voltages and charging currents, all you need is a voltage higher than the battery and a suitable value resistor. The resistor being calculated, (or its value adjusted by trial and error) until the correct charge current of one tenth of the batteries capacity is obtained. (My FT-290's d.i.y, internal charger consists of a 22Ω resistor wired from the rig's d.c. input, straight to the NiCads.)

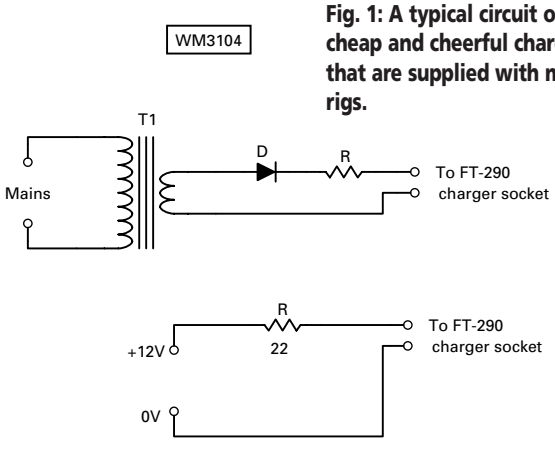


Fig. 1: A typical circuit of the cheap and cheerful charges that are supplied with most rigs.

Fig. 2: it's easy to build your own d.i.y. version of a charger unit using this type of circuit.

Looking After NiCads

NiCads are said to suffer from a 'memory' effect. This can be explained that if they are usually only discharged by say 20% of their capacity, they will lose the ability to hold a full charge. (Rather like the way in which if you never walk more than 20km, your legs will eventually not want to go much further!) The answer in both cases is exercise. In the case of NiCads, do not keep charging them when they are almost fully charged but let them run down first.

There is a catch here, however. When 1.2V NiCad cells are strung in series to make a battery, by the nature of things the capacity of the individual cells is not going to be absolutely identical. If one cell becomes discharged whilst the rest of the cells still have some voltage in them and the battery is still used, this cell will tend to be charged by the other batteries the wrong way round and this will damage it. To avoid this happening, rigs that use several separate cells, should always be fitted with a set of identical batteries and NiCad battery packs should not be used once the output voltage starts to fall. It's difficult to check the state of charge of a

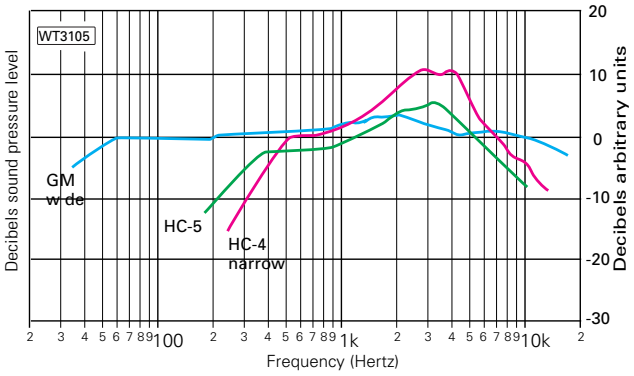


Fig. 3: The response of the Heil HC4 and HF5 microphones.

NiCad battery pack, as the voltage tends to remain almost constant until they are almost discharged. Try and carry a spare set of batteries with you and swap them just as they start to fail.

It's worth remembering that NiCad batteries can deliver a much larger current than normal dry cells. If you leave a torch battery in your trouser pocket with some small change, or a bunch of keys, the short circuit may make it hot and cause it to leak but it's unlikely to do you much harm. Under similar circumstances, a NiCad can get red hot, cause a nasty burn and damage some irreplaceable essential parts! There are even tales of Radio Amateurs having to rapidly remove their trousers when they burst into flames! If you are carrying around a spare charged battery, makse sure that you adequately insulate the terminals!

Speech Processing

I've had some comments about speech processors, which come in a variety of designs and can generate results varying from the spectacular to the awful. Judging by customer's comments, they also generate a great deal of confusion. So, over the next few issues of this column I will be taking a look at them.

Weak Signal Conditions

Would you like a communications system that has built in error correction controlled by the most powerful computer known to man and which tailors the used bandwidth to allow for different propagation paths? You would? Well you've got it, it consists of the voice, the ear and the brain!

If you are having a quiet one-to-one conversation and are near to the other person you each get the full audio frequency range. You can pick out the intonation in the voice and can immediately tell when the other person says 'yes please' in a certain way, that actually means 'not on your life mate'!

If, however, you are standing in a field a few kilometres apart and are shouting to each other everything is different. Your voice has no directional properties at the lower frequencies, even if you cup your hands, and the higher frequencies will be lost in the grass. As the high and low frequencies, along with the quieter voice sounds will not be heard, subtleties are not possible. In these circumstances with a 'weak signal' under 'poor reception conditions', the brain just latches on to the sounds it can hear, being mainly the middle frequencies from say 500 to 3000Hz! Before working out what is being said from these 'signals'.

When communicating over the radio with anything other than the strongest signals, a hi-fi type of response is not desirable. Under weak signal conditions, the brain is programmed to get its data from the mid frequencies. This means transmitting the lowest and highest frequencies adds nothing to the readability, whilst taking valuable transmitter power that could be better employed by radiating the frequencies that the brain can read.

Frequency Tailoring

When Japanese equipment first started to come into the UK, male Amateurs (in particular) soon discovered that their readability improved if the supplied microphone was exchanged for something with a more accentuated high frequency response. The Japanese microphones were naturally made to work best with Japanese male voices, which are rather higher in pitch than that of the average European male. In many cases, especially when used with someone with a deep voice, the transmitting speakers sounded muffled. If you flip through the adverts you will soon find mics such as the Heil HC4, which have a specially tailored response for Amateur Radio use. These microphones have a response that emphasises the information carrying frequencies, without introducing any sudden peaks and can, with some voices, make more difference to the readability under poor conditions, than adding a linear amplifier.

The response of the Heil HC4 and HF5 microphones, as supplied by their agent **Waters and Stanton**, is shown in **Fig 3.** The HC4 kind of response may sound a little over bright when you are '5&9 plus' on 3.5MHz but is great for DX operation. Heil also make mics with a rather flatter response such as the HC5, for those who still want bright audio but who wish to chat under good conditions.

The Heil microphones are aimed at modern low impedance rigs but the original Shure 444 microphone has a similar response, and matches rigs such as the FT-101E that have a 50kΩ microphone input, whilst later 444 microphones are dual impedance. Microphones with a bright sound are desirable, but those that are resonant and peaky must be avoided, as the peaks will make the Automatic Level Control (ALC) system turn down the gain, resulting in less average modulation, and possibly splatter.

Without going to the expense of buying special microphones, the clarity of the audio response can often be much improved by the simply attenuating the lower frequencies. I will look at this next time along with clipping and compression.

An Honest Report?

When assessing speech quality it's often very difficult to get an honest report, as Amateurs tend to be reluctant to criticise. Perhaps, we need children on the air?

When she was only three my grandaughter, **Lauren**, watched with great interest as **Brenda** (my wife) applied face cream. "What's that for Grandma?" Grandma then replied "Oh it's to make me look beautiful". Lauren followed her into another room, stared intently for a few minutes, and then commented, "It doesn't Grandma".

See you next time; keep the comments and questions (but no face cream recommendations please!) coming in. **PW**

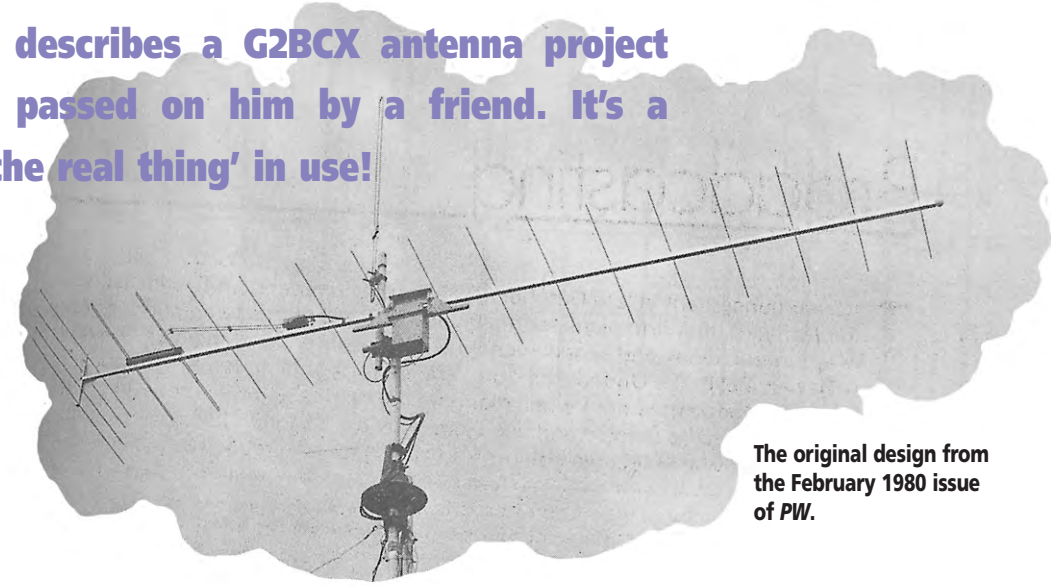
Harry's waiting to hear from You!

As I am now retired, I like to hear about problems with older equipment, particularly pre-1990 Yaesu rigs. If you want a direct reply send remember to send me your E-mail address or enclose a stamped addressed envelope. Send your letters to: **Harry Leeming G3LLL, 'The Cedars' 3A Wilson Grove, Heysham, Morecambe LA3 2PQ. Tel: (07901) 932763, E-mail: harryleeming@tiscali.co.uk**

Remember the mains supply is potentially lethal. Unless you really know what you are doing, always pull the mains plug out, **do not just switch off at the wall socket**, when working on equipment.

Antenna Workshop

John Bowen G8DET describes a G2BCX antenna project that was built and passed on him by a friend. It's a monster and looks 'the real thing' in use!



The original design from the February 1980 issue of *PW*.

I have been very fortunate indeed, receiving as a gift, a beautifully constructed 16-element 144MHz beam antenna made from a design published in the February 1980 *PW*. The project was fully described by the author, the late Fred Judd G2BCX on page 21 of that issue.

The antenna was actually made by my friend **Howard Jemmson G8WOW**, just after the article was published. Howard used the finest material and the detail of his work is incredible. He then used it for some years and when he moved, it was stored in his garage. Moving again, he passed it on to me.

Although the original article said the G2BCX design would "Be of reasonably light weight" I found it very cumbersome compared to my 8-element JB antenna, which uses aluminium alloy tubes instead of solid rods for the elements. The G2BCX antenna is over 4 metres long and supported on square section aluminium. However, it does look the 'real thing' when it's up in the air!

Club Analyser

As I'm a member of the **Chelmsford Amateur Radio Society** (CARS) I've had the benefit of using the club's MFJ-258 s.w.r. analyser. Using the analyser, I've been able to fiddle with the feed-point to provide s.w.r. readings of approximately 1.2 to 1 at 145MHz. This proved quite difficult to achieve and I feel this could be due to the effect of the coaxial cable on the half-wave feed line to the dipoles. I'm planning to inset a coaxial balanced-to-unbalanced (balun) transformer) to see if that improves matters. I also think that water collects at the point where the half-wave line enters the Perspex box and this effects the loading.

Testing the antenna on the monthly CARS v.h.f. net, the G2BCX design seems to radiate quite a large amount of vertically polarised signal. Again, this may be from the novel feed arrangements. Incidentally, if anyone has personal experience using this antenna, I would be interested to hear from them.

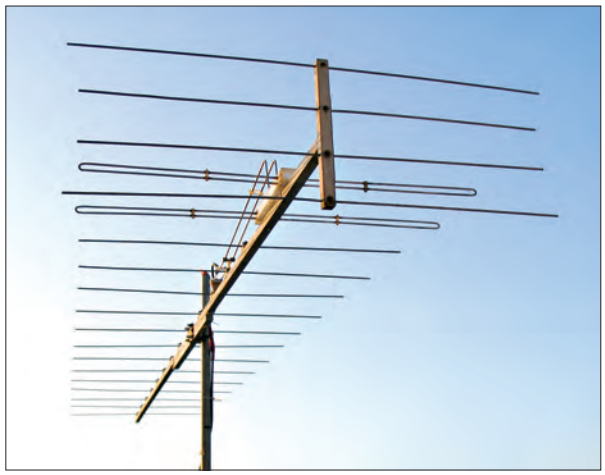


Fig. 1: Photograph of the G2BCX antenna, built by John G8WOW. This view shows the two driven elements. Photo by G8DET.

Fig. 2: Close up view of the antenna, showing the λ/2 feed to the centre of the two folded dipoles via the Perspex box. Photo by G8DET.

Fred Judd G2BCX 1915-1992

Further reading and other projects

Fred Judd G2BCX (1915-1992) was a prolific author and designer. Although he's well known for the prolific number of antenna designs over the years, to fully appreciate this remarkable man's work you have to delve a little deeper. I thoroughly recommend the article that Freda Judd wrote about her late husband, published in the January 2005 issue of *PW*. It's a truly fascinating article and although I first met and got to know Fred in the 1960s - I was very surprised to learn just how wide an experience in radio, electronics, communications and audio work he had gained over the years. I also learned that he had been closely involved in the development of CB radio, acting as a technical advisor for the British Government. I always enjoyed visiting the Judd family at their country home between Norwich and Great Yarmouth in Norfolk and even managed to become friends with their pet goose.

Note: We have very few of the January 2005 issues left for readers who missed the article.

Fred also featured in an appreciation by **Dick Ganderton G8VFH** (the former Editor), in *Short Wave Magazine*, June 1992. In this appreciative article Dick remembered the times when Fred G2BCX rang the office with ideas for new articles. He was busy right up to the end and was still planning things as time ran out. However, thanks to his prolific output we are able to select some of his projects occasionally for re-publication. In this way Fred's work is introduced to new generations of radio enthusiasts and by far the most popular of his designs used today is the famous 'Slim Jim' v.h.f. antenna, first described in the April 1978 issue (**Fig.s 3** and **4**). Indeed, this project has been used around the world by thousands of Radio Amateurs.

On reading an American Amateur Radio magazine (now closed unfortunately) I was pleased to write to an author who had featured the design who had asked , "Who was G2BCX?" I wrote to explain that not only was Fred a dedicated Amateur (the American - not recognising the pre-Second World War G2BCX callsign - had thought it was a company logo! I could understand the mistake for that's the problem associated with any immensely popular design or product). The design or product eventually becomes known for what they do, rather than who made or had the original idea. The exceptions include the term 'Hoover' (for vacuum cleaner') and I intend that Fred G2BCX's name and ideas will remain just as familiar and useful to Radio Amateurs as the ubiquitous dust collection machines!

Rob G3XFD

Further reading note: More examples of Fred Judd G2BCX's work will be appearing in *PW* soon. A list of his articles and projects published in the magazine over the last 40 years or so is also being prepared. Please contact the *PW* offices (marking your 50p SAE envelope and E-mails with G2BCX article/projects) so that we can send you details. **Editor**

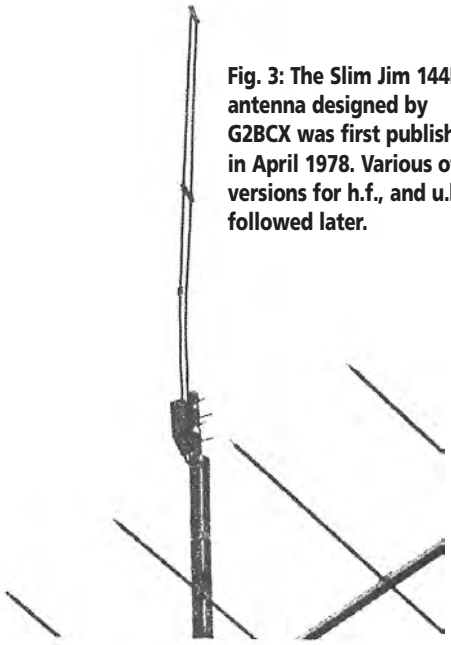


Fig. 3: The Slim Jim 144MHz antenna designed by G2BCX was first published in April 1978. Various other versions for h.f., and u.h.f. followed later.

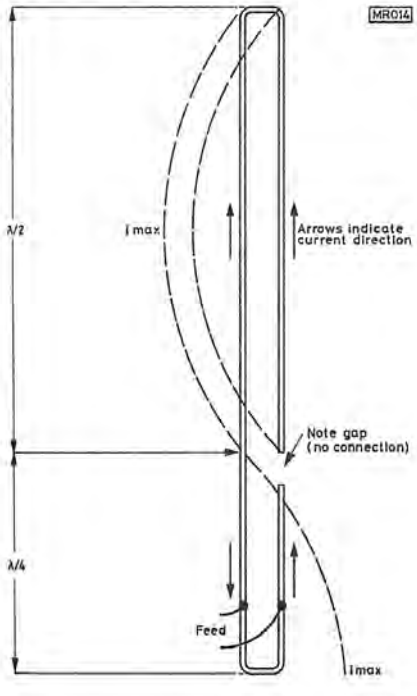


Fig. 4: Fred G2BCX's illustration showing current flow and phasing in the Slim Jim antenna. This popular design is still in use today and is an ideal home-brew project.

PW

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PORTLAND VFO as featured in March 2006 PW. 7-7.2MHz as local oscillator for a 40m direct conversion receiver or transceiver. Otherwise as 7.9-8.4MHz to use in conjunction with a mixer-vfo system as local oscillator for a 4 metre receiver/transmitter with a 9MHz or 10.7MHz IF. Available with Buffer 2 for high drive output or with Buffer 1 suitable for the Poundbury project transceiver. **VFO PCB with Buffer 1 or Buffer 2 PCB and parts kit with potentiometer £14.50.**
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Amateur Radio VHF Operations in Australia

Steve Mahoney VK5AIM, follows the action on the v.h.f. bands in the Northern Hemisphere. Now Steve thinks it's time for us to know what's going on in VK land!

I enjoy reading **David Butler G4ASR's** VHF DXer in *PW*. However, the comparison between G and EI at very high frequency (v.h.f.) and the VK counterpart is amazingly different. The first comparison in differences, is the number of active v.h.f. operators in the two countries.

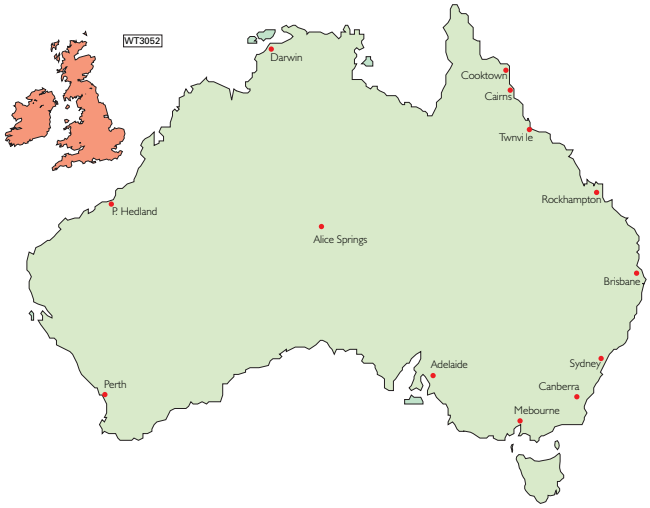
With approximately 13,150 Radio Amateurs listed in the *Australian Call Book,* the distribution of these is mostly in the Eastern States. Victoria VK3, 3500, New South Wales VK2, 3,900. Queensland VK4, 2100. South Australia VK5, 1300 (where I live), comes next with Western Australia VK6, 1200. Tasmania VK7, 490 and The Northern Territory VK8, with 210. It's my guess that about 10% of Australian Amateurs are active on v.h.f.

Most of the Australian population live on the Eastern coast, VK2 and VK4, in Sydney, Newcastle, Brisbane, Townsville and so on. Go west inland across the Great Dividing Range and the population is a lot less, especially Amateurs. Victoria VK3 is also split by this Great Dividing Range that runs from up in Queensland, right down through New South Wales (NSW) to the Snowy Mountains, before turning west across the top of Victoria to peter out in the Grampians in Western Victoria. It was this mountain range that held up exploration of the western areas of Australia 200 years ago. Now it's a barrier to v.h.f. signals!

Along The Coasts

South Australia's (VK5) population lives mostly along the coasts of the two Gulfs. Adelaide, on Spencer Gulf, is the capital city with Port Pirie, Port Agusta, Whyalla and Port Lincoln are all situated on their own peninsulas.

The second comparison is distance, with a map of Australia superimposed with the map of UK, on the same scale, give some idea of these distances.



Steve Mahoney VK5AIM follows the action on the v.h.f. bands in VK land, pointing out the similarities and differences between the UK and Australian operating conditions. The UK and Ireland inset shows the physical differences!

Let's begin by taking Adelaide in VK5 as a reference. To Perth in VK6, it's approximately 2300km (1430 miles), equal to Manchester to Sicily, Adelaide to Sydney, 1200km (746 miles) equal to London to Barcelona. Adelaide to Brisbane 1750km (1088 miles), equal to London to Lisbon. Adelaide to Townsville 2300km (1429 miles), equal to Edinburgh to Rome.

So, perhaps you can now see that v.h.f. QSOs around Australia are difficult. Most of the capital cities and larger country cities have their enthusiastic groups. In the eastern states these are all up and down the coastal cities.

Melbourne and its various cities and town have their Amateur groups. Being the smaller state, NSW has a total area of about equal to England and has a good Amateur population. Adelaide, in South Australia (SA) state, with a smaller Amateur population has most of its activity within the Metropolitan area, with a few operators in the county towns.

Looking At 50MHz

With regard to the 50MHz band, its quiet in the winter months. Incidentally, some states still have low band v.h.f. television services with limits on sections of 50MHz.

From November till March is the Sporadic 'E' season, with contacts to all Australian states. The path across the Great Australian Bight is especially good during summer, as it's mainly over water. Signals can be 5 and 9+10, sounding like a local contact.

Melbourne is difficult as it's too close for a 'hop'. You often get VK3 as 'Back Scatter'. However, if it's a Sunspot Maxima year, we can work New Zealand (ZL), and some of the Pacific Islands.

Trans Equatorial 'E' to Japan (JA), is common in these times. Such areas as VK4, VK8 and the northern areas of VK2 (NSW) get good signals, but it takes a good opening to get lower down into VK5, lower VK2 and VK3.

Sometimes, with luck, you can work Tasmania (VK7)! However, you really do need a 6-element, or more, Yagi beam with 150W peak envelope power (p.e.p.), with no received 'rubbish' from TV time base generators and computers to hear the Japanese (JA) stations.

You need to live away from the Metropolitan area.

The 144MHz Band

The Australian 144MHz (2m) band is twice as big as that in the UK, covering 144 to 148MHz. The first 250kHz is for s.s.b., etc., the beacons, then packet. The section 146 to 148MHz is for frequency modulation (f.m.) repeaters and simplex. Incidentally, it's worth mentioning we are at present having QRM troubles with pocket pagers, situated just above 148MHz. (They start at about 148.050MHz.).

Personally speaking, I believe that f.m. repeaters and packet have taken over the VK 'VHFers' interest from s.s.b. operations. It's hard to get a contact on 2m s.s.b. in Adelaide. When there's a 'lift' as you G operators call it, the repeaters can be opened from all directions, even from two directions at a time - causing much confusion. However, being so easily scanned and monitored they act as good beacons.

The path across the Great Australian Bight from Albany to Adelaide is excellent in the summer months, providing superb DX propagation conditions. It's believed that the cool sea air meets the hot dry air from the arid land at the end of the 'Bight' and causes massive ducting.

Before satellites came into use for aeronautical radio traffic, the propagation in the Bight used to effect aircraft communications and microwave telephone links across this area. Long distance signals are lifted on 144 and 423MHz and can last for hours at excellent signal strengths, until a strong wind blows the duct inland. I remember during the 1960s I worked across the 'Bight' with 25W of amplitude modulation (a.m.) on 2m.

A 14-element Yagi and 10W p.e.p. will do the job with a good 'Lift'. The microwave bands, 1.2GHz (23cm) and up have spanned the 'Bight' with a good lift.

The ducting also occurs up the east coast; NSW (VK2) to Queensland VK4. It also occurs to Sydney, Newcastle, Brisbane, Rockhampton, Townsville. Most keen v.h.f. operators watch the weather maps and forecasts for those 'Big Highs'. Lifts occur up the western Australian coast, Port Headland and Broom. Repeaters up that way can be locked up with private mobile radio (p.m.r.) transmissions and pirate v.h.f. signals from Indonesia, at these times.

Aircraft Enhancement

A new mode, invented/discovered in the Eastern Australian states (Melbourne, Canberra, Sydney) is 'Aircraft Enhancement' propagation. This has been going on for 10 years or more. There is great discussion as to how it works. Are the signals reflected by the aircraft themselves? Or do the temperature differences in the hot exhaust trails of the planes play a part?

There are a great number of aircraft going between Sydney and Melbourne and flight schedules are easily obtainable. You need a couple of 14-element Yagi antennas and 150W p.e.p. of s.s.b. (The new digital modes for weak signal QSOs go even better).

Hopefully, after reading my article, you'll agree that there's really no technical excuse for VK Amateurs not going on v.h.f./u.h.f. There's much encouragement, especially, as most of the commercial manufacturers are now producing transceivers covering h.f. to v.h.f., all modes with c.w., s.s.b., f.m., and data, with ample r.f. output power out. Commercial v.h.f./u.h.f. antennas are also readily available (Australian made, not imported) for those not inclined to build their own.

The possible effects of dropping of the c.w. requirement to all present licence classes, enabling them to go on h.f., then leading to a further reduction in v.h.f. activity, is yet to be seen. I only hope that the introduction in VK of an 'Introductory Licence' similar to the UK Foundation Licence brings more interested people into Amateur Radio.

Best wishes from Steve VK5AIM 'Down Under'. **PW**

A Versatile Broadband Amplifier Unit

Stefan Niewiadomski updates a classic broadband amplifier design, adding greater output power capability and input and output attenuators for increased versatility.

I recently had need of a broadband amplifier that would cover the whole of the h.f. bands with a relatively constant gain. It would also need to provide an output suitable to drive circuits to a slightly higher level than most signal generators can.

In my much valued copy of the *Solid State Design for the Radio Amateur* (*SSDRA*), now sadly out of print, there's a design for a four-stage broadband r.f. amplifier. After finding a suitable amplifier design, I took the trouble to update the design slightly and I designed a printed circuit board (p.c.b.) to make construction easy.

Added Attenuators

I also intended to add some attenuators around the amplifier to make the whole package more versatile. I've found this combination unit useful in many applications such as oscillator buffering, as a pre-amplifier for a frequency counter and driver for a power output stage.

The prototype was tested from one to about 40MHz with a gain of about 40dB and was found to have an essentially flat response over the range. I'm sure any constructor will find this unit useful in many of their projects, either as stand-alone unit or as part of a bigger project.

Four Stages

In **Fig. 1**, is the schematic of the broadband amplifier, with four stages of amplification, giving an overall gain of about 40dB. With a broadband amplifier, the gain of each individual stage is deliberately kept low so that the bandwidth of that stage, and hence the bandwidth of the complete design, is high. The active devices, Tr1, 2, 3 and 4 stages are very similar, each with heavy feedback to ensure stability and 50Ω input and output impedances.

The first three stages use 2N5179 transistors, but the final stage, Tr4, uses a 2N3866, which is capable of higher power than the 2N5179. This stage also has a broadband transformer in its collector circuit to give additional output power. I added a small heat sink to Tr4 but I'm not sure this is really required.

The 2N5179, used in the original design is still available from several suppliers. An alternative is the BFY90, in the same case style and with the same pin-out. The 2N3866 used in the output stage is also still easily available.

The circuit, **Fig. 2**, shows the basic linking of the unit, including the input and output pi-network attenuators and switches, which select the appropriate attenuation level. The attenuator resistors are mounted directly on their respective switches.

Though it may seem strange to include an attenuator at the output of the amplifier, the reason is to cater for cases when the circuit to be driven needs to see a resistive drive, rather than the complex drive impedance inevitable from a broadband amplifier. Also note that S1 and S2 both have a 0dB attenuation setting, so all attenuation can be switched out of the signal path if desired.

Winding Toroid

The toroid, T1, is wound on an FT-50-43 ferrite toroid. To form the primary winding, you'll need 150mm (approximately) of 24s.w.g. wire, keeping

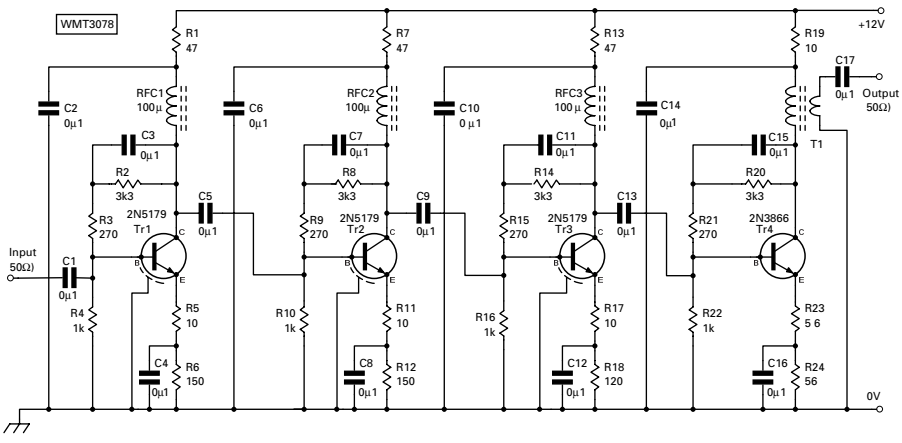


Fig. 1: The circuit of the four-stage broadband amplifier.

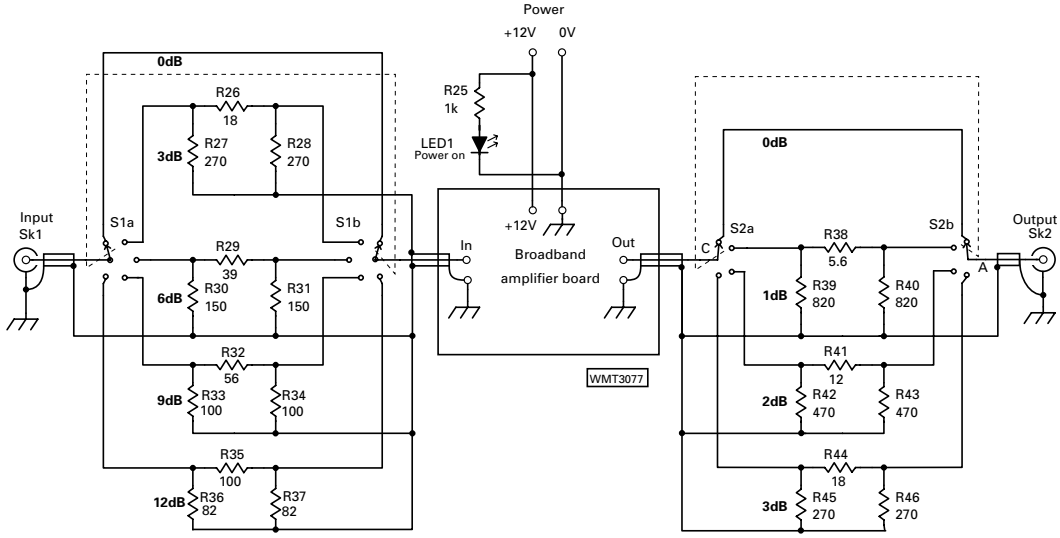


Fig. 2: The addition of two switched attenuators will increase the usefulness of the unit.

the 12 turns fairly evenly distributed round the toroid. For the secondary, wind six turns of the same wire type on the toroid, distributing these turns evenly over the top of the primary winding. Trim the ends of the wires to about 30mm they can be trimmed to the final length later.

Construction Using PCB

I'd certainly advise using a p.c.b. for this project, as it's easy to get instability with such an amplifier. I've shown a layout in **Fig. 3**, but if you use 'ugly' construction, be certain to keep the stages in line, with the output well away from the input.

To mount the components on the board, simply start at the input end and work your way towards Tr4, finally adding transformer T1. Make sure you scrape the enamel insulation from the ends of the wires and tin them before inserting into the holes and soldering in place. There are two links on the board, simply use discarded resistor leads for these connections.

Note: The 2N5179 has a fourth lead that's connected to the case of the device. This is to be taken to a 'chassis' connection on the board.

All the capacitors are identical, being high-quality 100nF ceramic decoupling type, used both for supply decoupling and r.f. coupling.

Add the push-on heatsink to Tr4 after soldering it into the board. Finally, insert terminal pins into the holes for the input, output and power connections to the board to facilitate unit wiring, rather than trying to insert wires into the board itself.

Mount the attenuator resistors on the relevant switches and pick up the ground connection at the bottom end of the pi-networks from the outer (braid) of the miniature coaxial cable connecting to the switches.

Thoroughly check the locations and polarity of the components on the p.c.b. and check that all the solder joints are good, with no solder bridges or shorts on the underside of the board. Double-check the wiring from the p.c.b. to the controls and sockets, especially the power wiring.

The front and rear panel layouts aren't too critical, and can be modified to suit any enclosure you have to hand, but be sure to keep Sk1 (the input) and S1 at the opposite side of the enclosure from Sk2 (the output) and S2. This will ensure maximum r.f. stability of the unit.

Simple & Easy

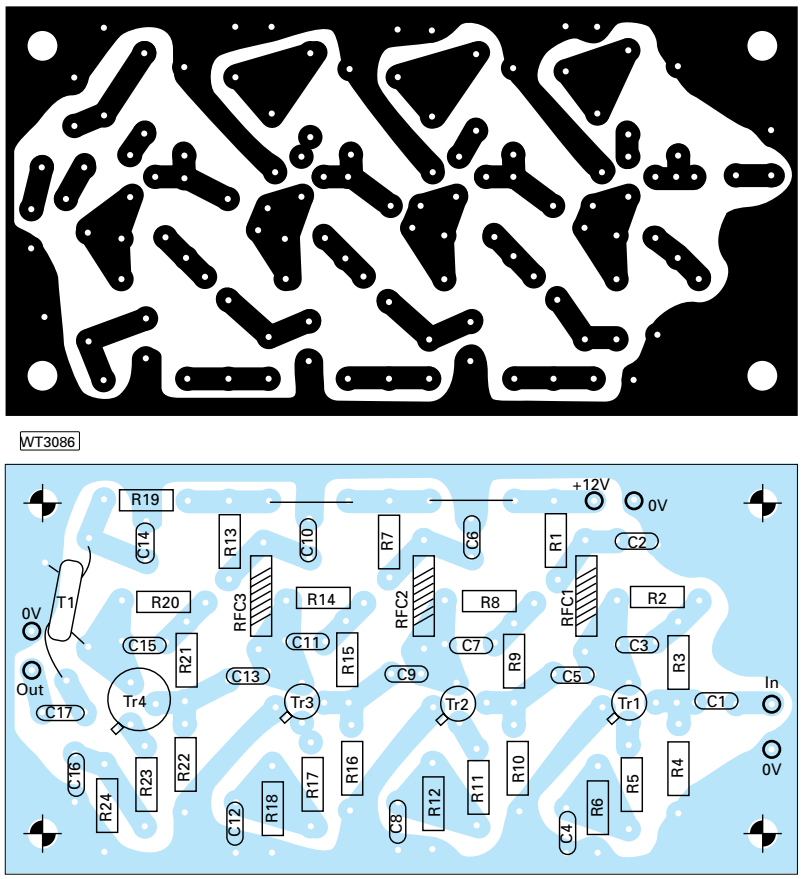
The amplifier unit is very simple and easy to use. You merely connect the 12V power source (making sure to get it the right way round of course) and the l.e.d. should light, which with its current limiting resistor R25, indicates when power is applied to the unit.

Then plug the r.f. source (crystal oscillator, v.f.o. or signal generator) into Sk1 and take the amplified output from Sk2. I usually set S2 (the output attenuator level switch) to 1 or 2dB and then adjust S1 (the input attenuator level switch) so that the output is a good sine wave without any distortion caused by overloading and at the level I need for the circuit being driven.

So, there you have a useful broadband amplifier that will cover the whole of the h.f. bands. And you've built it yourself!

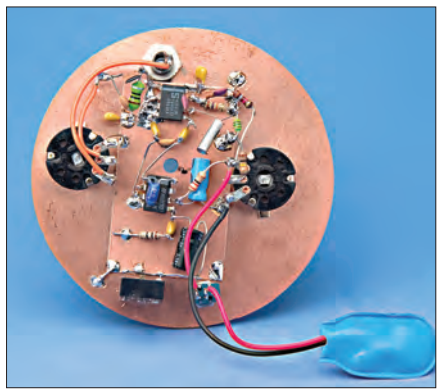
PW

Fig. 3: A suitable p.c.b. track pattern and component overlay of the circuit of Fig. 1.



Carrying On The Practical Way

This month tinned Ham Radio is on offer from George G3RJV!



This time, the Rev. George Dobbs G3RJV has a tin opener at the ready. After he's opened the tin it's turned into a radio receiver, a classic demonstration of recycling useful materials!

"Labels are for cans, not people".
Anthony Rapp (American Actor)

In the January 2006 Carrying on the Practical Way (COTPW), I offered readers a basic little transmitter built inside an empty sardine tin, it was a scaled down version of the W1FB Tuna Tin II transmitter. The circuit was repeated in May of this year using copper nails pinned into a printout of the circuit.

About the time the sardine version appeared, I mused on doing a matching receiver in a tin but never got around to it. Then, I was approached by **Rex Harper W1REX**, an active QRP operator and builder in the USA. Rex, inspired by the W1FB Tuna Tin II transmitter, has begun producing kits for those who want to replicate the design.

Designer Tin!

Rex's kits are interesting in that he has had a special 'designer' tin can made just for the project. All the parts and a printed circuit board (p.c.b.) come complete with a brand new tin. In fact in a version I saw, the can was sealed and pulling off the top with the ring-pull revealed the radio parts inside the tin! There are also special labels to fit to the can which describe the contents (a transmitter) and have the frequency of the crystal in a printed digital display format.

The reason why Rex contacted me about using the Sudden receiver design was the need for a matching receiver to go with the Tuna Tin transmitter. The Sudden first appeared in the **G QRP Club** journal *Sprat* in 1989 and a later version was featured in *PW*. What follows here is the little direct conversion (DC) receiver I built inside one of Rex's tin cans. However, it could be built in any similar sized or even smaller, can.

My aim was to build a receiver that's a little simpler than the Sudden. It was to be designed to go alongside a crystal controlled transmitter like the Tuna Tin II, using inexpensive parts and with no coils to wind.

For some reason, coil winding often appears to be a problem for some constructors! Although, I would admit that hand wound coils are difficult to reproduce with the exact inductance, they are very easy to make. This receiver uses off-the-shelf moulded inductors, they're not ideal but they serve the purpose. The circuit in **Fig. 1** shows the final receiver I built into the tin.

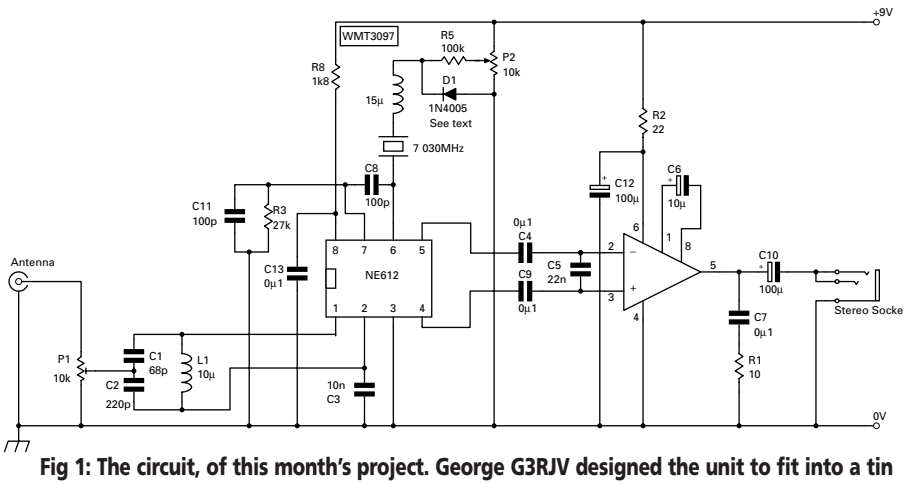


Fig 1: The circuit, of this month's project. George G3RJV designed the unit to fit into a tin supplied by his American friend Rex Harper W1REX.

Two Chips

The receiver uses the same two devices as the Sudden receiver; the NE602 (or NE612) and the LM386 integrated circuit (i.c.) 'chips'. The NE602 has formed the basis for many simple receivers.

The NE602, an 8-pin DIL package, contains a balanced mixer, a local oscillator and a voltage regulator. The mixer produces 20dB of conversion gain. The incoming signal is amplified 100 times as it is mixed with the local oscillator. In recent times, the NE602 has become a replaced part (being superseded by the NE612) the pin-out and operation is the same for either device in this circuit.

The LM386 audio amplifier i.c. can provide 46dB of audio gain, which is a power gain of 40,000. The combined gain of the two devices is enough to allow weak Amateur Radio signals to drive a pair of headphones or a small loudspeaker in a quiet location.

The Signal Pathway

First, I'll describe the signal pathway through the simple circuit. The signal from the antenna goes to a linear potentiometer that acts as in input attenuator. This is the only gain control in the receiver. **Note:** If there is to be only one gain control in a simple receiver, the input is my choice.

The potentiometer control not only adjusts the volume of the signal output, it

Fig 2: The circuit exactly as G3RJV laid it out on the board. All 0V points are connected to ground and directly soldered to the p.c.b. material.

also prevents large signals entering the mixer. This helps to prevent cross modulation from adjacent strong signals. For an even attenuation adjustment, the input potentiometer must have a linear track.

The input tuning is rudimentary. A single 10µH inductor (L1) forms a tuned circuit with two series capacitors (C1 and C2). The capacitors allow a rough match to the input from an low impedance antenna. A 10nF capacitor (C3) provides a radio frequency (r.f.) ground as inputs (pins 1 and 2) to the mixer.

The NE612 requires a supply voltage in the 4.5 to 8V range. A discerning constructor would perhaps add a 6V integrated circuit regulator to supply the NE612. I simply used a 1.8kΩ series resistor (R4) and this provides an appropriate input voltage.

The NE612 internal oscillator connections are to pins six and seven. Two capacitors (C8 and C11) form the capacitive feedback tap for a Colpitts oscillator. The resistor (R3) at pin 7 enables a sure start for the oscillator.

This tin can receiver was made go alongside the Tuna Tin transmitter, which is crystal controlled. So, the local oscillator is designed around a variable crystal oscillator (VXO), which can tune a little either side of the transmitter frequency.

My version uses a reverse connected 1N4005 diode as a varactor diode. The diode, D1, acts as the variable capacitance, which is used with a series inductor of 15µH to move the crystal frequency either side of the nominal frequency. A 10kΩ linear potentiometer provides via R5, the variable voltage, required to vary the capacitance across the diode.

Just as the input to the mixer is balanced, the balanced output, at pins four and five, is used to feed the LM386 audio amplifier. The LM386 circuit follows the common configuration for the chip set to higher gain.

The capacitor C7 and the resistor R1 are the usual filter circuit applied to an LM386 amplifier. If real economy of parts is required these could be omitted at the slight risk of instability in the chip. Portable cassette player headphones are cheap and easy to find and the stereo socket is wired to enable stereo headphones to work as mono.

Tin Lid Assembly

The circuit is built on the back of a purpose-built tin lid. This lid is made from a piece of blank p.c.b. material. After mounting the front panel fixtures (the two potentiometers, antenna input socket, stereo output socket and on-off switch) on the lid's top surface, the receiver is built 'ugly' style on the opposite surface. Ugly construction, as regular readers will know, is a common method of building the projects to be found in this column!

I attempted to layout the circuit, Fig. 1, roughly in the same manner as the construction layout. To make this clearer, **Fig. 2,** shows the circuit as it's laid out on the board. All connections to the 0V rail are soldered directly to the p.c.b. material.

Note: Please be aware the 1N4005 is mounted vertically, the top end being the anchor point for the inductor and the series resistor.

No Labels!

I never got around to the intended task of adding labelling on the tin lid. As the there are only two controls - and I used a large knob for tuning and small one for gain - there's little need for labels!

The little receiver is minimalist and uses very few parts but I was pleasantly surprised at how well it worked. It received many c.w. signals over its small operating range including several QRP stations.

It should certainly hear anything that the little Tuna Tin transmitter is likely to work. Remember also, that portable cassette type headphones vary a lot; some are more sensitive than others. The usual rule of thumb is that the more they cost the more sensitive the headphones will probably be.

After the construction exercise, I had filled the little tin that Rex gave me with a suitable receiver!

Possible Improvements

The diagram, **Fig. 3**, suggests a couple of possible improvements to the receiver. They both use 10.7MHz i.f. transformers of the type found in older a.m./f.m. receivers. These can be bought cheaply or culled from old radio sets. Ideally, try to use the final i.f. transformer. This should have a winding tuned to 10.7MHz, with an internal capacitor and a link winding.

The first modification is to use a better input tuned circuit; the fixed inductor and capacitor suggested in Fig. 1 is a very rough and ready way of achieving the desired frequency for the filter. In the suggested circuit in Fig. 3, a 10.7MHz i.f. transformer replaces the fixed inductor. The link winding matches the input impedance and the tuned winding has extra capacitance to bring the frequency down to 7MHz.

In practice 10.7MHz i.f. transformers usually have a nominal inductance of around 5.5µH but also include a threaded slug to adjust the inductance. The value of the internal capacitance should be in the order of 50pF and since it would take 114pF to tune 4.5µH to 7.030MHz, the extra capacitance required is a little over 60pF.

I would suggest trying a value of 68pF and adjusting the core to peak the signals. The diagram, Fig 3, shows a trimmer capacitor. This technique is a good 'belt and braces approach' as the trimmer and the adjustable slug both provide means for peaking the input signals.

The other suggested modification is to control the frequency of the oscillator with another i.f. transformer and a variable capacitor. The values will depend very much on the inductance of the particular transformer used.

I would suggest removing the internal capacitor; it's usual in a recess in the transformer base. Simply break it with a pair of needle nosed pliers and use a trimmer across a variable capacitor to obtain the required frequency range.

I'll leave readers to experiment with values! Part of the fun of these simple receivers is that they are ripe for experimentation. **PW**

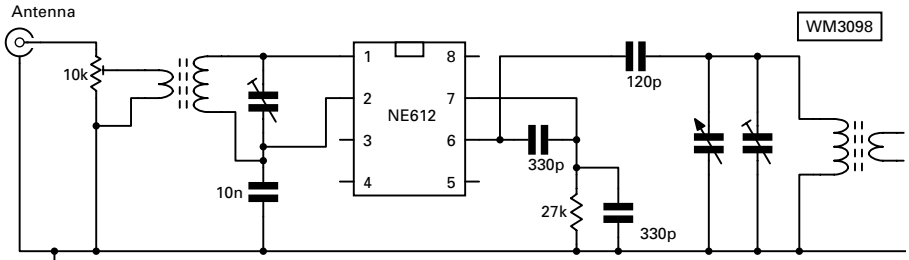


Fig 3: Suggested modifications to the receiver project use 10.7MHz i.f. transformers, obtainable from scrap receivers or as surplus items.

A Two Metre Transmitter

By F G Rayer
G3OGR

Editorial comments on 2006 article republication: This project - originally published in the September 1967 issue of *PW* - effectively emphasises the changes made over the years since it first appeared. The circuit, although viable even today, brings back many memories of 1960s Amateur Radio and I've no doubt, many others of the same vintage! Learning how to set up a crystal oscillator multiplier chain with nothing more than a test meter, crude wavemeter and (if you were well equipped) a dip meter capable of working on v.h.f., was a real challenge.

The passing comment made by the author to the (then new) Class B Licence doesn't really provide a real insight to the tremendous impact that the G8s were to have on the v.h.f. and u.h.f. bands. Suddenly, from being dead throughout the week there was activity most of the day on 'two'. It was then I began to meet Amateurs who were real radio 'professionals', often working in broadcasting and at the forefront of technology development. There was a breath of fresh air blowing into our marvellous hobby.

I have only updated terms and terminology where I think it's really necessary for clarity. Again, I can proudly say that this is another G3OGR project that helped me on to the bands. However, not being able to afford a 6146 valve, I just used the QRP version by employing the 5763 as the final amplifier and output! **Rob G3XFD**

The 1967 Project

The 144MHz Amateur band covers a very wide frequency range compared with the low frequency bands and crystal control is quite often used offering a simple means of obtaining good frequency stability. In addition to its obvious use on the two metre band, a transmitter of the kind described here may be adapted for use as a driver, with its output frequency multiplied into the 430MHz band.

The new Class B licence permits operating on frequencies above 430MHz without any need to pass the Morse test, callsigns being allocated in the G8 (followed by three letters) series.

The diagram, **Fig. 1**, is the circuit, V1 using an 8MHz 3rd overtone type crystal so that output is obtained directly on 24MHz. If the tuned circuit L1/VC1 is tuned for maximum output, oscillation may not recommence after switching on and off and VC1 is adjusted slightly as necessary to correct this.

In the circuit V2 triples to 72MHz, while V3 doubles to 144MHz. Driving the power amplifier V4 at 144MHz ensuring reasonable efficiency. As grid current is very important, VC2 is panel operated and a grid current meter is included. It is possible to omit this meter, fitting a jack for use as an external test-meter or similar instrument.

If a grid dip oscillator (g.d.o.) is available this will be very useful to check the frequencies of the various circuits before applying power. Should a g.d.o. not be to hand, tuning up can be accomplished by means of the indication wavemeter described.

Initial adjustments should be made stage-by-stage and no high tension (h.t.) must be applied to HT+2 until the circuits are correctly tuned. If the coil details given are followed carefully, this should avoid any serious error such as working on the wrong harmonic.

The coil details are given exactly as a guide and this does not mean that somewhat dissimilar coils would not be satisfactory (especially if a g.d.o. can be brought into use to adjust their frequency).

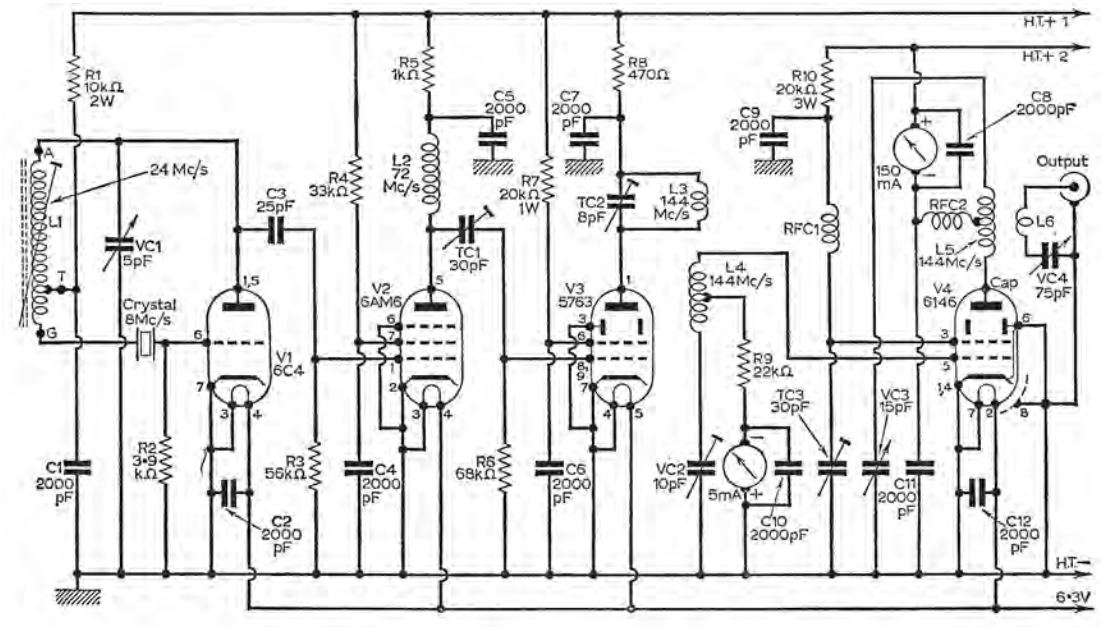


Fig. 1: Circuit of the 144MHz valved transmitter. The oscillator, V1 uses an 8MHz 3rd overtone type crystal so that output is obtained directly on 24MHz.

Construction Straightforward

Construction of the project is quite straightforward, with all circuits except the power amplifier (p.a.) anode and output below the chassis. A piece of aluminium 4.25in. x 9.75in. (108 x 248mm) has 0.25in. (6.3mm) flanges bent on it and is

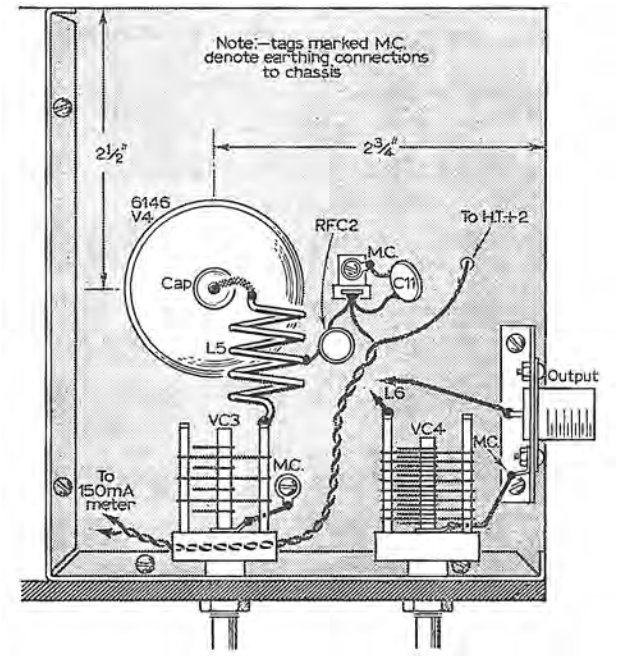


Fig. 2: The chassis details showing power amplifier valve position.

shaped to fit as in **Fig. 2**. The positions of valve holders and other items on the chassis can be judged from Figs. 2 and **3**.

The illustration, Fig. 3, is the underside of the chassis. Heater and h.t. leads run close against the chassis. All bypass capacitors are connected with very short leads.

Crystal Oscillator

The oscillator is intended for 3rd overtone type crystals and other crystals may not be satisfactory. With the 8MHz overtone crystal, the lowest frequency present is the overtone or 24MHz. The output frequency of the transmitter is approximately x18, so the crystal frequency and crystals can be chosen on this basis.

The position of the tapping T on L1 considerably influences results and will probably have to be adjusted to suit the particular operating conditions. If the tapping is too near the grid end G of L1, no oscillation will be obtained. If the tapping is too near the anode end A, oscillation will continue at all frequencies to which L1 may be tuned. When the tapping is correctly placed oscillation arises only at the crystal overtone.

The inductor, L1, is wound with 24s.w.g. enamelled wire, on a 0.281in (7.15mm) diameter cored former. there are 18 turns in all, with the tapping five turns from the grid or crystal end, as shown in **Fig. 4**. Some adjustment of the ease of operation as the circuit oscillates, can be made by modifying the position of the core and restoring tuning by VC1.

If a g.d.o. is available, place V1 and V2 in and set L1 core and VC1 to give resonance on 24MHz. Connect a meter between R1 and the h.t. line and apply about 250-300V. The current may be around 10mA off tune, falling to 8-9mA on tune.

If adjustments of VC1 and L1 core do not produce a dip in current, the circuit may not be oscillating. A receiver or sensitive wavemeter tuned to 24MHz will show this.

Alternatively, there will be a sharp rise in current if L1 is shortened, if the circuit was oscillating. If oscillation is not obtained, tapping T may need to be a turn or so nearer A. Should these tests show the circuit oscillates but that the frequency can be tuned by VC1, tapping T needs to be a turn or so nearer G.

If a g.d.o. is not available, use a receiver or wavemeter to make sure that L1 is not tuned to 16 or 32MHz in error. **Note:** Some 3rd overtone type crystals will oscillate at multiples other than the one required.

When adjustment is correct, adjusting L1 or VC1 will change the frequency only slightly, due to pulling the crystal. If L1 is put very far off resonance, oscillation will cease, as shown by a rise in anode current.

Coil L2 has six turns of 16s.w.g. wire, spaced to occupy 0.75in, with an outside diameter of 0.625in (16mm)The shortest possible connections are used from the coil to tag 5 and from C5 to the coil and chassis.

Next, insert V3. Temporally insert a meter between R6 and chassis (positive to chassis). If a g.d.o. is available, adjust TC1 until L2 is resonant at 72MHz. If no g.d.o. is to hand, adjust TC1 for maximum grid current through R6, this should be over 0.5mA. Check with the wavemeter that L2 is tuned to 72MHz and not some other multiple.

Adjustments of TC1 may seem quite flat, because it is in series with V3 grid capacity. The trimmer, TC1, should be at least half closed. Should L2 not tune to 72MHz, it must be stretched or compressed slightly.

The driver coil L3 is adjusted to 144MHz with the parallel trimmer TC2. The coil L3 is two turns of 16s.w.g. wire, with an outside diameter of 0.625in

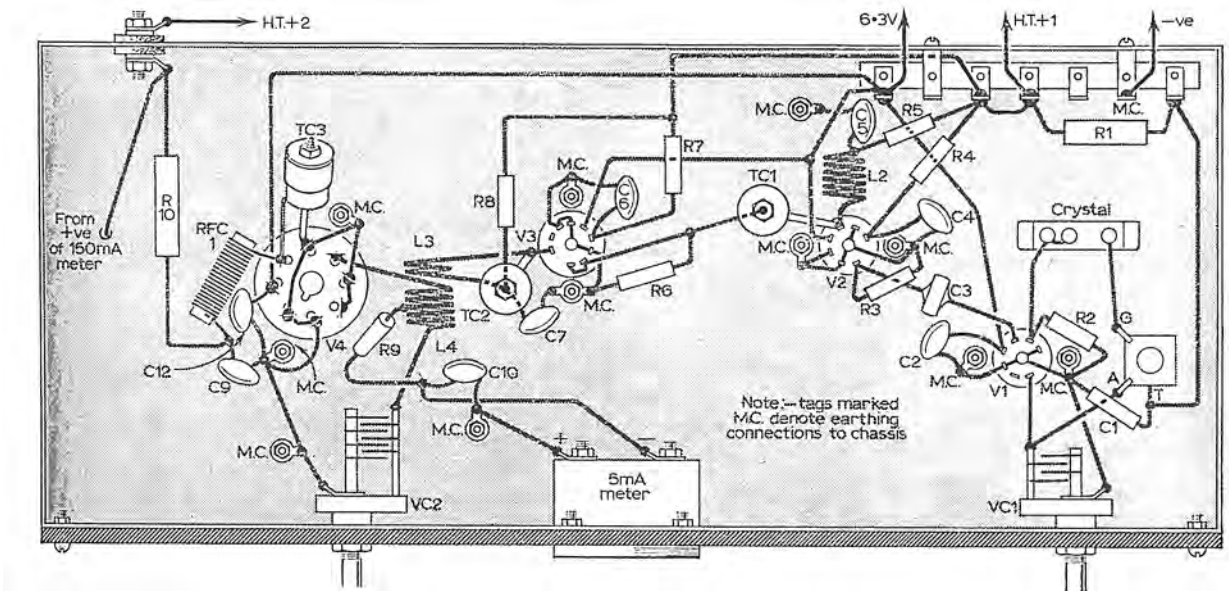


Fig. 3: Under chassis view showing wiring diagram and layout (see text for important layout information).

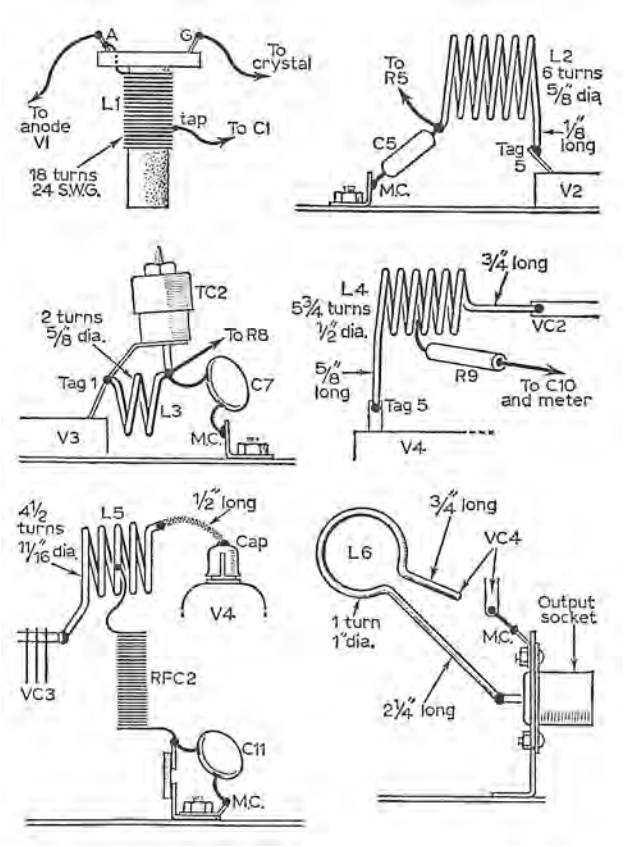


Fig. 4: Coil details. For information on individual coils please see text.

(16mm). with its turns separated to occupy 0.313in (8mm). With grid current obtained through R6 as mentioned, rotate TC2 for maximum output, as shown by a wavemeter or lamp loop. The latter can be one turn of insulated wire, soldered directly to a 0.06A bulb. The trimmer, L3, and C7 have the shortest possible leads. If L3 does not tune to 144MHz, it will have to be compressed or stretched slightly.

Grid Coil

Next, we'll look at the p.a. grid coil. As stray capacity is otherwise too great for efficient working, the coil is series tuned by VC2. It has five and three quarters turns of 16s.w.g. wire and is 0.5in. long, with an outside diameter of 0.5in (13mm).

Wire the V4 holder with stout conductors (16s.w.g.) and the shortest leads possible. Take by-pass capacitors and other connections to the tags adjacent to the sockets, not to the ends of the tags. A Paxolin holder of the thin type, with little solid material was found satisfactory and the moulded type of holder with embedded sockets should not be used. A ceramic or other low-loss holder is preferable.

Connect L4 directly from tag 5 to VC2. Cut one lead of R9 very short and solder this to the centre of L4. Put V4 in, but be sure no h.t. is applied to anode or screen grid. L3 and L4 are closely coupled as in Fig. 3. Adjustments in all stages can now be directed towards obtaining maximum grid current. With VC2 correctly adjusted, grid current should be 2mA to 3mA. If maximum grid current is with VC2 open, stretch L4 slightly. Should maximum grid current be obtained with VC2 closed, press the turns of L4 slightly together.

All the previous trimming adjustments can then be checked, to get maximum grid current on the meter. Although L3 and L4 need to be close together, **on no account must they touch**. The adjustments of TC2 and VC2 to some extent depend on each other but after these are peaked VC2 should allow ample adjustment of grid current on the meter.

Power Amplifier Anode

The p.a. anode coil L5 has four and a half turns of 14s.w.g. wire wound to an outside diameter of 0.69in (17.6mm. the coil is 0.75in (19mm) long and a 0.5in flexible lead is soldered to the anode end. this can be a piece of coaxial cable outer braiding, or a number of pieces of bared flex twisted together. The other end goes directly to VC3. A 14s.w.g. wire runs from VC3 moving plates tag to chassis.

RFC2 is self-supporting and has 30 turns close wound of 22s.w.g. enamelled wire on a 0.25in (6.3mm) diameter rod. Straighten a piece of wire and fix one end to some object. Wind by rotating the rod, keeping tension on the wire. then when the rod is removed the turns will not spring out, but will remain as a solenoid. the actual tapping point is slightly off centre on the coil, as shown.

With no h.t. applied to V4 rotate VC2. A dip in grid current should be found indication resonance for L5. If this is not found, compress or stretch L5, or check its frequency with a g.d.o. L6 is a single turn of 14s.w.g. wire, covered in stout sleeving. the co-axial socket is fixed to a bracket and the ends of L6 go directly from this to VC4. A lead from VC4 moving plates tag runs to the socket outer member at a soldering tag.

Series Tuned Neutralising

Series tuned screen neutralising is used, adjusted by TC3. The choke, radio frequency choke (r.f.c.) 1 is made up of 90 turns of 38s.w.g wire on a 0.19in (4.8mm) diameter former.

With TC3 fully closed and no h.t. applied to V4, tune VC3 so that the dip in grid current mentioned is seen. Unscrew TC3 while VC3 is swung from side-to-side. A point should be found when the dip in grid current is much smaller or absent and TC3 is left in this position.

Power Amplifier

As a 6146 may readily draw a destructive anode current, a first test of the p.a. stage at reduced voltage is wise. Take HT+2 to a 250V or similar supply, with a switch in circuit. A domestic lamp can be used as an artificial load.

Note: This in not ideal at 144MHz and will present a much higher impedance than the usual load. A temporary loop having two or three turns of insulated wire should be made and connected by short leads to the lamp holder terminals.

Put this loop near L5, switch on the HT+1 supply and adjust VC2 for about 2mA grid current. Switch on h.t.2 and immediately rotate VC3 for a dip in anode current. If this is under about 100mA, bring the lamp loop nearer L5. With 25 watts input (100mA at 250V) a 15W lamp should light fairly brightly.

Efficiency is much higher with increased voltages. VC2 may need slight re-adjustment after applying h.t. to V4. A 275V or 300V supply is recommended for HT+1. When a lamp or other artificial load is connected to the output socket, closing VC4 from zero increases loading, but a 200/250V lamp is too high an impedance for this to be sufficient for full p.a. input.

The c.w. ratings of the 6146 at 175MHz, are given as 140mA anode current at 320V. At 60MHz, ratings are 112mA at 600V. Telephony ratings are normally somewhat lower. In addition, the highest input ratings need ample grid drive, or full output is not obtained. In view of this, I have operated the amplifier at about 100mA anode current, from a 320V supply.

Grid Current

The p.a. must not be operated without sufficient grid current (bias) or off resonance, or in conditions where the output obtained is so low that the anode dissipation is exceeded. With normal care, this should not be difficult. for increased output, R10 may be reduced to 16kΩ.

Point HT+2 is supplied with modulated h.t. from the secondary of a modulation

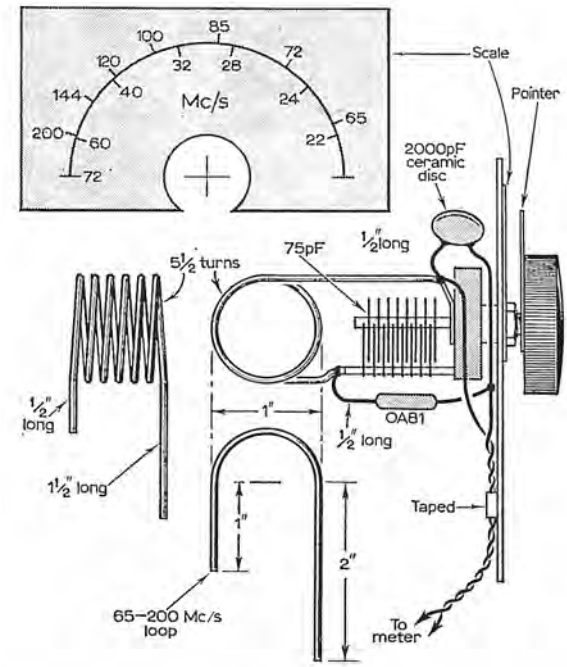


Fig. 5: A simple v.h.f., wavemeter for alignment purposes.

transformer. The modulator can be of normal type with a pair of 6L6 or 807 valves or similar stage delivering power about equal to half the p.a. input.

Note: The h.t. must be removed when changing crystals, if this is not done the valves could be permanently damaged.

Simple Wavemeter

If a g.d.o. or wavemeter is not available, a simple indicating wavemeter can be constructed, as in **Fig. 5**. Provided the inductance and other details are exactly as shown, accuracy should be high enough for the various harmonic multiples to be identified.

The output from the diode is taken to a test-meter or other instrument with a 1mA or similar range. The variable capacitor is fitted to a piece of insulating material, to serve as a handle and carry a card scale.

For the 22-72MHz band, take 17.5in (445mm) of 16s.w.g. wire and straighten it. Wind 5.5 turns so that the coil has an outside diameter of 0.9in (23mm) and is 0.5in (102mm) long with the ends going directly to the tuning capacitor. For the 65-200MHz band, use 4in. of 16s.w.g. wire. Bend this round a suitable object to form the loop as shown and solder it to the capacitor.

To cover both bands, it is necessary either to make two wavemeters, or to unsolder the unwanted coil. The wavemeter coil is loosely coupled to the appropriate transmitter coil and tuned for maximum reading on the milliammeter.

Editorial note: *The simple v.h.f. wavemeter described by G3OGR is a most useful little instrument. Even today I think it's extremely useful when setting up multiplier chains, etc. Although my version of the transmitter disappeared many years ago - I still use the wavemeter, as described in Fig. 5 today!* ***Rob G3XFD***

Fixed Capacitors

Fixed capacitors should be of high-frequency by-pass type and sufficient voltage rating. When the p.a. is operated from a modulator, C11 should be rated at more than twice the h.t. voltage. A 1kV disc ceramic capacitor is ideal but a mica capacitor can be used and the value may be reduced to 1000pF.

The variable capacitors VC1, VC2 and VC3 can be modified somewhat, to use 7.5pF, 10pF or similar components. Much larger values, such as 25pF or 50pF, are not suitable. the minimum capacity is too great and adjustment too difficult. The capacity of some surplus miniature short wave tuning capacitors can easily be reduced by taking off plates. **Note:** VC should be rated at twice the h.t. voltage or more, so it needs double plate spacing.

Various combinations of inductance and capacity will reach the resonant frequency required in each stage. But with L3 in particular, output rises when TC2 is at quite low capacity, so the coil may be compressed slightly if needed.

Cathode Keying

Unfortunately, cathode keying (for c.w.) of V4, suitable for lower frequencies, cannot be used. However, the screen grid supply to V3 can be keyed and bias applied through L4 so that the input to V4 does not exceed 20W during key up intervals. In this case R9 should be reduced to 2.2kΩ and the negative bias taken to positive on the 5mA meter.

Bias from a small power pack delivering some 40V or so is most convenient, with a potentiometer to allow voltage adjustment. A check should then be made with no drive so that V4 d.c. input (voltage x current) is not over 20W for the anode and 3W for the screen grid.

During phone of c.w. working the p.a. must be so coupled and loaded that the d.c. input does not exceed by more than 20W the r.f. output obtained. In the absence of bias from a power pack or battery, R9 must be 22kΩ.

PW

Component list

Capacitors:
All disc ceramic except C3
C1
C2
C3
C4
C5
C6
C7 2000pF
C8 2000pF
C9 2000pF
C10 2000pF
C11 2000pF
C12 2000pF

Resistors:
R1 10kΩ 2W
R2 3.9kΩ
R3 56kΩ
R4 33kΩ
R5 1kΩ
R6 68kΩ
R7 20kΩ 1W
R8 470Ω
R9 22kΩ
R10 20kΩ 3W

Variable Capacitors:
TC1 30pF Beehive
2000pF TC2 8pF Beehive
2000pF TC3 30pF Beehive
25pF mica VC1 5pF air
2000pF VC2 10pF spaced
2000pF VC3 15pF s.w.
2000pF VC4 75pF variables

Inductors:
RCF1
RCF2
L1
L2 See text and
L3 Fig. 4
L4
L5
L6

Valves:
V1 6C4
V2 6AM6
V3 5763
V4 6146

Miscellaneous:
Crystal (8MHz 3rd overtone); two B7G skirted valve holders with cans; one B9A skirted holder with can; one octal holder; 5mA meter; 150mA meter; chassis 12 x 5 x 3in.; crystal holder; coaxial socket; four knobs; tag strip; wire; solder, etc.

Trader's Table

The equipment for sale on this page is secondhand or ex-demonstration

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VHF DXer

REPORTS & INFORMATION BY THE LAST SATURDAY OF EACH MONTH.

DAVID BUTLER G4ASR TAKES A LOOK AT YOUR REPORTS ON THE TREMENDOUS SPORADIC-E OPENINGS ON THE VHF BANDS.

During the summer months of June and July, many operators in the UK have been sending in reports of DX contacts made throughout Europe and some parts of the African continent. Among the countries worked have been the former Russian Republics of Belarus (EW), Estonia (ES), Latvia (YL), Lithuania (LY), Moldova (ER), Ukraine (US) and, of course, Russia (UA) itself.

Scandinavians in the very north of Sweden (SM) and Finland (OH) were also contacted, as were stations in Eastern Europe including those in Albania (ZA), Bulgaria (LZ) and Romania (YO). Hundreds of contacts were made into central Europe with stations in Austria (OE), Czech Republic (OK), Germany (DL), Hungary (HA), Poland (SP), Slovakia (OM) and Switzerland (HB).

Several QSOs were also made with operators in the Balkan Republics and nearby regions, including Bosnia and Hercegovina (T9), Croatia (9A), Macedonia (Z3), Montenegro (YU6), Serbia (YU3) and Slovenia (S5). Around the Mediterranean area contacts were made with stations in Balearic Islands (EA6), Corsica (TK), southern France (F), Greece (SV), Italy (I), Malta (9H), Sardinia (IS0) and Sicily (IT9).

On a southerly heading contacts were reported with stations in Azores (CU), Portugal, (CT), Spain (EA) and into northern Africa with Algeria (7X), Canary Islands (EA8), Ceuta & Mellilla (EA9) and Morocco (CN). The band in question could have been 40m (7MHz) or perhaps even higher at 6m (50MHz). But no, these are DX contacts being made on the 2m (144MHz). Yes - that's right, contacts up to 3000km away on the 144MHz band!

All of the above contacts were made possible by Sporadic-E (Sp-E) propagation, that's probably familiar to many low frequency operators as the summertime 'short skip' on the 28MHz (10m) band. It's also responsible for most of the long-distance (1000km and greater) contacts on the 50, 70 and 144MHz bands. In my opinion, the Sp-E season this summer must surely go down on record as being one of the best ever.

During May, June and July, the 50MHz band was open every day with single-hop and double-hop contacts being made to stations throughout Europe and the nearer reaches of Africa and Asia. But this was nothing compared to the real DX that could be found during 48 days of transatlantic openings to North and South America and five extremely rare openings over the North Pole to Japan.

Propagation on the 70MHz band was equally good with (almost) daily DX openings from May 16 through to early August. The only days without Sp-E propagation being reported were June 1, 29, 30 and July 24, 25, 28. Other than that there were numerous c.w., s.s.b. and f.m. two-way contacts being made with stations in Azores (CU), Croatia (9A), Denmark (OZ), Dodecanese (SV5), Greece (SV), Luxembourg (LX), Portugal (CT) and Slovenia (S5). Dubious contacts were also made with stations in Bulgaria (LZ), Romania (YO) and Serbia (YU) as it's most likely that these countries don't have permission to use the 4m band just yet.

One of the longest distance QSOs reported on the 70MHz band occurred on July 7, between the stations of GM4SIV (IO57) and SV1DH (KM27) over a 3200km path. There was also a very large increase in the number of European operators with cross-band capability, listening on 70MHz and transmitting back on either the 28 or 50MHz bands.

THE 144MHz BAND

Last month, I took a look at propagation on the 50MHz band so this time I'm concentrating on the DX contacts made on the 144MHz band. The conditions were truly spectacular with UK stations reporting Sp-E propagation on 34 days during June and July enabling 144MHz contacts to be made in 40 DXCC countries located within Europe and Africa.

The first reported 144MHz Sp-E openings of the season actually occurred on May 12 between 1710-1743UTC, when the station of HA5CRX (JN97) reporting s.s.b. contacts with EI5FK (IO51) at 2013km, G0KPW (JO02), M0UKR (JO02) and PA2DB (JO22).

Another brief opening was reported on May 17, by the station of **Tim Fern G4LOH** (Cornwall IO70). In a ten minute opening between 1525-1535UTC he contacted the stations of IW0ULG (JM49), IT9ASX (JM67) at 1986km and heard 9H1XT (JM75) at 2240km.

The main 144MHz Sp-E season really got going in June with openings on 20 days throughout the month. However, on 11 of these days there were more than one opening throughout daylight hours and I've calculated that at least 36 discrete Sp-E events occurred in June. For the record, they were reported on every day between June 3-14, 18-22, 24-25 and 27. That's truly amazing!

The UK opening on June 3 occurred between 1145-1200UTC with stations in the north of England and Scotland making contacts into Spain. The best QSO of the day though, was made at 1306UTC between RN6BN (KN95) and the stations of 9H1GB and 9H1TX (JM75) over a 2300km path. Stations mainly in southern England reported working into Italy in an opening on June 4, between 1400-1530UTC. At 1504UTC, Tim G4LOH made an s.s.b. contact with SV3GKE (KM08) at a distance of 2505km.

IN EXCESS OF 2000km

There were two openings on June 5 both involving paths in excess of 2000km. The first event took place around 1045UTC, with central England stations working into Finland (OH5LK) and the second event between 1115-1215UTC, with stations in southern England working into Italy and Greece (SV3CYM). Two openings also occurred on the following day, June 6 around 1715UTC, to Italy and later between 1905-1925UTC, to Italy and Sicily.

Two lengthy openings were also reported on June 7. At 1000UTC, the 144MHz band opened up to I, LZ, YU and Z3 and remained open to these countries for nearly two hours. In the afternoon between 1545-1830UTC the band sprung into life again with contacts being made into I, IT9, OE, S5, T9, YO, YU, 9A and 9H.

John Govier G6YJD (Yorkshire IO93) reported making s.s.b. contacts with the stations of IK8YTA (1835km) and I8MPO (1869km). He was very surprised as he was only running 50W into a tri-band V2000 vertical antenna. The station of **EI5FK** made 20 s.s.b. contacts over the 2000km mark with his best DX being YZ1RA at 2271km. The best DX of the day, though, may well have been made between G4LOH and LZ1KG (KN31) at 2583km completed during the morning opening. Stations in southern England reported a five minute opening to the Republic of Belarus (EW6FS) around 1005UTC on June 8. At the same time there was also a path to Morocco with the station of **Gordon Wyatt GW8ASA** (Glamorgan IO81) making contacts with CN2DX, CN8AT and CN8YZ. The Canary Island station of EA8BTV was also heard

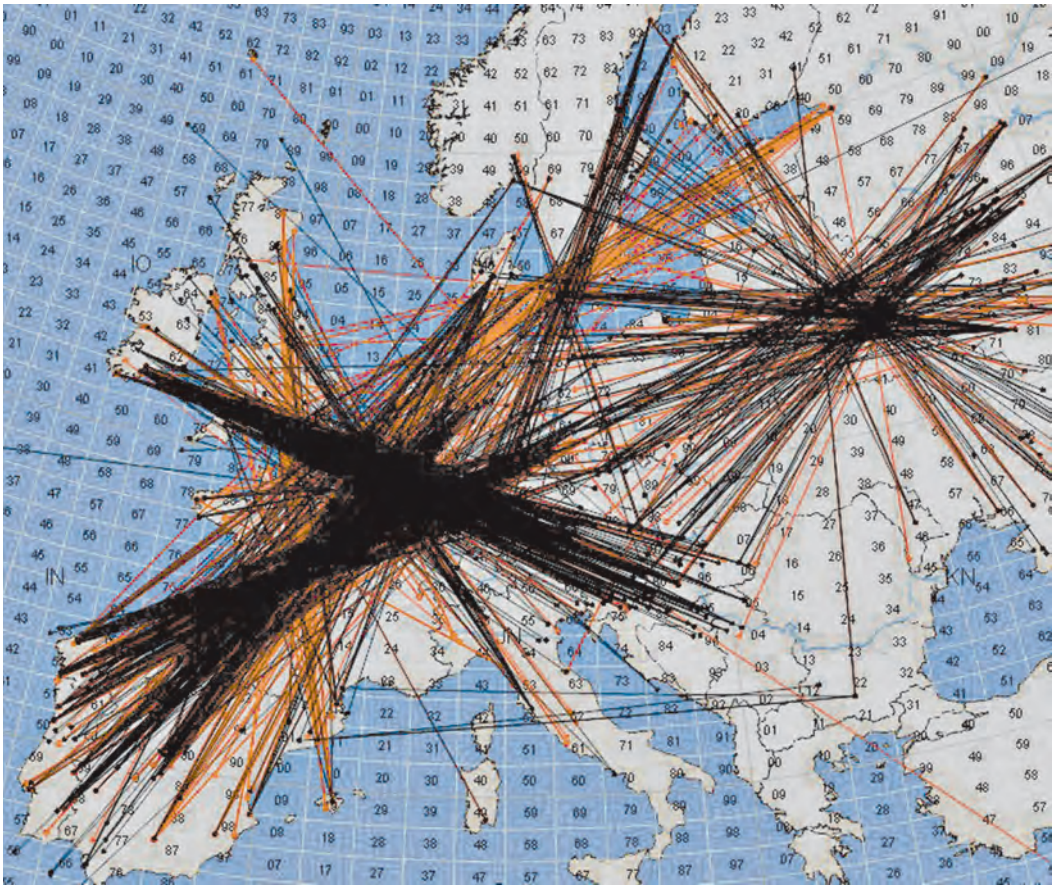

Fig.1: The 144MHz Sporadic-E opening on June 18.

during this opening over a 2700km path.

An event to the south of the UK was reported between 1700-1830UTC on June 9 to stations in France, Portugal and Spain. The station of **Keiron Brunning 2E1HKB** (Suffolk JO02) running 50W into a pair of 9-element Vargarda antennas worked CT1ESJ, CT1HTZ, CT1HZE, EA4AKH, EA4CZV, EA4DS, EA4EHI, EA4LU and EA4TF. A opening was reported around 1700UTC on June 10 to stations in Croatia and Spain but the event didn't appear to last more than five minutes and relatively little DX was worked.

The following day, Sunday June 11, was set for the *PW* 144MHz QRP Contest and many participants were eager at the prospect of working DX stations with low power. Reports indicate that there were three separate Sp-E openings on the Sunday, 0725-0730UTC to Czech Republic (OK2PMA) and Slovakia (OM5KM), 1620-1630UC to Algeria (7X5RC) and Balearic Islands (EA6DD) and 1800-1915UTC to Morocco (CN8LI), Portugal (CT1HZE) and Spain (EA7AFM).

Unfortunately, the contest was scheduled to run between 0900-1600UTC and appears to have missed all of these events. It's likely that some contesters managed to find a transitory Sp-E 'cloud' during the QRP event but I haven't received any reports that they did. It may have been possible. because at 1530UTC the station of G4LOH heard the Azores beacon CU8DUB (HM49) peaking 599 over the 2350km path. At 1620UTC, he briefly heard EA6VQ but no other stations. Tim then decided to make some "CQ" calls on the f.m. calling channel 145.500MHz and was very surprised to receive a reply from the Algerian station of 7X5RC (JM26). Signals were 59 both ways - a very rare contact indeed. Later in the evening between 1812-1905UTC. Tim also worked the Moroccan stations of CN8IG, CN8LI and CN8SG. During the same opening the station of **Paul Pasquet G4RRA** (Devon IO80) reported making s.s.b. QSOs with CN8LI, CN8SG, CT1DIZ, CT1HZE, EA6DD and EA6VQ.

A large scale opening between 1635-2030UTC to ER, HA, I, LZ, OE, OK, OM, SP, SV, S5, T9, UT, YO, UA3 and 9A occurred on June 12. The station of **Ian Goodier G0UWK** (Staffordshire IO83) reported s.s.b. contacts with ER5AA (2314km), HA4XG, HA5CW, HA5OO, HA5OV, HA8IH, HA8MK, HA8UG, LZ2ZY (2123km), OE6IWG, OM2IK, OM5CW, YO2LEA, YO5OHY, YO7LGI (2127km), YU1EV, YU7BCL, YU7EW, YU7NOU, YU7XL, YZ1JA and 9A3LN. John G6YJD, running a Yaesu FT-857D transceiver into the tri-band vertical, managed to complete an s.s.b. contact with the station of YO2LEA (KN04) at 1840km. Other DX stations worked from the UK included the stations of LZ2ZX, SV2JL, T93O, US5WU, UT5ST, YO2IS, YO3DMU, YO4GJH, YO5OHY and YO7LGI.

On June 13, the band opened up between 0925-1015UTC to CT, EA, EA6 and IH9. A number of stations including G4LOH and G4RRA worked the mobile station 7X2VX/M (JM16) on the f.m. calling frequency 145.500MHz.

Later in the day between 1535-1730UTC, it opened up to HA, OM, SP, YO and YU.

On the following day June 14, there was an early morning opening at 0630UTC into Russia with the stations of RX1AS (KO59) and RV3YM (KO63) being worked by operators in eastern England (JO01, JO02). From 1100UTC the 144MHz band opened up to HA and YU and later in the day at 1400UTC the Russian station RZ6BU (KN84) was heard working stations in eastern England again.

Then something unusual happened - there was a three day gap without any 144MHz Sp-E propagation! However, it all started again with a vengeance on June 18, with two tremendous openings as shown in **Fig. 1**. The first was a three hour session between 0915-1215UTC to EA, EA6, F, HA, HB9, I, OE, S5 and 9A. John G6YJD, still running 50W into the tri-band vertical antenna, made contacts with EA3GCJ/P, EA4WT, EB4DYS, EA6VQ, I0JX and IZ0FWE. Later in the day between 1715-1830UTC, there was an excellent 'Russian' opening with contacts being made with stations in ES, LY, YL and UA1. The DX included ES3BR, ES4EQ, ES6RQ, LY2SA, LY/DH8BQA, RU1AA, RW1AY, RX1AS, YL2HA, YL2OK, YL3AG and YL3GDF. This went on day after day during June - it really was amazing to hear everyone popping out of the woodwork to make DX contacts on the 144MHz band. The other openings during the month occurred on June 19 to the OH1 and OH6 call areas, RA6HHT (3099km!), UT5ER, HA, LZ, OM, S5, YO, YU and 9A, June 20 to I, IT9 and 9H, June 21 to SM3JLA (JP93), June 22 to CT, June 24 to HA, I, IT9, S5, YU, 9A and 9H, June 25 to CN8JH and EA8AVI (2700km) and June 27 to CT, EA and EA8BEX (2750km).

DEADLINES

Oh dear - I've run out of space and I only managed to get the June 144MHz reports in! There's still 14 days of openings in July to report about and I haven't even mentioned all the DX on the 50 and 70MHz bands! Wow - what a fantastic summer Sp-E season!

I hope that you managed to catch some of the DX? If you did, then please send me your reports to the address given above by the last Saturday of each month. Good luck and see you again next month.

73 David G4ASR

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HF Highlights

AS USUAL, INFORMATION, REPORTS AND PHOTOGRAPHS TO ME PLEASE BY THE 15TH OF EACH MONTH.

Chuck Brady N4BQW (NASA photograph).

Political Entities appear to be the topic of conversation at the moment, judging by all the mail received this month. Montenegro started the ball rolling a few months ago and now, with the addition of Section II, Criteria Rule 1c to the Political Entity criteria, certain former '**separation**' entities may now qualify as '**political**' entities. Are you following so far? One such entity has been determined to be American Samoa. which is now a political entity for DXCC purposes. As a result of the reclassification of American Samoa, Swain's Island has been added to the DXCC List making it entity number 337. The distance between American Samoa and Swain's Island has been determined to be in excess of the 350km required by DXCC Rules Section II, Paragraph 2, Section b.

All QSOs made with Swain's Island on or after 0001UTC on 22nd July will now count for DXCC credit. Judging by the pile-ups heard from this QTH on 14MHz sideband, the first operation by team leader Kan Mizoguch JA1BK, Uti KS6FO, Paul Granger F6EXV, John Peters K1ER, Tetsuo Tanaka AH7C and John Papay K8YSE under the callsign **KH8SI** is a popular one. Maybe in the near future we'll see the rules change yet again and the Isle of Man or Isle of Wight becoming separation entities! I wonder where all this is going to end?

There have already been several reports in the media indicating that representatives from Kosovo have had discussions with Serbia to discuss their possible independence. Could this be DXCC entity 338? Watch this space! Further information and the latest DXCC list can be found at **http://www.arrl.org/awards/dxcc/**

Martin Addison 2E0MCA received this QSL card from F5IDD.

SILENT KEY

It was sad to hear the news that **Dr. Charles 'Chuck' Brady Jr. (Captain USN) N4BQW**, a keen DXer and retired space shuttle astronaut, became a silent key on the 23rd July. He passed away at his home in Washington State aged just 54 following a lengthy illness. During his years as an active astronaut in the 1990s, Brady was among the pioneers of the Shuttle Amateur Radio Experiment (SAREX).

An ARRL member, Brady, was active using Amateur Radio during the 16-day STS-78 shuttle mission in 1996, then the longest mission ever. He activated some of the rarer American Pacific islands, including Kure, Palmyra, Jarvis and Baker and Howland Island to name a few but the most memorable of his DXpeditions was the 3Y0C operation from Bouvet Island, which had been kept totally secret until he went on the air in January 2001!

CARL GW0VSW SAYS DESPITE MONITORING HIGH NOISE LEVELS AT HIS QTH, YOUR REPORTS ARE STILL FLOODING IN!

DX NEWS

On to this month's DX News now and the island of Palau where Hideyuki Kai **JM1LJS**, plans to be active as **T80W** from the Rental Shack of West Plaza by the Sea Hotel, Koror, Republic of Palau OC-009 from the 6-10th October. If Hide can't use the special callsign T80W he will be signing **T88LJ**. Acitivty is expected to be on most bands and the QSL route is via Hide's home call direct to: **4-22-15, Takata-Higashi, Kohoku-Ku Yokohama City, 223-0065, Japan** or through the bureau. More information on this activity is available at **http://radio-dream.com/t80w/**

For prefix hunters, **Richard Westerberg N0HJZ**, will be operating from Canada from 26th to 30th October as **VB4MWA**. He believes this is the first time in 15 years that the VB4 prefix has been used. Rich will also be operating in the CQWW DX Phone Contest between the 28-29th using the VB4 callsign as a Single-Operator/High-Power/Assisted category, so there should be plenty of opportunity to work him. All QSLs are to go via home callsign to: **Richard Westerberg, 18003 Palmer Circle, Eden Prairie MN 55347, USA**.

Also active during the CQ contest will be **Zoltan Szoke HA5PP**, who will be active from Madeira Island as **CT3/HA5PP** as a single-op/single-band entry, though the band has yet to be decided. All QSLs should be sent direct to: **PO Box 1157, Budapest 1245, Hungary** or via the bureau. Information and rules for this years s.s.b. and c.w. contests can be found at **www.cqww.com/**

NEW TOOLBAR

A new toolbar has been created by **Maurizio Pregliasco IZ1CRR,** which has several useful features. With the '425 Toolbar' you can search a 'string' in the *425DX News Bulletins* or look for a callsign in **qrz.com** or **dxwatch.com**, have fast links to 425DXN calendars, bulletins, magazines, old DX spots and links to DXWatch spots plus several Amatuer RSS feeds for news or use a chat feature to name a few. For further information and a free download look-up **http://425.ourtoolbar.com/** and no personal information will be required.

MANAGER DATABASE

If like me you occasionally have difficulty finding the QSL manager for a station you have worked I suggest you try the huge **QSL Manager database** maintained by **Paul ON6DP**. This contains over 73,100 QSL routes and can be downloaded free at **http://on6dp.be.tf/** and a regular newsletter is also available.

YOUR REPORTS

On to your reports now and first off is **Panos Dadis SV1GRN**, in Athens who used a home-brew 'inverted-L' with an antenna coupler on

Contest Station YR0HQ QSL card as worked by Panos Dadis SV1GRN.

1.8MHz. Panos found the Romanian Amateur Radio Federation callsign for IARU Contests YR0HQ at 1859UTC.

Leighton Smart GW0LBI in Trelewis, Mid-Glamorgan also worked Top Band using his Yaesu FT-100 with 50W c.w. to a 67m (220ft) long wire antenna tuned against earth. Voice contacts include, OH2HQ (Finland), ES9HQ (Estonia) 9A3B (Croatia), T90HQ (Bosnia) and LY4A (Lithuania), while on c.w. Leighton worked EA5Hq (Spain), YL4HQ (Latvia) SN0HQ (Poland) and TM0HQ (France) also made his log between 2255 and 2355UTC.

THE 7 & 10 MHz BANDS

Moving to 7MHz and the QRP report from Worcester Park in Surrey, where **Eric Masters G0KRT** used a Yaesu FT-817 running 5W into a modified W3EDP antenna, which is 25m (84ft) long. Eric found fellow QRP stations ON6CW (Belgium) 0926, DA0CW (Germany) 1502, OM7DX (Slovak Republic) 1650, OK1KZ (Chech Republic) 2039 and UA3LMR (European Russia) 2055UTC.

A trip to France enabled **Roy Walker F/G0TAK** to operate QRP while giving his grandson, **Ezra**, a first lesson on the key! Contacts made from a location in Bougival, West of Paris, included Paul G0BHI in Cheltenham who was also running QRP at 1150, Jean-Louis F5LLE/P on the Mediterranean Coast at 1414 and well known low power operator and GQRP club member George GM0OXX in Clunie, Scotland at 1519UTC.

Roy Walker F/G0TAK's portable station using a Yaesu FT-817 and MFJ-1621 portable antenna

On to 10MHz and the log of all c.w. man **Ted Trowell G2HKU** on the Isle of Sheppy in Kent. Using his Icom IC-703 at 5W to a G5RV, Ted worked OH0JFR (Aland Island) EU-002 and CT4CH (Portugal) around 2000UTC.

THE 14MHz BAND

Moving to 14MHz Ted found HZ1AN (Saudi Arabia) 1500 and 9V1YC (Singapore) AS-019 at 1520 while later at 2000UTC YK1AH (Syria), PP5WRTC (Brazil), 7X4AN (Algeria), P42A (Aruba) SA-036, JA7AKH (Japan), 8R1J Guyana) and 8P6CF (Barbados) NA-021 all made his log. **David Bambrook 2E0DAB**, in Little Milton near Oxford lists s.s.b. stations EE7WFC (Spain) 1906, RL3FT (European Russia) 2148, 9H5SN (Malta) EU-023 2154, EW6GF (Belarus) 2212, T77EB (San Marino) 2223, 4L4ND (Georgia) 2253 and OE6TGD (Austria) at 2312UTC using a Yaesu FT-747GX at 50W to a dipole installed in his loft!

The log of **Owen Williams G0PHY**, Biggleswade, Bedfordshire included s.s.b. call SU8IOTA (Egypt) AF-099 on White Rock (Norus island) now confirmed as the first IOTA operation from an Egyptian island at 0554, followed by CE3PG (Chile) at 2143UTC. Owen used a Yaesu FT-757 and 100W into a dipole.

This band is a favourite of **Martyn Medcalf M3VAM** in Chelmsford, Essex. Martin used an Icom IC-746 and half-size G5RV antenna with an SGC-237 auto tuner to work s.s.b. calls TF3ZA (Iceland) EU-021 1704, SV9CVY (Crete) EU-015 at 1727, SY05AIS (Greece) a special call for the fifth anniversary of Athens Airport at 1852 and 7X5VRK (Algeria) at 1947UTC. **Martin Addison 2E0MCA** in East Finchley, North London managed DG5RBK (Germany) 0637, GB150VC, Robert working from the Royal Arsenal at Woolwich celebrating 150 years of the Victoria Cross at 1348, 9A2YM (Croatia) 1515, OH2BAD (Finland) 1531, EE7WFC (Spain) 1812 and OD5NH (Lebanon) at 2004UTC using a Yaesu FT-840 and 10W to a folded half-size G5RV.

The s.s.b. mobile log of **Mark Taylor G0LGJ** in Dereham included OC5I (Peru) 0610, C56W (Gambia) 0724, 8P6GU (Barbados) 1003, HS0/IK4MRH (Thailand) 1739, ZS4U (Republic of South Africa) 1917, TO0O (Martinique) NA-107 at 2144, OD5NH (Lebanon) 2208 and HR1AAB (Honduras) at 2335UTC using a Kenwood TS-480 and DK3 screwdriver antenna.

THE 18 & 21MHz BANDS

In Greece, Panos SV1GRN worked the 18MHz band for a while logging SM5WGK (Sweden) 1008, CU7X (Azores) on EU-175 at 1931, S57LU (Slovenia) 1945 and G3RCV/P on EU-011 at 2017UTC. In Nuneaton, **Chris Colclough G1VDP** managed a short spell on the band finding s.s.b. stations V25V (Antigua and Barbuda) NA-100 at 1956 and HI9CF (Dominican Republic) on Dominican Island NA-122 at 2216 before moving to 21MHz where he logged 9J2VB (Zambia), a new entity for him at 1443, YU6AO (Montenegro) 1819, T70HQ (San Marino) 1921, 4N8A (Serbia) 1923, LU5HM (Argentina) at 1933 followed by a PSK31 QSO with 3XM6JR (Guinea) at 1959UTC, using a Yaesu FT-1000 Mark V Field at 100W to a rotary dipole or Cushcraft MA5B beam.

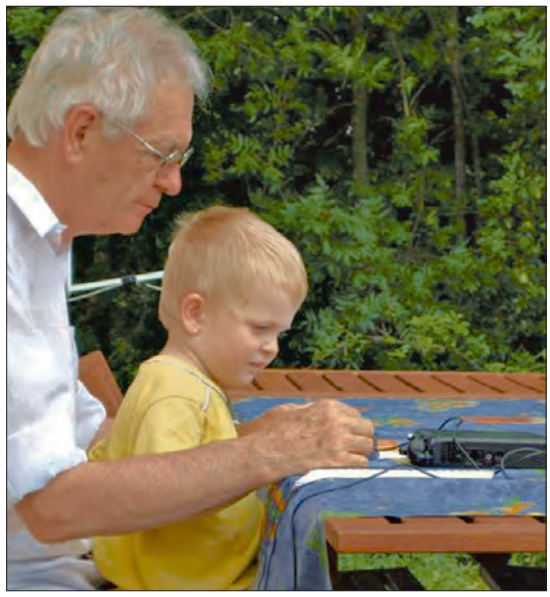
THE 24 & 28MHz BANDS

The 28MHz band was open for a while and provided a few contacts for Ted G2HKU who added OY1CT (Faroe Islands) EU-018, 7X4AN (Algeria) and LY2PX (Lithuania) to his log around 1600UTC. Meanwhile, Chris G1VDP logged C31MO (Andorra), HB9HQ (Switzerland), LZ7HQ (Bulgaria), UT7QF (Ukraine) 3V8ST (Tunisia)EA6BH (Balearic Islands) EU-004 and SM0GYX (Sweden) between 1020 and 1120UTC. Eric G0KRT found two calls, EA3EVL (Spain) at 1854 using c.w. and IN3RSV (Italy) on s.s.b. at 1905UTC during a brief spell on the band.

SIGNING OFF

That's it for another month and a busy one it has been for most of our reporters. The bands continue to be poor with high noise levels, which I have monitored at well over S9 here but openings are occurring throughout the day, which is always good news.

Many thanks for all your logs and E-mails and special mention must go to **Tedd Mirgliotta KB8NW** editor of the *OPDX Bulletin* and **Mauro Pregliasco I1JQJ/KB2TJM** editor of the *425 DX Newsletter* for the DX information. Until next time, have a good DX filled month. **73, Carl GW0VSW**



Roy G0TAK teaching his grandson Ezra c.w.

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In Vision

GRAHAM G8EMX ROUNDS UP THE LATEST NEWS FROM THE ATV SCENE

Readers of *Practical Wireless* who buy their copy on its first day of sale, or by subscription, will be delighted to learn that there is still time to go to the **British Amateur Television Club** (BATC) exhibition and general meeting on 24 September. After much speculation, offers and withdrawal of offers for venues, and exchanges of E-mails, the Village Hall at Stow-cum-Quy near Cambridge has been confirmed.

Stow Village Hall was suggested a few months ago by stalwart ATV member **Ian Waters G4KKT**, who designed the original Cambridge ATV repeater GB3PV. Ian asked if someone from the BATC committee could actually visit the place to take a look, before finalising a booking. So, when other business took me to Ely, I arranged to call at the village on my return journey.

Visitors enter the hall into an adequate indoor exhibition space with a separate room at the rear of the building where lectures and the formal meeting can be held. The grounds have adequate car parking for a 'flea market' but not for rebuilt TV Outside Broadcast vans, so sorry **Paul Marshall** (BATC Secretary) and **Brian Summers** (Treasurer) who often bring their terrific television wagons along!

All things considered, the Stow Village Hall will be as good as it is going to get for this year. Stow is located just off the excellent A14 dual-carriagewa but **do not** miss the Stow turning; there is no other way off the A14 for over 32km (20 miles)!

Past BATC rallies have been held at Harlaxton Manor in Leicestershire; the Sports Connexion near Coventry; Shuttleworth; Bletchley Park; unfortunately, all have been host to the exhibition and General Meeting over the years. With such grand places either no longer available or, I must be frank, justified by present membership numbers, it's lucky that acceptable accommodation could be found at all.

IN THE SHACK

After my tour of the hall, Ian Waters gave me a viewing of his Amateur Radio and television shack. Ian has equipment for most of the Amateur bands, with many feeder cables leading to assorted antennas mounted over three masts - one close to the house and two at the end of the lovely garden. These were the 24cm transmit and receive antennas looking at the Cambridge ATV repeater **GB3PV**.

Back in the shack, the ATV rack in the corner housed 70, 24, 3cm (I think) and a Digital ATV transmitter. Unfortunately, said Ian, all this kit was not matched by much on-air ATV activity. Turning on the ATV 24cm receiver and shack monitor, the 'PV test cards appeared, cycling through their sequence but there was precious little actual ATV operation in the area. Previous regular users had either moved away or found other interests. Now, as a principal university city, Cambridge must have plenty of science and electronics graduates to explore Amateur Radio and television or is that just wishful thinking?

Ian Waters G3KKD in his shack with his ATV rack. The digital ATV transmitter is at the top.

COLOURFUL CQTV

For its own publicity of the coming exhibition, the BATC published details in the August edition of the club's quarterly magazine, *CQ-TV*. But something was different.

After looking at the first few pages it hit me - the August edition of *CQTV* is in full colour! Pictures, diagrams, even the accounts, normally a very 'black and white' subject but this time on bright yellow pages with a red headline! The main reason for all this explosion of printed pyrotechnics was to mark the final edition to be edited by **Ian Pawson**. Over ten years, Ian took the production from literally 'cut and paste' to a computerised version, put pdf files on the website and CD and changed the format from A5 to A4. Ian has decided to spend more time travelling and working on the BATC's website.

The BATC has also said goodbye to its President, **Mike Cox**, a Chartered Engineer and Fellow of the Institute of Electronic Engineers. Mike wrote many articles on studio digital techniques into *CQ-TV*, notably the Serial Digital Interface, now commonplace. The Club has found a very worthy replacement – **Peter Blakeborough G3PYB** MPhil, C.Eng, MIET.

Peter has an impressive broadcast TV career; BBC, commercial manufacturers, Independent television and continues to be very active with ATV, principally on the microwave bands, holding the UK record of 78km on 76GHz. In Peter's introduction to BATC members, it's good to see mention of the late **Tom Douglas G3BA** (ex. Chief Engineer, BBC Transmitter Site, Sutton Coldfield) who introduced Peter to BBC Television Centre. Tom was a much respected Radio Amateur here in the Midlands and an RSGB Newsreader, always punctual to the second with his transmissions.

NEWS

In the newsletter from the Kent Television Group (KTG), **Alan G3TCI** reports that a 13cm ATV repeater in Clacton-on-Sea is now in test mode. The repeater, **GB3CZ**, is only transmitting at 5W e.r.p. at the moment but is being received, albeit sometimes weakly, along the North Kent coast. Output frequency is currently 2432MHz, which is in the 'free-to-air' band and close to some video senders. Alan comments that a slight shift l.f. and a bit more power would be useful.

Closer to home, I recently gave what was probably the third ATV talk to Solihull Amateur Radio Society. The first, years ago, had been basic ATV, bands and equipment and for the second I had been asked to chat about digital television! This was well before anything was being broadcast, so a quick read of a few magazines enabled some form of lecture to be 'thrown together' (what's new?).

Now, with ATV going through, in my opinion, a bit of a difficult period, how would I fill a third call to Solihull ARS? Basically, by explaining why I thought ATV was having a somewhat rough time! At the end of my lecture, one of the members offered a site for an ATV repeater. We have been here a few times before, without much success so this time it can only be a case of 'wait and see'.

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EXCHANGE

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rob mannion's topical talk

This month's topical discussion has been prompted by a letter from Richard Brunton G4TUT. Richard, as mentioned in the letters pages, runs the well known Southgate Amateur Radio Club website. His story of meeting the policeman in London has reminded Rob G3XFD of meeting a Scottish policeman!

Richard Brunton G4TUT's letter recalling an amusing encounter with a policeman near London's Billingsgate fish market, reminded me of a fond memory I have going back almost 30 years. Richard met a policeman who was interested in Amateur Radio but my memory is of a Scottish policeman who was already an Amateur!

The meeting took place on the kerbside of the busy road outside Ninewells Hospital in Dundee, Tayside. A friend and I were parked outside the hospital undertaking tests for the Independent Broadcasting Authority (IBA/ITV). The white Range Rover, with its large (10 metre) pneumatic mast and u.h.f., antennas was very distinctive at full height. Packed with specialised equipment, the vehicle looked like an Amateur's mobile dream when the mast was in use.

We hadn't been parked for long when we were approached by a Tayside police officer. Even though the police were very tolerant of IBA and BBC vehicles carrying out their technical work, it wasn't unknown for an over zealous officer or traffic warden to issue a parking ticket, but this time we had no need to worry.

The officer came over to me (I was driving and my friend was operating the television equipment) and introduced himself as **Frank GM8BZX**. He was very friendly and made sure we weren't bothered during our tests (I seem to remember it was in preparation for Channel 4). We were frequent visitors to that part of Scotland and Frank became a special friend. Little did I realise that I would come to meet him again many years later at the National Exhibition Centre (NEC) in Birmingham in 1990!

I've never enjoyed attending the NEC in Birmingham, it's an expensive place and money drains from wallets and purses as soon as visitors arrive! However, it was a real pleasure to meet Frank once again during his year as the **Radio Society of Great Britain** (RSGB) President for 1990. We were soon chatting about old times and we were photographed together as I renewed my lapsed membership. In private, Frank said he never thought he would "collar an old friend in such a pleasant fashion!"

Our friendship continued right up until the weekend of another RSGB Presidential installation in Wales some years later. I was unable to stay overnight, as I had to be back in Dorset for the Sunday morning. It was the last time I was to see my old friend. He died on the following Monday. However, Frank's name, valued friendship and the memories of his deep, friendly

voice live on in the form of the Tennamast trophy, which is dedicated to his memory and is awarded to the highest scoring Scottish station in the annual *PW* 144MHz QRP Contest. It's a most fitting tribute to a truly dedicated Radio Amateur.

Friends Everywhere

We are extremely fortunate in Amateur Radio because the basis of our hobby is communicating with others. There are few enough of us in the UK for us to feel that we are part of an extended 'family'. In fact, wherever we go in the world it's likely that another Amateur or radio enthusiast will be met somewhere on the journey.

The meetings can happen literally anywhere and I encourage readers to write in to share their own memories. Many lasting friendships can result and I still have Christmas cards and birthday greetings from Amateur friends I met in diverse places such as the Soller Railway on the Spanish Island of Majorca and on the Bergen to Oslo railway in Norway. **PW**

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