ANTENNA SPECIAL - PW Looks Into The World Of The Antenna And Related Equipment

REVIEWED
The Cushcraft R5 Vertical Antenna
Nelson Electronics 21 and 28MHz Cubical-quad Antenna
The MFJ-247 SWR Analyser

CONSTRUCTIONAL
Build A Simple RF Bridge And ATU
Experimenting With Beam Antennas

ANTENNA & ACCESSORIES PRODUCT SHOWCASE
To be a truly world-class competitor, you have to have a truly world-class rig. And it’s here now. The versatile FT-1000 from Yaesu.
The FT-1000 will blow away your competition with a spectacular combination of power and operation flexibility. There will be no contest.
Just superb performance...yours and your FT-1000
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NEXT MONTH Special Issue
We celebrate our Diamond Jubilee with a nostalgic look back at the last 60 years

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ARE COMMUNICATIONS '92

YAESU FT5200/FT5100
Dual band receive, dual display, high power, what's the difference?
What's the price?
PHONE NOW

YAESU FT530
The latest dual band handy with all internal options fitted as standard. Too many to list.
PHONE NOW FOR THE LOW-DOWN

YAESU FT26/FT76
Designed to replace the FT23/FT73. Also available with a full keypad, the Yaesu FT415/FT815

YAESU FT890/7TU
Small HF transceiver with ATU - plus all features - as expected. How much we hear you say?
YOUR PHONE CALL WILL TELL YOU

KENWOOD TS450S *
Very special deals available with ATU, filters, etc. etc. 6 metres also available on Kenwood TS690S

AOR 1500 RCV
At last it's here 100kHz - 1300MHz in a hand held, with SSB, FM, AM, FM-W.

ICOM ICR7100HF
Still the best base scanner available on the market.
No need for two receivers, listen to everything in one box or update your model with the ARE modification board.

ALINCO DJ580E
A dualbander which has certainly taken off. A complete package with wideband receiver.

YAESU FT1000

ICOM IC229H
KENWOOD TM241E
YAESU FT212RH

2 metre FM mobiles. All three are 50 watts output, all three are small in size, all three are packed with features. What's your preference, what's your price?

DAIWA
POWER SUPPLIES - FULLY METERED
With 9, 24 or 32 amp units to choose from at prices for today's market.

NRD535G
PROFESSIONAL SHORTWAVE RECEIVER
From the Japan Radio Company or compare with its rival the Drake R6E - both in stock.

TOKYO HY-POWER
These are the power amps that deliver! A complete comprehensive range covering HF, 6m, 2m and 70cm with auto input select and power out that's stated.

YAESU FT747GX
Still the best selling budget HF transceiver. Especially at ARE price.

There are simply just too many items to list and talk about on one page, if there is any requirement for any brand available on the market, new or secondhand, you cannot afford not to give us a call, dropping us a line or by coming in to see us.
Not only do we cater for a large part of the amateur fraternity in this country but we are suppliers of amateur and commercial radio equipment - WORLDWIDE.

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Practical Wireless, September 1992
**HF-150**  
**Compact Communications Receiver**  
£329 inc VAT

Designed as a logical alternative to the Japanese 'push button portables', the HF-150 places a 'real radio' within your price reach. Whilst reflecting the Lowe approach to simplicity of operation, the HF-150 nevertheless has all the features and facilities you need. This truly is 'Real Radio'.

- **Frequency coverage**: 30kHz - 30MHz  
- **Modes**: USB/LSB/AM/Sync. AM (Selectable S'band)  
- **IF Bandwidths**: 2.5kHz & 7kHz  
- **Tuning**: 8Hz steps with variable speed  
- **Memories**: 60 holding frequency & mode

- **Aerial inputs**: 600 ohms, 50 ohms & Hi-Z Whip  
- **Power**: 12Vdc from mains adaptor (supplied)  
- **Case**: All-metal light alloy case  
- **Size**: 185mm(W) x 80mm(H) x 160mm(D)  
- **Weight**: 1.3kg (less batteries)

**HF-150 Specifications**

- **Frequency coverage**: 30kHz - 30MHz  
- **Modes**: AM/LSB/USB/CW/NBFM (Sync AM optional)  
- **Filters**: 6 Input bandpass filters  
- **Tuning steps**: 8Hz - 125Hz (stepped by mode)  
- **Construction**: Fully floating chassis

**HF-235**  
**The Professionals' Choice**  
£1116 inc VAT

- **Remote control**: RS232C Computer interface (optional)  
- **Memories**: 30 holding a host of data  
- **Tuning**: Spin-wheel, keypad & MHz button freq. entry  
- **Power supply**: 110-120 or 220-240Vac 50Hz  
- **Size**: 483mm(W) x 88mm(H) x 320mm(D)

**HF-235 Specifications**

- **Frequencies**: 30kHz - 30MHz  
- **Tuning**: 8Hz steps.  
- **Memories**: 30 channels  
- **Filters**: IF filters for all modes fitted  
- **Tuning**: Keypad & spin-wheel  
- **AM/FM Sync. Detector**: (optional)  
- **Keypad for remote entry**: (optional)  
- **Excellent quality at reasonable cost**

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**C500**

New low price of **£299***

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**C150**

The new Standard C150 is a super compact 2m transceiver that has all the usual features that you would expect from a modern microprocessor controlled radio - plus several new ones.

**£199** Special Offer

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**C528 Dual Band Hand Held**

Special September Offer!

Now tried and tested by hundreds of users.

- Direct 13.8V in for 5 Watts out
- Programmable offsets
- VHF 2.5W, UHF 2W with CNB151 NiCad pack
- Coded paging function
- Dual Displays
- Various scanning modes
- Power save function
- Programmable step sizes
- Multiple memories
- 144-146 VHF, 430-440UHF, 800-975 Rx only
- Priority Channel
- Separate Vol. and Squ. Controls for each band
- Tone Squelch (option)
- 2m & 70cm
- 5 Watts output
- Repeater Function

---

**C168**

**C468**

Series

- World's smallest full-keyboard handheld
- 5W RF power
- Intelligent scan
- Cloning feature
- DTMF paging and code squelch
- 40 memory channels/200-channel memory unit available
- Unsurpassed 0.158μV sensitivity (12dB SINAD)

**C168 - £269**

**C468 - £279**

---

Please remember, we are the sole authorised importer of Standard equipment in the UK and we are able to offer a full back-up service and spares from stock.

We are a main agent for Icom, Kenwood, Yaesu, Alinco and all popular brands of scanning receivers, SWR meters and aerials, plus a large selection of plugs and sockets.

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---

NORMAN G4THJ
The DJ-580E hand-held is the most advanced design ever offered to the radio amateur. Building on the winning formula of the DJ-560E, ALINCO have now reduced the size dramatically and introduced a combination of innovative features that will make your operating even more fun and certainly more versatile.

It goes without saying that ALINCO offer you all the standard features you expect from a hand-held including dual watch, dual controls, scanning, searching, priority, etc. Of course ALINCO's standard of engineering and reliability is now becoming the envy of its competitors. (They're also pretty envious of ALINCO's prices!) Naturally you get a full 12 month warranty including parts and labour. It's the extra features that really make this a winner.

For example you now have ALINCO's patented circuit that retains full operation with dry cells even when battery voltage falls by 50%. Great for emergency applications. You get a programmable auto power off feature, battery saver, digital telephone dialler and three output power levels. And we've only just started! Key in a special code on the keypad and your rig will turn into a fully operational automatic crossband repeater. Key in another code and you will open up the receiver for a.m. airband reception and frequency segments up to 995MHz! You can even use the DTMF feature to send and receive two digit code messages.

To learn more about the transceiver that has already taken the Japanese and American markets by storm, phone or write for a full colour brochure.

WATERS & STANTON ELECTRONICS
22 Main Road, Hockley, Essex. Tel: (0702) 206835
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Retail Only: 12 North Street, HORNSHURCH, Essex. Tel. (04024) 44765
VISA & ACCESS MAIL ORDER: 24 Hour Answerphone. Open 6 days a week 9 am - 5.30 pm
Rail: Liverpool Street/Hockley or District Line/Hornchurch
After 25,000 hours of research and development time Yaesu's engineers have achieved the ultimate in DX and contest transceivers, the FT1000. Offering peak performance and unfailing durability the FT1000 delivers unmatched performance for the serious HF operator including unlimited simultaneous crossband dual receive, with BPF1 fitted, 200 watts power output with heavy duty P.S.U. The world's best receiver performance utilising quadruple conversion, Yaesu's exclusive DDS, IF notch, IF shift, IF variable bandwidth, CW AFP, independent mode and IF filter selection.

The latest version internal software works with both the K1EA and DX base contest logging program. Also included are CW spotting and built-in high speed antenna tuner unit. This all adds up to proven performance: The choice of the world's top DX'ers, the FT1000.

Write, phone or drop in for a demonstration or full details. Part exchange always considered and HP available.

With the arrival of the FT415 and FT815 miniature hand-helds to complement the existing range Yaesu now has a hand-held to suit most tastes and pocket sizes. Including all the latest in miniaturisation techniques the FT415 and FT815 boast many features including Automatic Power Off (APO) and Automatic Battery Saver (ABS) to extend normal battery life. Along with two independent VFO's, 41 memories and direct keypad frequency entry these transceivers are extremely versatile machines. Next in line are the FT26 and FT76 although similar to the FT415 and FT815, the FT26 and FT76 are a different kettle of fish, so to speak, being designed with ease of operation as the major consideration but still with the versatility expected of a modern hand-held. With 53 memories, APO and ABS what more do we need to say. Last but definitely not least in line are the FT411, FT811 and FT911 hand-helds. Based on the popular FT23 and FT73 these transceivers are packed with useful features to suit most occasions. Built inside diecast aluminium cases the transceivers are designed to be 'bullet proof' and provide many hours of trouble free enjoyable operation. A wide range of accessories to complement all the above transceivers are available to adopt the hand-held to meet your exact requirements.
SMC stock a comprehensive range of scanners to suit all tastes and pockets. Ranging from a simple all-band through to 16-18 slot to the top of the range models. Always in touch with latest developments we maintain a watchful eye on the market and buy the latest and best models in so that you, the customer, can obtain the scanner that’s the current hottest seller.

So why not contact us today for more details of our comprehensive range?

**LISTEN OUT**

with **SMC**

**SONY at SMC**

SMC are pleased to be able to offer a large number of models from the very comprehensive AOR range which includes both handheld and mobile/base stations.

All the radios are built to the highest possible specification yet remain very competitively priced. Often the leaders in the field, the AOR range is proving very popular amongst both professionals and hobbyist users.

The currently AOR1000 is the latest model on the market and is an incredible range at prices of $2000 to $3000 with SBF. So why not phone us today for more details of this super scanner.

**NRD535 from JRC**

The new NRD535 epitomises the very best in communications receivers design. This high technology product is based on the abundant experience gained by JRC in the professional communications receivers field. This means that the NRD535 is capable of the highest quality, and is very competitive in price. It is an excellent choice for anyone looking for a high-quality communications receiver. The NRD535 is available in a variety of models, including the NRD535A, NRD535B, and NRD535C. It is available in both handheld and mobile/base station versions.

**DRAKE R8E**

Now available from SMC, the new DRAKE R8E communications receiver. These receivers utilise the very latest technology to meet the demanding requirements of today’s listeners. Conversationally loud output, a number of features, including a soft key, and an easy to use interface. The R8E receivers are available in a variety of models, including the R8E, R8E, and R8E. It is available in both handheld and mobile/base station versions.

The UK appointed agents for:-

Yasu, Daiwa, Comet, Create, Tokyo Hy-Power, Hokushin & Teleredce.

Also suppliers of:-

AOR, Sony, JRC, Jaybeam, Drake Henry Linears, Toyo, Icon & Strumec.
From the person who put the "stuffing" back into celebrating his 2nd birthday at the EALING shop.

For those of you who couldn't make it to my party last year, no worries! Here's another one for you to go to. The official day is SATURDAY, the 12th of SEPTEMBER. Open from 8 o'clock to 8 o'clock there is of course FOOD and DRINK, but most of all I'll be TALKING TURKEY even more

I'll be talking Turkey POUND FOR POUND TURKEY & HAM PIE THE LATEST H.F. TOP TEN

1. ICOM IC278 - Straight in at number 1. ICOM latest H.F. Multimode. All band, general coverage, 100W O/P with R.I.B. tuning and up-to-date packaging make this a firm favourite! £1075.00

2. YAESU FT990 - You thought the FT990 reviews were good, wait until you read this one! The world's smallest H.F. band transceiver with optional auto A.T.U. - built in. £1799.00

3. KENWOOD TS450S - As popular as the TS850S in its day? Probably. Without question the most reliable and best priced H.F. transceiver I've ever reviewed. £1599.00

4. YAESU FT767GX - Now series I. YAESU are the best engineered transceiver and appreciate quality, ring me for a super deal. £1395.00

5. KENWOOD TS850S - A first 100W H.F. transceiver with general coverage receive and a full feature 6 metre option, running 50W output thrown in! Price up two separate rig and see what that comes to! Free PSU. £1395.00

6. KENWOOD TS950SDX - The latest version of the 950 series, more user friendly and further enhanced features will ensure this competes head on with "No 5." £2595.00

7. ICOM IC725 - H.F. 100W, all mode general coverage, built to ICOMS exacting standards, enters the world of H.F. for a budget price. £775.00 - Free F.M. fitted.

8. KENWOOD TS850S - As popular as the TS850S in its day? Probably. Defnitably the most reliable and best priced H.F. transceiver I've sold in the last eighteen months. £1475.00

9. YAESU FT735R - New version II. YAESU are the only company to offer general coverage. 100W all mode and 2M/440/70CM (optional) all in one neat package...Oh don't forget the built in S.S.U., digital power/SWR metering, auto A.T.U., etc., etc., £1599.00


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The full range of Tonna antennas is still available at great value for money prices.

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Base and Mobile, their range of Verticals and car fixings is virtually endless.

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20-4CD 10m 4 element Beam
20-5CD 10m 5 element Beam
10-5CD 15m 5 element Beam
10-6CD 15m 6 element Beam
2B-3 15m 3 element Beam
A5 20-15-10m 4 element Beam
A5S 20-15-10m 5 element Beam
A39S 13-2m 3 element Beam
D0 40m Rotary Dipole
D1 40-20-15m Dipole
D2 20-15-10m Dipole
D3 20-15-10m Dipole

TONNA ANTENNAS
The full range of Tonna antennas is still available at great value for money prices.

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Manufactured in the U.K. by Airwave Systems, this is the very latest in advanced electronic keyers. Based on the Motorola 68HC705 microcomputer, the designers have eliminated the requirement of input keyboards and rows of switches and knobs - in favour of you telling it what you want - by the key itself! Features include:

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- Keyer status enquiry mode
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- Analogue or digitally controlled speeds
- Ultra low power consumption
- 6 - 60 WPM
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- Internal 9V battery or external 9 - 15V DC supply
- Designed and built in the U.K.

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It's like having a wideband receiver in your hand, displaying transmissions going on around you, but giving you the actual TX frequency their operating on in BIG CLEAR digits! Ideal for checking your own transmitter frequency and lots of others. Can detect I.F. at over 200 meters depending on power output. Ideal for the D.F'er. See the frequency, then tune in on your scanner. Only £149.00, including nicads, charger and antenna.
RALLY at Sandown Park in Esher Surrey. For all of you who are into PACKET and Data transmissions don't miss it - it's one of the biggest events in the rally calender! Remember to bring your PART-EXCHANGES along. I'm still paying top money either to buy out-right or as a part exchange against another item.

Finally, Thanks for a great first TWO years at Northfields. Without your help, I couldn't have got as far as I have today. Without you I haven't got a business. I'll never forget that.

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At the last count, over six pages of condensed print. All pre-owned equipment sold by Martin Lynch is thoroughly tested cleaned and offered with a meaningful guarantee. Furthermore, if you are ordering mail order, you have a money back guarantee if the equipment is not as described to you. Here's a little sample of what's in stock at present.

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**FOR PART-EXCHANGE GIVE US A CALL**

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**RALLY at Sandown Park in Esher Surrey. For all of you who are into PACKET and Data transmissions don't miss it - it's one of the biggest events in the rally calender! Remember to bring your PART-EXCHANGES along. I'm still paying top money either to buy out-right or as a part exchange against another item.**

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**FOR PART-EXCHANGE GIVE US A CALL**

286 Northfield Avenue, Ealing, London W5 4UB
Tel: 081 566 1120 NOW!
FAX: (24HR) 081 566 1207
Practical Wireless, September 1992
We can supply almost any magazine in this library within 24 hours.

Free Power Supplies with any hf 12v Transceiver!

MFJ-1088
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MFJ-207
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MFJ-722
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MEI-110
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adjustment simple and a 3 way aerial switch completes the package.

The MFJ-948 is a complete HF ATU. Other keder and single wires. A dual needle VSWR/Power meter makes experimenting with the various modes, all at a very modest price and all in one box. Send for latest list.

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Our mail order operation is the fastest and best stocked in the UK. Virtually everything in this magazine is available from us and the chances are that we can get it to you within two weeks of receiving your order. We operate a completely computerised system with two terminals and even have three staff solely packing goods. We also take care of you and your order. Everything we despatch is carefully checked, packed and insured against loss or damage. No risk to you whatsoever. And if the goods are not satisfactory immediately upon arrival we will offer a full refund or an alternative item.

Ten-Tec OMNI-VI

Coming soon is the all new Ten-tac OMNI-Vi hf transceiver. It includes such extras as digital signal processor, automatic notch filter, programmable CW offset, even stabilised stylus, "Sport" PC interface, new RIT control, 100 memories, fast CW break-in and superb receiver front end. This promises to be the most professional transceiver ever to come to the ham radio market.

Price £995 inc VAT.

APRIMETER HF LINERS NEW

600 Watts £699!

AL-811

This linear is incredible value. We have put it through its paces and it is stated and prove it. 3 rugged 811a tubes provide up to 600 Watts output from 160-10m. A humbucking mains transformer and full metering is included. Used by DX pedlators to be amazing value at £699 inc VAT

AL-80AX 1KW from 160-10m 3-500tube. £199.00

Other APRIMETER lines are available. Send SAE today.
Many hf stations would benefit from an ATU. The kind that go inside rigs are fine but they won't handle long wires and balanced feeders. If you are using a G3RV, end fed wire, Zepp, wire dipole on the LF bands or wire and balanced feeders. If you are making output and have a more efficient radiating system. Order MFJ-901B, Bal. feed.

MFJ-901B is a remarkable product that is offered at a remarkable price. It comes with an inverted "V" system. The great thing about this mast is that it won't damage and it won't damage you! The mast is constructed of a carbon compound that makes it virtually indestructible. Nine telescoping sections lock together automatically. The mast can be used on the LF bands or can be used to carry lighter weight wire HF antennas and inverted "V" systems. The great thing about this mast is that it is "bomb proof!" If it falls down it won't be damaged and it won't be damaged! What is more, there are no metal parts to rust and its size means it can be easily transported in any vehicle or aircraft. Its telescopic portable nature means it probably won't even contravene planning regulations. According to the British hamnet, the mast is "great for expeditions, portable work or where space is lacking. It truly is a remarkable product that is offered at a remarkable price."

A complete vertical system can be made by taping wire elements along a 1.8 to 30MHz. This amazing instrument enables you to tune your antenna system in minutes. It has built-in a digital frequency counter and meter. All self contained, simply connect to antenna system and watch the effect as you make adjustments in the garden. Amazing!

The latest 2 meter mobile from ALINCO now offers superb value. No longer than a car radio it boasts 50 Watts output and extended receiver coverage. Completely reengineered it offers all the usual features including memories, scanning etc. and comes with microphone, mounting kit and full warranty. For more details send or phone for brochure.

Just arrived, this is the replacement for the DR-590L and has been radically updated. It now includes the AM VHF airband and extended receiver capabilities. Also included is the automatic remote repeater function enabling you to operate your own cross-band repeater. Power has been increased to 50 Watts per band and we have the full colour brochure available for the asking.

The Flexi-Mast is constructed of a compound carbon that makes it virtually indestructible. Nine telescoping sections lock together automatically. The mast can be used on the LF bands or can be used to carry lighter weight wire HF antennas and inverted "V" systems. The great thing about this mast is that it is "bomb proof!" If it falls down it won't be damaged and it won't be damaged! What is more, there are no metal parts to rust and its size means it can be easily transported in any vehicle or aircraft. Its telescopic portable nature means it probably won't even contravene planning regulations. According to the British hamnet, the mast is "great for expeditions, portable work or where space is lacking. It truly is a remarkable product that is offered at a remarkable price."

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are pleased to announce that we are now approved dealers for both KENWOOD and ICOM products as well as being the sole UK distributor for YAESU equipment.

These latest additions to our product range enable the SMC retail shops to provide you, the customer, with all that’s best in Amateur Radio and at our fully stocked showrooms our experienced staff will be pleased to assist you in choosing the best transceiver to suit your needs whether it be a handheld or a top flight transceiver.

With many years experience in the amateur radio business we feel we are more than adequately qualified to provide the very best in back up and after sales service whichever brand or product you choose.

So why not drop in and see what’s new in amateur radio!!

Kenwood products available at most branches
I enjoyed our QSO. I was pleased to know that the channel wasn’t already in use. This station turned out to be relatively quiet, as the ‘official’ system wasn’t being used. Amateur radio operators are a privileged group and we make our frequencies available to others (or repeaters for that matter) and depriving its use to others is spreading from 144MHz.

Amateur radio operators are a privileged group. We have the use of frequencies that many others covet, and at times I wonder if other illegal users aren’t already on our bands!

In fact, whenever I drive through or near London, Birmingham and other large cities, I’m never too sure whether the many QSOs I overhear without call signs are amateur radio operators who operate without their call signs should realise the error of their ways. Surely, this behavior must always work against the hobby, if attending amateurs don’t identify their transmissions?

You can also be sure that other people are listening. A recent court case where amateurs overheard suspicious transmissions (they reported it to the Radio communications Agency), led to an office cleaning company being fined for illegal use of 144MHz equipment.

The Amateur Radio Observation Service (AROS) and the Department of Trade & Industry’s Radio Investigation Service are hard pressed. Despite the fact that they try their best, we can help them on their way.

The System Works

So, now you know the system works, and it can help the hobby as well. You can either continue to listen on the channel.

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So, now you know the system works, and it can help the hobby as well. You can either continue to listen on the channel.
Dear Sir
I’ve just been reading your review (July issue) regarding the MFJ-9020 transceiver. I find it somewhat perplexing as to why you recommend PW readers to spend an arm and a leg on such obviously over-priced equipment. I’m wondering whether it’s a case of ‘you scratch my back and we will scratch yours’?

No, you look to me to be a fine upstanding fellow! By the way, is it true that your feet are size 18, and your height 7ft? If it’s true, there’s no chance any one could lose you in a crowd and maybe not the sort of chap to stoop to questionable favours.

It’s my opinion that any radio amateur who spends his or her hard-earned £179 on pseudo-Japanese technology must want their head read. (Our American cousins purchase the same thing for £90, even if this price is too high). After all is said and done, the RAE doesn’t include intelligence tests...right? Perhaps then, those of us who possess this questionable ability, would not be sucked into perverse selling techniques?

You strike me as a naval type, you certainly fit the bill. I can just imagine you standing up there on the poop deck, barking out orders to the men. I was of course, suckered by your advertisement for the MFJ QRP rig, because there are not many cheaper (ready-made) h.f. rigs available. Perhaps other readers would like to express their views on reviews.

Ray Howes G4OWY
Weymouth
Dorset

Editor’s reply: Thank you for your amusing letter Ray. The team enjoyed it, although we’ve had to shorten it for publication. Yes, I am big, and my feet are too, and I was in the navy. But far from shouting the orders from the poop deck, I was receiving them. In reply to your comment regarding the review on the MFJ 14MHz c.w. rig, I have to say that in all fairness to everyone, PW must review a large a variety of equipment as possible. Readers have commented in the past, that we have appeared to concentrate on main rigs, and equipment in the £1000 plus bracket. Many readers have also stated that they like to be informed about anything that’s slightly different. I took the decision to review the MFJ QRP rig, because there are not many cheaper (ready-made) h.f. rigs available. Perhaps other readers would like to express their views on reviews.

Practical Wireless, September 1992
Dear Sir

Ref. the map on page 35 May PW.
The trouble with getting middle-aged is that it becomes increasingly harder to read the SMALL PRINT in magazines.
Now on your map of Europe, all the countries are showing in large letters with one exception - that of Gibraltar. Hey, what have you got against ZB land?
However, the information about getting a reciprocal licence is correct, people tell me its particularly easy to get a reciprocal licence in Gib' and it's free too. The only ones that have a problem are the Spanish, but there again, they do not recognise that we exist, so that makes it hard!

Jim Watt ZBOD
Gibraltar

Editor's reply: Sorry Jim, our mistake. Next time I'm on 'the rock' I'll come and apologise! You probably saw that we managed to 'flood' Germany with colour as well as forgetting Gibraltar. I apologise for both production errors.

COMPETITION CORNER

Wordsearch...win a Kent Morse Key worth £42, kindly donated by Bob Kent.

C V J W A Y Q R D X Y U O V B H S R F E
B V Z F E U S V Y S M S L T J V D E P L
Q T I S S G Y C K Q L H Y U D S D F H K
J I U M L C W G E E H F K R O T O L J P
R Q A J D H U I N D Y S P R F K D E U D
W E Y C N E U Q R F T A E B K R C I S
B L Y C U B I C A L Q U A D P M E T D T
C V S P F I X V V C L J O A S S T I W E
V E R T I C A L A N T E N N A P E O T V
V L A F R M Y E K T N E K Z U Q P N E
X C H G N I T N E M I R E P X E P S A O
H Z K E A O K Y J M B K X V W G O M S R
S H B X H W J L S Y Q G Z L J Z V I E T
C J R O T A L L I C S O Y E L T R A H M
T U L Y O X D F N T B M G P Y U S Q Y A
K E S H U A N F W R A E G Z H I A X L Y
U G T F A R C H S U C Y S H J Q N I T E
A T I M D R N I C X J G B Q M W G Z L R
J B L Z W U F O U F J E T X U H V U Z W

Twelve different words have been hidden in the letter grid. They have been printed across (forwards or backwards), up and down or diagonally, but they are always in a straight line without odd letters in between. You can use the letters in the grid more than once for different words. Once you have found all 12 words, mark them on the grid and send it, along with your name and address (photocopies accepted with the flash below please) to our editorial address, marked Competition Corner, Wordsearch September '92. Closing date is Friday 25 September 1992.

Name.................................................................
Address.............................................................
.................................................................
.................................................................

_subscription  _voucher

Send your entry (photocopies acceptable with coupon) to: Wordsearch September '92, PW Publishing Ltd., Enefco House, The Quay, Poole, Dorset BH15 1PP. Editor's decision on the winner is final and no correspondence will be entered into.

Entries to reach us by September 25.

First Prize: A Kent Morse Key.
Second Prize: One year subscription or £20 book voucher.
Two runners-up: Six months subscription or £10 book voucher.
Happy Second Birthday!

Martin Lynch's business is two years old on Saturday September 12. So, how about giving him a visit at his shop in Ealing. From 8am to 8pm, there will be food and drink. You'll find huge savings across the range. New and used, it doesn't matter, offer him a sensible price and you've got a deal.

The Amateur Radio Exchange Centre, 286 Northfield Avenue, Ealing, about giving him a visit at his shop in Ealing. Open from 2am to 8pm, there will be

Satellite Scene

Pat Gowen G3IOR, author of 'Satellite Scene', is producing a new reader send-out service, 'Basic Amateur Radio Satellite Information Requirements'. The document will cover all the amateur satellites, MIR, SHUTTLE, etc., and include frequencies, methodologies and modes. Regularly updated, you can get a copy of this, by sending a s.a.e. to our Poole editorial address, marked 'Satellite Scene'.

RCA Courses

Oldewood School, Oldewood Road, Wombourne, Wolverhampton. Commencing September 21. RCA classes on Monday, 7.5 to 9.15pm. Enrolment will start on Saturday September 19, at 10am. Further details from Bob G3NOW on (0902) 321968.

Redditch Vale Evening Centre, Redditch Vale Road, Redditch, Stockport SKS 17D. A full RCA course of 25 sessions, commencing Monday September 28. The classes will run on Mondays, 7 to 9pm. Facilities will be available for students who register for the course to take the examination in December 1992, either for those wishing to obtain the licence quickly, or for students needing to re-sit one or more components. The examinations are held at the centre.

They also run a Morse Code course of 25 sessions, up to 20w.p.m. Several tutors are available to cater adequately for all levels of ability. The Morse course will run on Thursday, 7 to 9.15pm, commencing Thursday October 1. Enrolment for both of the above courses on September 15, 14, and 17th, between 7 and 9pm, at the centre. Further details from course tutor, Dave Wood G4UJD, on 061-430 6246.

Belfast Institute of Further and Higher Education, College Square, East Belfast BT7 1DJ. Commencing September 8 at 5.30pm. A 28-week RCA course. For further details, contact J. Wilson G3NXL on 028 926 2827 from September 1.

West Notts College, Mansfield. Commencing September 14. A full RCA course for the May 1993 examination. Classes will be on Mondays, 7 to 9pm. Enrolment takes place on September 9 and 10th. Further information from course tutor, Alan Lake G4DVN, on (0602) 382509.

Oldenford Hospital School, Heath Lane, Stourbridge, West Midlands. Commencing September 1. A Morse code class, aimed at those 12 to 16 years of age, amateur radio Morse test, the course will run until Easter 1993. As last year, the course is designed to suit people of all ages and no experience or knowledge of the code is required. For enrolment details, contact the tutor, Phil Harris GA2IPO, on (0292) 403028.

Hellesdon Adult Education Centre, Middleton Lane, Hellesdon, Norwich. Commencing Tuesday September 15. A full RCA course. Classes will be on Tuesdays, 7 to 9.15pm. Thorpe Adult Education Centre, Longfellow Road, Thorpe BT, Norwich, commencing Wednesday September 16. A full RCA course. Classes will be on Wednesdays, 7.15 to 9.30pm. Tutor for the above will be Pat Gowen G3IOR. After examinations, Roger Cooke G3DNI, will commence with Morse tuition.

Avondale Adult Education Centre, Heathbank Road, Edgbaston, Stourport, Cheshire. An RCA course. Classes will be Tuesdays, 7 to 9pm.

Also at the Avondale Adult Education Centre, a Morse code course, Classes will be Mondays 7 to 9pm.

Enrolment for the above two courses will take place the week commencing September 14. Courses start the week commencing September 28. Further information is available from the above address or from course tutor, Wilf Whitaker G4AWU, on 061-427 4730 evenings and weekends.

New BBC English Dictionary

Four years of BBC World Service radio broadcasts and millions of words of output have been analysed by computer, to produce a new kind of English dictionary aimed at a wide-reading public.

Published jointly by BBC English, the language teaching arm of BBC World Service, and Harper Collins, the new BBC English dictionary places a special emphasis on the spoken language. The analysis of the broadcast material provides evidence for many new expressions and uses. For example, the dictionary's compilers found that in broadcast English the word 'hardware' most typically refers not to hammers and nails, nor even computers, but to military equipment. A 'plank' usually refers to the most important element of an idea or policy rather than a piece of wood. 'Goal posts' are now more likely to be mentioned in a current affairs context, rather than a sporting one, as in 'moving the goal posts'.

The Cobuild team of researchers at the University of Birmingham were responsible for compiling the new dictionary in co-operation with experts in linguistics and current affairs from the BBC.

They analysed more than 70 million words of news, current affairs and sports output. The words they fed into Cobuild's computerised 'bank of English', a 150 million word database, which has already been used to develop a range of English teaching materials.

Work on compiling the dictionary began in April 1991, and information up to January 1992 is included. It contains over 60 000 references and there are more than 70 000 authentic language examples showing how English is actually used. The dictionary includes some 1000 encyclopedic entries designed to help readers follow a news or current affairs programme. These provide information about countries, capital cities and political leaders in the news. Differences in American English have also been recorded, with the aid of broadcasts from National Public Radio of Washington.

The BBC English Dictionary is published in hardback at £14.95.

BBC English Dictionary

Bush House

The Strand

London WC2B 4PH

Practical Wireless, September 1992
Kenwood Amateur Radio Distribution

From 1 December 1992, Trio-Kenwood UK Ltd., will take over the distribution of Kenwood Amateur Radio Products in the UK and Ireland, from Lowe Electronics Ltd.

Lowe Electronics will continue to distribute the products until the end of November, by which time Trio-Kenwood UK will have set up dealerships, avoiding any disruption of supply to customers.

Mike Atkins, Communications Division Sales & Marketing Manager, says: "Our relationship with Lowe Electronics has been long and successful, and we look forward to its continuation, albeit on a different basis."

Surplus Postal Sale By Auction!

Greenweld are holding a massive disposal sale by auction - with a difference, to clear older items of their stock. As their customers are located all over the country, they've decided to hold a postal auction sale. A catalogue with hundreds of items on sale is being prepared and will be sent to anyone who encloses an s.a.e.

Bids can be submitted by post, and full details of all goods listed are in their catalogue and lists, and a special supplement showing just the goods to be auctioned is available for £1, plus an A4 size s.a.e.

Lots vary from individual items to thousands, so both the hobbyist and bulk buyer are catered for. Viewing is from 10am to 4pm, September 1 to 5th. Final acceptance of bids by 5.30pm on Monday September 7.

This really is the 'Sale of the Century', so don't miss out - send for your catalogue now!

Greenweld Electronic Components, 27 Park Road Southampton SO1 3TB. Tel: (0730) 236363.

Special Event Station G8OLSF

Special event station G8OLSF (Lions sight first), at RAF Mona Anglesey, on 22 August 1992, from 9.30am to 6pm.

Lions international sight first, objective to eradicate preventable blindness throughout the world by 1996. Expected (hopefully) are 30,000 people, and 10,000 are needed to attend so that they can attempt the world record for musical chairs (Guinness Book of Records). Events include:

- Team Toyota Aerobatics; hot air balloon; British Hovercraft Soc.; go-carting; archery; brass band; bungee jumping; hangar theatre; funfair; dog show; stalls; helicopter rides; aircraft rides.
- The event will be televised for eight minutes on national TV, and also local TV Radio Gold and Marcher Sound (local radio).

Further details from Dave Keely GWOOGI on (0407) 810996 QTHR.

Scarbrough Special Events Group

The North York Moors is one of Britain's eleven National Parks where special care is taken to conserve beautiful landscapes for the benefit of all. The National Park was designated in 1952 and extends over 555 square miles of heather moorland and attractive dales farmland edged on the eastern side by some of the highest cliffs in England.

To celebrate the 40th anniversary of the National Park, in 1992, the DTI have issued the very special callsign GB40NY, which the Scarborough Special Events Group will be using from Sutton Bank visitors centre, during the weekend of September 12 and 13th. Operation will be around 3.725 and 7.055MHz, in the h.f. bands, plus 144 and 432MHz. A special full colour souvenir OSL card will be issued to commemorate the occasion and further details can be obtained from Roy Clayton G4SSH, 9 Green Island, Irton, Scarborough, North Yorkshire YO12 4RN.

Practical Wireless Elmer Award Nominations

The closing date for nominations for the first Practical Wireless 'Elmer' Award is September 7th 1992. If you have a possible 'Elmer' to nominate for the special PW award, you still have time to write in to us.

The PW 'Elmer' Award is designed to recognise all those unsung heroes who help others to enjoy the radio hobby. They may not be radio amateurs themselves, and they don't need to be PW readers. The person you're going to nominate has already shown what they can do, because they've earned your nomination.

Full details of the 'Elmer' award are provided in the January issue of 'Keylines', but just to make sure your nominee doesn't lose out, here are the brief details again:

The 'PW 'Elmer' Award is very special. The award is open to all (except full-time PW Publishing employees, regular authors and advertisers and anyone professionally involved in producing the magazine) in recognition of the very varied type of helper who is, or has been an 'Elmer' at some time.

Some nominees will be radio amateurs, others will be experienced s.w.l.s and they may not be directly interested in the hobby as such. Readers who wish to nominate someone (who can be in the UK or abroad) are asked to write in immediately (by Monday September 7 at the very latest) telling us why their particular nominee deserves the award, and a recent photograph of the prospective 'Elmer'.

Presentation of the specially commissioned 'Elmer' cartoon, drawn by John Worthington GJ3COL, and hand-painted in water-colours, mounted in an attractive wooden frame, will take place at the 21st Leicester Show, during the weekend of October 23/24th.

So get writing, and the person who helped you start off in the hobby, could have their name on the brass nameplate that goes with the 'Elmer' cartoon.

All Formats Computer Fairs

There have now been over 40 All Formats Computer Fairs all over the country. Between one and two hundred trestle tables at every Fair, the diversity of products on sale is amazing, as are the prices. Here's a look at their Autumn schedule:

- September 5 - National Motorcycle Museum, Birmingham
- September 12 - Sandown Racecourse, Esher, south London
- September 12 - Donington Racecourse, east Midlands
- October 2 - Northumbria Centre, Washington
- October 4 - University Sports Centre, Leeds
- October 10 - Assembly Rooms, Edinburgh
- October 11 - City Hall, Cumbernauld, Glasgow
- October 17 - Novotel, Hammersmith, north London
- October 18 - Brunel Centre, Temple Meads, Bristol
- October 24 - Haydock Park Racecourse
- November 1 - University Sports Centre, Leeds
- November 6 - National Motorcycle Museum, Birmingham
- November 7 - Sandown Racecourse, Esher, London
- November 8 - Southampton
- November 14 - Novotel, Hammersmith, north London
- November 15 - Brunel Centre, Temple Meads, Bristol
- November 21 - Donington Racecourse, east Midlands
- November 22 - Northumbria Centre, Washington
- November 26 - Haydock Park Racecourse
- November 29 - City Hall, Cumbernauld, Glasgow
- December 5 - National Motorcycle Museum, Birmingham
- December 12 - Sandown Racecourse, Esher, south London

Club News

As of next month, only the clubs giving specific activity details of their meetings will be included in our 'Club News' pages. Details of those clubs who do not send in their activity details will still be available, but only upon receipt of an s.a.e. to 'Club News', at our editorial offices in Poole.

Practical Wireless, September 1992

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August 18: The Southend Rally will be held at The Railway Hotel, 104 High St, Southend-on-Sea, Essex. Buy & Bring sale, bar & refreshments, ample parking. Tickets in or out on S22 x 5. For booking & other details, contact John Steel G0F/OE on (0268) 202716.

August 22: The West Manchester Radio Club's 'Red Rose Rally' will be held at Bolton Sports & Exhibition Centre, Silver Street, Bolton (town centre). The usual trade stands, societies, junk & their usual excellent refreshments. All at pavement level. Doors open 11am until 4.30pm. More details from John Campbell, 9 Brunton Park, Bowden, Melrose TO6 0U2. Tel: (0383) 22086.

August 31: Huntingdon ARS will be holding their Annual Rally & Junk Sale at the Medway Centre, Coneygaere Road, Huntingdon, Cambridgeshire. Doors open 10am until 4pm. Featuring trade stands, Bully & Buy, comes, junk & all their usual excellent refreshment bar. Car boot pitches available. Talk-in on S32 & G00ZS (22MHz). Details from David Leech G7DOU on (0460) 433322.

September 6: Bristol Radio Rally will be held in Brunel's Great Train Shed, Temple Meads Station, Bristol. Lots of traders in an historic venue.

September 6: Preston ARS will be holding their 25th Annual Rally at the University of Lancaster, as in previous years. The university is located south of Lancaster & the entrance is on the A6 trunk road. From the A6 at junction 33 on to the A6 & proceed north for approximately three miles. Trade stands, club/interest stands, large Bully & Buy, snack bar, lunchtime restaurant, licenced bar, free piece draw & free parking on campus. Doors open 11am (10.30am for disabled). Details from George Farrington on (0772) 751819.

September 6: Venga Amateur Radio Society will be holding their Annual Rally at The Llandovery Community Centre, Llandeilo High Road/Aston Road, Llandeilo, Brecon. The centre is a short walk from Llandeilo Railway Station on the Fenchurch Street to Shoeburyness Line. Doors open from 10.30am to 4.30pm. Admission £7. Featuring many traders, Bully & Buy, refreshments & a free raffle. Talk-in on S22. Approach roads will be patrolled for further details contact Mike Musgrave G4NVT on (0259) 565235 or Dave Thompson on (0259) 552066.

September 6: Milton Keynes & DARS will be holding their 4th Car Boot Rally at Cranfield Airfield, (south side), Cranfield, Bedfordshire MK43 OAL (off J13 or J14 of the M1). Doors open 9.30am until 4pm. Hot & cold snacks & drinks.

Is Your Car A Cause For Alarm?

The all new remote control alarm system from Maplin Electronics, at just £29.95 (including VAT), is without a doubt, one of the best value remote control alarm systems in Britain. Packed with more features than many other more expensive models, the unit uses latest technology self code-learning remote microprocessor and control with one remote, to offer maximum security.

The system also produces maximum sound. Because the piercing 120dB siren is installed under the bonnet, where there is usually little sound insulation, it sounds much louder than similar units installed in the passenger compartment.

The two wire installation is easily fitted and the unit provides full radio remote control operation. The one button transmitter - DTI approved - controls all functions:

- Sets alarm, with or without 'warn-away' feature, (this prevents many false alarms - if car is only accidentally lightly knocked - the warning alarm bleeps).
- Sets off alarm instantly - panic feature.
- Unsets alarm - feature menu lets alarm tell you if its been set off while you've been away.
- Electronic sensor sets alarm off if any door, etc., is opened.

Order information: Remote Control Car Alarm MAP70 £29.95 + £1.35 carriage (inclusive of VAT). Maplin Electronics, PO Box 3, Rayleigh, Essex SS6 8LR. Tel: (0702) 552911.

Radio Diary

August 18: The Scottish National AR Convention which will be held at The Fair Isle of Physical & Recreational Education, Viewfield Industrial Estate, Dullatur, Falkirk. Doors open 16.30pm until 5pm. For further details, contact John Hardwick G4MLA on (0565) 409037 or anyone of the organizers. Tel: (0772) 476787.

September 12: The Napier Lincoln Hamfest will be held at the Lincolnshire Showground, Exhibition Centre, four miles north of the A15 Scunthorpe Road. As well as the usual amateur radio stands, they hope to have helicopter rides, model car racing and model aircraft displays. Refreshments (hot & cold) are available inside and out and licensed bar with real ale. Sue inside. Tel: (0352) 217180.

September 13: The East of England Showground, Oundle Road, Laindon, Basildon, Essex. The centre is open 9am until 4.30pm. More details from John Musgrave G4NVT on (0268) 220584 evenings.


September 20: The City of Lincoln Hamnet, Computer & Satellite Rally will be held at the Lincolnshire Showground, Exhibition Centre, four miles north of the city on the A46 Lincoln Road. As well as the usual amateur radio stands, they hope to have helicopter rides, model car racing and model aircraft displays. Refreshments (hot & cold) are available inside and out and licensed bar with real ale. Sue inside. Tel: (0352) 217180.

September 26/27: The RGGB International HF & ITU Convention will be held at the ICL Beaconium Convention Conference Centre, Old Windsor, Berkshire, (situated near motorways M25 & M40 & is just 10 miles from Heathrow Airport. For further details contact Roger ELLISTON, ELeMA, Mimbled, Windsor, Berkshire, on 0734 296129.

November 22: The Bishop Auckland Radio & Computer Rally will be held at a new venue, The Spannyburn Leisure Centre, Spanyburnmoo, Co. Durham. There will be catering & bar facilities on site, as well as all the other amenities of a top-class leisure facility, for those members of the family not wishing to partake in the rally. The venue is very easy to find from major routes through the area. Details from Mike G0PGQ on (0383) 636204.

* Practical Wireless & Short Wave Magazine in attendance.

Radio Diary

- October 4: The Great Lymley Rally will take place in the Commerce Centre, Great Lymley, nr. Chester-le-Street, Co. Durham. Doors open 11am (10.30am for the disabled). Trade stands, Bully & Buy, refreshments, Talk-in on S22 & G0HUR. Admission will be £1, which includes programme. Children under 16 free if accompanied by an adult. For further details, contact Barry G4P/c on 0191-388 8585.

October 11: Computers '92 (Computer & Radio Rally) will be held at Chippenham Campsite, Dunsford Road, Bratley, South Devon. Trade stands, Bully & Buy, raffle, refreshments, unlimited free parking, overnight camping & car boot sale (space permitting). Doors open 10am. Talk-in: S22 07FCG + G4/SS. Special event station G4/STJ. Details from W T. Trezise G62RM on (0908) 316435 (business hours) or 0991 762900 evenings.

- October 23: The 21st Annual Leicester Amateur Radio Exhibition will be held at the Greybull Halls, Leicester. Doors open at 10am each day (9.30am for the disabled). All the usual facilities. For further information, contact Frank G4UPO on (0533) 553293 (business hours) or 0533 277404 evenings.

- November 2: The Barnsley Amateur Radio Rally will be held at the Wilkinson High School Senior Centre, Grimesthorpe Road, Grimesthorpe. For further information, contact Emru G4LAI on (0268) 716339 between 4 & 7pm.

November 12: Blenheim PEL's Christmas Computer Shopper Show takes place at Olympia's Grand Hall. The show offers the complete buying solution for home and business. For further details on The Christmas Computer Shopper Show '92, contact Moy Mans on Blenheim PEL on 061-432 182.

November 20: The West Manchester Radio Club's 'Yamato' Rally will be held at the Manchester Sports & Exhibition Centre, Silver Street, Bolton (town centre). All the usual trade stands, societies, junks & their usual excellent refreshments. All at pavement level. Doors open at 10.30am for the disabled & 11am for general public. Admission £1, children free. Further details from Dave G0DYO on (0254) 240106 evenings only.

November 22: The Bishop Auckland Radio & Computer Rally will be held at a new venue, The Spannyburn Leisure Centre, Spanyburnmoo, Co. Durham. There will be catering & bar facilities on site, as well as all the other amenities of a top-class leisure facility, for those members of the family not wishing to partake in the rally. The venue is very easy to find from major routes through the area. Details from Mike G0PGQ on (0383) 636204.

* November 22: Bridgend Rally.

November 30: The Greater London Amateur Radio & Computer Rally will be held at a new venue, The Spannyburn Leisure Centre, Christchurch Avenue, Harrow, Middlesex. Major suppliers & manufacturers of radio equipment, computers, accessories, antennas, computer software & second-hand gear. Close to Harrow-Weston's SE & Tube station. Easy access from motorways M1, M4 & the A40 north circular road. Fully staffed by the AA. Ample car parking available. Two bars & self serving hot meals & drinks all day. Large Bully & Buy. Easy access for the disabled. Rally information centre at site. Talk-in on S22 & G0HUR. Doors open from 10.30am until 4.30pm. CLPK, 18 Litchfield Close, Dacconyll-Sea, Essex CO5 3ZL.

Practical Wireless, September 1992
LAUNCH DAY FOR ICOM'S BIRMINGHAM SHOWROOM

Well, it's not exactly the official opening day, because we opened in Birmingham last January. Since then we have been very busy bringing it up to Super Hamstores standard by stocking up with all kinds of goodies for the radio Amateur, shortwave listener and scanning enthusiast.

We believe that we now have one of the best showrooms in the country, but don't take our word for it, come along and take a look for yourself. We are open every day from Tuesday to Saturday, but on ...

SATURDAY 12th SEPTEMBER

you are invited to call in and celebrate the setting-up of our Super Hamstore in Birmingham.

Between 10am and 4pm on that day we plan to give our visitors an extra special welcome. Yes, we do have the best coffee on hand every day, but how about a little Buck's Fizz? Maybe you might even treat yourself to a new radio, there will also be some extra special discounts on offer plus ...

• Loads of clearance items • Selection of second-hand radios • 2m/70cms transceiver checks
• Test your morse code skill • Advice on the Radio Amateurs exam • Guidance on the novice course • Local radio club representation • Loads of radio books
• Shortwave listening demonstrations • Operating desks c/w rigs by major manufacturers • Extensive stocks of new gear • Scanning radio displays • Mobile radio aerials and accessories • Portable radios of all kinds • Data sheets for you to mull over, in fact everything for radio hobbyists, be they listeners or transmitters!

We stock items by AEA, AKD, Alinco, AOR, Barenco, CDE, Comet, Cushcraft, Dee Comm, Diamond, Drae, Hills Kits, Hustler, Icom, JRC, Kenwood, Lowe, MFJ, Siskin, Sony, Toyo, Yaesu, Yupiteru etc. Gordon G3LEQ, John G8V1Q and their Herne Bay colleagues look forward to meeting you!

BOTH STORES OPEN TUESDAY - SATURDAY. 09:00 - 17:00 WEEKDAYS.
and 09:00 - 16:00 SATURDAYS.

HERNE BAY & BIRMINGHAM

Payment by Access, Visa and Switch. Part-exchanges welcome, finance can easily be arranged (subject to status). Interest free credit is available on selected new ICOM products.

If you cannot visit either ICOM HAMSTORE in person we operate an efficient Mail order service. Stock items normally dispatched within 24Hrs.

INTERNATIONAL HOUSE, 963 WOLVERHAMPTON RD. OLDURY, WEST MIDLANDS B69 4RJ
Telephone: 021 552 0073, Fax: 021 552 0051
Bury RS meet Tuesdays, 8pm in The Mosses Community Centre, Cecil Street, Bury, Lancashire. For more details contact Ian G4ZAA on 0632 821 339. 2nd Tuesdays to Thursday, lecture/talk nights & other Tuesdays are general Q&A nights with the club's new Radio Society. Contact David Limebeer G4GIZ (0632) 315 121.

Buxton Radio Amateurs meet at the Lee House Hotel, Buxton, every 4th Friday at 7.30pm. August nice battery charging & September 8 is a visit to a local company. For further details contact Richard G4VSR (0635) 625 059 or Ferndown Police Station, Ringwood Road, Ferndown BH21 8SF. Tel: (0225) 529293 ext. 3198.

Cleethorpes ARC meet 1st Mondays, 7pm at Manton College, Arbour Lane, Cleethorpes. More details from Pat G4MTO on 0630 421 792. 2nd Sundays at The Alhambra, Loughborough. Dedicated to operating & demonstrating the joys of amateur radio & further details, contact David MO on 0630 421 792.

Cambridge Amateur Radio Contest Club meet Wednesdays, 7pm at the 1st & 3rd Sundays at The Alumni, Loughborough. For further details contact John G4CWZ (0635) 234526.

Chelmsford ARC meet 1st Mondays, 7.30pm at Marconi College, Arbour Lane, Chelmsford. More details from Pat G4MTO on 0630 421 792. 2nd Sundays at The Alhambra, Loughborough. Dedicated to operating & demonstrating the joys of amateur radio & further details, contact David MO on 0630 421 792.

Cheltenham Radio Amateurs meet at the Equity & Law Social Club, which is located on the top of the hill above the promenade, Cheltenham Road in Hatherop. More details from Dave Kipping, 48 Old Hardway, High Rocks, Cheltenham GL52 6HP. Tel: (0665) 72207.

Clacton RC meet alternate Wednesdays in The Royal Public House, Regent Street, Clacton-on-Sea. For their membership details, phone (0525) 62006, 433655 or 215972.

Conway Valley RC meet 1st Thursdays, 7.15pm at The Studio, Penrhos Road, Colwyn Bay, Conwy. Tel: (0722) 737221.

Cornish RAC meet at the Memorial Hall, Perranwell Station, Perranwell, nr Truro, Cornwall. 7.30pm. For further information, please contact Mr T. Reed.

Carthick, Redruth, Cornwall TR5 0GZ. Tel: (0502) 62006.

Coulson AS meet 2nd Mondays, 7.45pm at St. Swithin's Church Hall, 7.45pm at South Shore Lawn Tennis Club, Portchester, Hants. August 14 is the 28th in series and the "10am is the Radio Data Systems" by Chris Nicholas GOV.

Cowell, Eaglescliffe, Stockton-on-Tees TS16 0EF. Tel: (0863) 703793.

Darlington ARC meets at the Community Hall, St. Martin's Court, Kinston Crescent, Darlington. Saturdays, 7.30pm. Further details from P. Townshend G6FMT on (0342) 451093.

Edgware & District RS meet at the Westfield Community Centre, Morden, Surrey. 7.30pm at Mill Road, Burnt Oak, Gat. August 27 is a SSB field day, September 5 is a "Radio Construction" & the 10th is the Radio Data Systems" by Chris Nicholas GOV.

More details from Howard Drayton on (081) 470111.

Easterley ARC meet, 7.30pm at The Albion Club, Hurst Road, Bedford. Tel: (0234) 365660.

Easington ARC meets 1st Mondays, 7.30pm at the RSGB EMC committee, the 26th is 'How to Build a Radio Station' by G4ZTU & G6ZSU on 081-6531090.

Essex Trinidadian (West Essex) ARC meet 1st & 3rd Sundays at The Albion, Loughton, Essex. More details from Rod G8YHL on (0405)769130.

Essex Tropical Society have a monthly quiz night. For further details, please contact J. Howser on 081-814 4292.

Ipswich RC meet 2nd & 4th Thursdays, 7.30pm at 19th King's Lynn Scout HQ, North Runcton. Further details from Derek G3HOD on (0543) 233123.


King's Lynn ARC meet Thursdays, 7.30pm at Hornsea Community School, Hornsea, East Yorkshire. Further details from George Millar G4UNL on 081-804 5643.

Kirkcudbright, Galloway, Scotland KA22 9TA. Tel: (0542) 501100. More details from Steve Price GW7AAV on (0244) 819618.

Leicester & District RS (Co. Durham) meet Thursdays, 7.45pm at Southside Social Club, Easington Village. Further details from Mr. W. Hunter on (0209) 820836.

Lichfield, Lightcliffe, Halifax, West Yorkshire HX3 5NU. Tel: (0229) 25206.

Loughborough AMRS meet in West House, Allertonshire School, Northallerton at 7.30pm. On September 10 they have a Practical night. For more details contact Carl Watkins GW9HMH on (0663) 77608.

Louth & District ARS, 2nd & 3rd Fridays at the Civil Defence Hall, Magistrates Court, Castle Street, Louth. More details from Emil Robinson G4GMN, 29 Folly Lane, Herfordshire. Tel: 081-5011 61L1X. Tel: 0452 (035292).

Midgeland Road, Blackpool. August 13 is a 28th in series and the "10am is the Radio Data Systems" by Chris Nicholas GOV.

More details from Howard Drayton on (081) 470111.

Malmesbury, Wiltshire. For more details contact Geoff Price G3RCH on (081) 237 1963.

Manchester, Cheshire WA2 7HJ. Tel: (061) 683 3276.

Marchfield ARC meet 1st & 3rd Tuesdays, 7.30pm at the Running Man, Public House, Pellon Lane, Halifax. August 15 is a "Radio Construction" & the 10th is the Radio Data Systems" by Chris Nicholas GOV.

Further details from David Moss G4EK with (0342) 402029.

Marsden, Huddersfield. Further details from Paul Truitt G4WQC on 071-938 2561.

Milton Keynes ARC meet 1st Wednesdays, 7.30pm in Room 3 of Gladys Buxton Hotel, Buxton. Further details from David Hicks G6IFA on 081-3025944.

More details from Pat G4MTO on 0630 421 792.

Morafield, Wiltshire. For more details contact Geoff Price G3RCH on (081) 237 1963.

Newcastle & District RS meet 1st & 3rd Tuesdays, 7.30pm at the Running Man, Public House, Pellon Lane, Halifax. August 15 is a "Radio Construction" & the 10th is the Radio Data Systems" by Chris Nicholas GOV.

Further details from David Moss G4EK with (0342) 402029.

Northampton, Northants. For further details contact Paul Truitt G4WQC on 071-938 2561.

Norwich ARC meets Wednesdays, 8pm at the Mill, Acton Wick, Norwich. Further information from Steve Price GW7AAV on (0244) 819618.

Northwich, Cheshire. Further details from Steve Price GW7AAV on (0244) 819618.

Oxford & District RS meet alternate Sundays, 7.30pm at the Backswann Inn, Oxford. For more details contact J. Howser on 081-814 4292.

Perranwell Station, Perranwell, nr Truro, Cornwall TR16 501. Tel: (0209) 820836.

Plymouth, Devon. Further details from Pat G4MTO on 0630 421 792.

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Manchester & District ARC meet Tuesdays, 7pm at 1, The Common
Community Association, Mottram Lane, Macclesfield, Cheshire.
Further contact details from Roger G6KX & G8ARD.

Midland ARCs meet in Unit 22, 60 Regent Place, off Castle Street, Birmingham B1 3LU. Wednesdays are RAE classes & Thursdays are natter nights. August 18th is a June Soiree, the 28th is MBF's 20th Anniversary. For further details, contact Brian Lennard GM9VY at 44 Orchard Close, South Petherton, Somerset TA11 6QZ.

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Jalishan G3WNI, 162 Orchard Road, Uphill, Wrington, North Somerset. Contact details from Mr W. Lindsay -Smith G3WNI, Way House, Beaconsfield, Buckinghamshire.

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Warwickshire ARC have meetings & activity evenings & 4th Tuesdays are their main lecture evenings. Further details from John Vaughan G4JOY at 7, 3rd Mondays, 8pm at Robin Woods Community Centre, Prospect Road, Ossett. All those interested in PARS should contact Brian Mulleady GMOKWL, QTHR or on (0324) 670235.

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Sudbury District ARC meets 2nd & 4th Mondays, 8pm at the North Road, Mansfield. Further details from Alen Beasley GOCXJ, 2 Ilmington Road, Blackwell, Shipston-on-Stour, Warwickshire. Details from Dennis Body GOHTJ at 53 Grove Road, Westlecote, Brackley, Northampton.

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Stevenage & District ARC meet every 2nd & 4th Tuesdays, 8pm at G3WHK/GOPNT, September 3 is a natter evening.

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It is also possible to build with non-radiating baluns, as for the cases of isolation and matching. For more information, see the Radio Amateur's Handbook.

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Further details from Andrew Paterson GOHAL on 061-9801334.

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To request a copy of this issue, please write to Practical Wireless, 40 Bowen Street, London WC1B 3QH.

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Further details about the construction of this class of antenna can be found in the ARRL's Antenna book.
Getting Started - The Practical Way

This month the Rev. George Dobbs G3RJV looks further into the subject of radio frequency oscillators, and has more to tell us about the mysterious Mr Hartley of oscillator fame.

Fig. 1: The Hartley Oscillator type b.f.o. circuit described in the text by G3RJV.

Fig. 2: Copper track lay-out for the Hartley Oscillator b.f.o printed circuit design.

Fig. 3: Component side overlay and placement diagram for the Hartley Oscillator p.c.b.

Readers of Practical Wireless are well known for their response to what they read. I can vouch for that, because in the April 'Getting Started... ', I asked if anyone knew who 'Mr. Hartley' of the Hartley Oscillator circuit was.

My question brought a result of course! Not being one to leave the question unanswered, Sam Smith G7LSO, a keen PW reader, conducted his own research.


Telephone Engineers

Sam found that the story goes back to about 1915. It began when American telephone engineers had installed improved versions of de Forest's Audion valve on their long distance telephone lines. The stations were around 480km apart, and were located in Long Island and Delaware.

At this point, the American Navy stepped in. They then installed equipment developed at the Long Island and Delaware stations, in the Navy base at Arlington, Virginia and were that same year transmitting speech to Paris and Honolulu.

At that time, the largest valves (in 'American' they're called 'tubes') were made by Western Electric and were rated at 25W! To get the necessary power, they had to use a lot of valves. In fact they had to use 500 to obtain 1.5kW of modulated power in the antenna!

The Triode Valve

America's first big transmitter was made possible by the invention of the triode valve. Although familiar now, the engineers of those days had overlooked the possibilities of the amplifier-oscillator-modulator. But they soon made up for lost time.

In the experimental transmitters Sam G7LSO read about, the grid modulation circuit was developed by a South African engineer by the name of H.J. Van der Bijl. The transmitter itself was designed by Raymond A. Heising, and the inductive feed-back oscillator was devised by one Ralph V. Hartley!

Sam suspects that there may not be any biographical details available on Ralph Hartley because if he was a serviceman without flag rank, details on him may well be restricted to footnotes in text books. But then, who has heard of Heising* or Bijl! Perhaps some other enterprising reader may dig up more details on Mr. Hartley?

Editorial note: *We've heard about 'Heising modulation', but research in the PW office drew a blank on Mr Bijl!

A Practical Circuit

The diagram, Fig. 1, shows a practical circuit using a Hartley oscillator. This is a beat frequency oscillator or b.f.o. for use with a short wave receiver.

Those of you who are familiar with communications receivers, will probably know the function of a b.f.o. They're used when c.w. (Morse) signals or single-sideband suppressed carrier (s.s.b.) signals are being received.

For reception of these signals the receiver must add a carrier (an oscillator signal) to the incoming signal to make it intelligible. This is an important
facility, as the majority of amateur radio signals use the c.w. or s.s.b. modes. Modern communications receivers have a switch position for receiving c.w. and s.s.b., which automatically selects a b.f.o. However, older receivers often have a b.f.o. which could be switched on and off.

Intermediate Frequency

The b.f.o. signal is usually added to the received signal at the intermediate frequency (i.f.) stage of the receiver. This is a fixed frequency, within the receiver, at which a lot of the signal processing takes place. This has the advantage that the b.f.o. can be at a single fixed frequency.

There are many short wave receivers around, usually of the older 'cheap and cheerful' types, which don't have a b.f.o. Fortunately for us, more often than not these have an intermediate frequency of 455kHz.

A simple b.f.o. with an output frequency of 455kHz is a useful circuit to build, as it will enable older receivers to resolve amateur c.w. and s.s.b. signals. The circuit in Fig. 1, is about the simplest way to do this job.

The Circuit

The circuit, shown in Fig. 1, is a Hartley oscillator using inductive (via the coil) feedback. The transistor, Tr1, has a tuned circuit in its collector, provided by a coil and capacitor within an i.f. transformer.

The transformer is the same type as used in a receiver using a 455kHz i.f. The second winding on the i.f. transformer provides the feedback to the base of Tr1. The resistors R1 and R2, provide biasing by setting up of the correct working voltages for Tr1.

A Suitable Layout

A suitable printed circuit board layout for the Hartley b.f.o. is shown in Fig. 2. As you can see, the layout of the copper tracks are comparatively simple.

As I've said before in this series, the circuit could just as easily be built using perf-board, if you prefer doing it that way. The method used with this technique has already been described in previous articles.

The diagram in Fig. 3, shows the view of the p.c.b. from above, with the component overlay provided to help you position each item on the board.

A BC182L transistor was used in the original design. The recommended transistor is not expensive, and it's easy to buy either at rallies or from mail order sources.

The i.f. transformer could be culled from any old transistor radio. If you do use an i.f. transformer recovered in this way, make sure you remove one that's placed centrally in the i.f. amplifier. They're usually fitted with a green or yellow core.

If the circuit is to oscillate (and that's the object of the exercise!), the feed-back must be in-phase with the signal. So if you're using a surplus i.f. transformer which fails to oscillate, all you have to do is reverse the connections on the feed-back winding, and try again.

No Modifications Required

The b.f.o. is not connected directly to the receiver, so no modifications are required to the existing equipment. The b.f.o. output goes to a Practical Wireless, September 1992

random length of wire, approximately one metre long.

The wire acts as the b.f.o. antenna. It radiates enough signal to be picked up in the i.f. amplifier stages of the receiver.

Testing the completed unit is very simple. All you have to do is attach the wire to the b.f.o., and lay it over the receiver and switch both units on. You'll have to tune the b.f.o. to the i.f. frequency. This is done by adjusting the core in the

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**Fig. 4:** Circuit diagram for the alternative, Colpitts type oscillator b.f.o. project.

**Fig. 5:** Copper track lay-out p.c.b. design for the Colpitts Oscillator version of the b.f.o. project.

**Fig. 6:** Component side overlay and placement diagram for the Colpitts version b.f.o.
transformer.
To start the tuning process, tune in a station on the receiver. You should then adjust the core until a distinct whistle is heard on the signal. In practice, this operation can be done with a normal broadcast on the medium wave band (often referred to as the "a.m. band").
Ideally the core should be adjusted with a non-ferrous trimming tool, but for this purpose a small screwdriver will do the job. However, do try to avoid forcing the core to move because this could damage the core material. If you do break the core, it's best to replace the i.f. transformer and start again!

After this initial adjustment, find a c.w. or s.s.b. signal on the receiver, and re-adjust the b.f.o. until the signal sounds right. This may also involve adjusting the amount of signal injected into the radio, which is done by changing the position and closeness of the radiating wire.

With a little practice, it should be possible to resolve c.w. and s.s.b. signals, even on a simple short wave receiver. You'll then find a whole new world open to you as a listener.

The Limitations

The Hartley b.f.o. I've outlined above, offers a simple circuit, but like many simple circuits, it has limitations. One of the serious shortcomings is its lack of frequency stability.
As a result of this problem, you'll find it will require re-tuning from time to time, in order to remain at the correct frequency. To help in this respect, I've included a small (optional) variable capacitor, C1 in Fig. 1, which makes fine tuning easier.

To help overcome the tuning stability problem, a better circuit is the Colpitts b.f.o., which is shown in Fig. 4. The Colpitts circuit is a favourite with amateur radio constructors who are looking for a stable r.f. oscillator.

The necessary feedback for this oscillator is provided by a capacitive arrangement. The capacitor, C102, couples the tuned circuit in the i.f. transformer to the field effect transistor (f.e.t.) Tr101.
The signal appears at the f.e.t.'s source, where you'll see there's a radio frequency choke (r.f.c.). This signal appears at the junction of the two capacitors, C103 and 104.
The two capacitors are of equal value. This means that half of the signal is decoupled to ground, and half is fed via C103 into the gate of Tr101, providing the feedback.
The resistor R102 and capacitor C105 decouple the supply at the drain. The resistor R101 and D101 together provide the bias for Tr101, while D101 is also an aid to the level stability of the signal.
Finally, the output signal may be taken from the secondary winding of the i.f. transformer or from the source of TR101. The signal is then radiated via the simple antenna, and picked up by the receiver.

Colpitts Version

The diagram, Fig. 5, shows the p.c.b. copper track side layout for the Colpitts b.f.o. The next diagram, Fig. 6 shows the component side of the board in an overlay fashion to help you place the individual parts.
As with the first version, there's no need to connect the b.f.o. to the receiver. The radiating wire is used, in the same fashion as the first version.
The central core in the i.f. transformer will also require adjustment, using the procedure I've already described. But, there will be a difference. This is because of the added capacitance of the circuit, and the core will need to be unscrewed almost to the top of the screening can of the i.f. transformer.

Best Results

Although both circuits perform well, the Colpitts oscillator gave the best results. I used it with a very old medium wave and short wave receiver. We'll be using this circuit in another project, so you'll probably find it to be the best option in any case.

Using the Colpitts b.f.o. I found it very easy to resolve s.s.b. signals for long periods of time without having to alter the tuning core. It put new life back into that old receiver!

Shopping List For Hartley Oscillator BFO

<table>
<thead>
<tr>
<th>Resistors</th>
<th>1</th>
<th>R1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon film 5% 0.25W</td>
<td>100Ω</td>
<td>220kΩ</td>
</tr>
<tr>
<td></td>
<td>1000Ω</td>
<td>470kΩ</td>
</tr>
<tr>
<td>Capacitors</td>
<td>1</td>
<td>R1</td>
</tr>
<tr>
<td>Miniature ceramic</td>
<td>100pF</td>
<td>C101, 104</td>
</tr>
<tr>
<td>0.1µF</td>
<td>2</td>
<td>C102, 106</td>
</tr>
<tr>
<td>Semiconductors</td>
<td>1</td>
<td>Tr1</td>
</tr>
<tr>
<td>Transistor</td>
<td>BC182L</td>
<td></td>
</tr>
</tbody>
</table>

Miscellaneous

Suitable i.f. transformer, recovered from scrap radio or bought new, Maplin HX43 or similar suitable. Optional fine-tuning capacitor (Ct) 20pF. These are obtainable at rallies or you can use the f.m. tuning section of Maplin FT79L, as these are 20pF maximum, p.c.b. (PWR PCB Service).

Shopping List For Colpitts Oscillator BFO

<table>
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<tr>
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<td>R1</td>
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<tr>
<td>Polypropylene</td>
<td>200pF</td>
<td>C101, 104</td>
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<td>1nF</td>
<td>2</td>
<td>C102, 106</td>
</tr>
<tr>
<td>Semiconductors</td>
<td>1</td>
<td>Tr1</td>
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<tr>
<td>Diodes</td>
<td>1N914</td>
<td>D101</td>
</tr>
<tr>
<td>Transistor</td>
<td>MF102</td>
<td></td>
</tr>
<tr>
<td>Inductors</td>
<td>Radio frequency choke RFC101</td>
<td>1mH (see miscellaneous)</td>
</tr>
<tr>
<td></td>
<td>RFC101</td>
<td>(See text)</td>
</tr>
</tbody>
</table>

Miscellaneous

The variable capacitor, C101, can be 20pF section of f.m. section of Maplin FT79L. The i.f. transformer (T101) can be recovered from scrap radio as in the Hartley version, or bought new (see Hartley version of b.f.o. project). The r.f.c. (RFC101 can be Maplin ref. WH47B).
Experimental 430MHz Wire Antennas

The two antennas I'm going to describe came about from a series of experiments. But, I'm going to describe them individually.

The diagram in Fig. 1, shows the first experimental antenna. For this version, which is a 5x8 over 5x8 collinear antenna, you'll need a piece of hard drawn copper wire 1.5 metres in length.

Take the length of wire and straighten it out. But be warned, this isn't as easy a task as it sounds!

I've found the best method to straighten the wire out, is to start by fixing one end to something that won't move. Then, all you have to do, is ask someone to pull the other end as hard as possible, by leaning back and using their weight against it.

While this kind person is pulling, and the wire is under tension, you can be busily 'wiggling' the kinks and bends out by hand.

Vital Statistics

Now let's look at the vital statistics of the project. It's easy enough, as all the measurements are made from one end. You'll see I've marked this as point A in Fig. 1.

Mark all the points B-I out before you start. I find a small triangular file provides one of the best methods of marking this wire, as it is rather hard. Make rings, or nicks (but not too deep) on the wire at the distances shown, taking care to measure everything accurately.

Bending Wire

You start by bending the wire at a right angle at point B, and trapping it against a length of 12.5mm (1/2 inch) dowelling. I use a self-gripping wrench for this job.

Keeping about 7mm between each turn, wind the wire in a clockwise direction around the dowelling as tightly as possible. After four turns, this should bring you to point C, which should be in line with the section A-B.

Now bend the wire, again at a right angle, to continue in the original direction. At point D, repeat the process with the dowel and pliers, to create a similar coil to above.

The next job we have to do, is form the T match feed-line. From point E, make a mark at 178mm in the direction of point I. This is to become the centre line (mid way between G and H) of the 'u' bend at the bottom of the 'J' match section.
**Tuning Arrangements**

The tuning arrangements are straightforward. Make up a 'patch' lead to fit your s.w.r. meter, using good quality crocodile clips on one end.

Ideally, the 'patch' lead should be an odd number of half wavelengths long at the centre working frequency of 434MHz. The free space 1/2 wavelength of 434MHz is 346mm. Taking the usual velocity factor of coaxial cable as 0.66, this would give a coaxial 1/2 as 228mm.

To start the tests, suspend the antenna from the ceiling (or somewhere out of the family's way!), using nylon mono-filament fishing line or similar. Don't forget to keep the antenna, as far away as possible from anything that might detune the system.

Next, you should attach the coaxial outer clip to the short side of the 'J' and the inner on the long side. Once this has been done, you can begin to adjust the feed-point to give the lowest s.w.r. reading possible.

It's not a difficult process, as long as you remember the following rule. And that golden rule is: keep both clips equal distances from their points G or H as you adjust the feed-point.

**Potted Antenna**

When you are happy with the s.w.r. measurements you’ve obtained from the antenna, solder a piece of 50Ω coaxial cable to the same positions as the clips. Then check the s.w.r. again, to see that it’s still low.

If all is well, the antenna may be 'potted' into a piece of plastics water pipe. This is not a difficult job, and it will provide a neat finish, as shown by the diagrams in Fig. 4 and 5.

**Antenna Two**

Having tackled the first project, I'll describe antenna two. As you've probably surmised, the second version I’m going to describe, is based on the first antenna.

Project number two is slightly different, as I've added another 5/8 section to provide greater gain. This time, I've also altered the phasing arrangements between the upper two sections of the antenna.

Before you start, look at the diagram in Fig. 2 which is the linear diagram of the second project. The new phasing sections, comprising B-C and D-E are phasing lines, rather than phasing coils. I have retained a phasing coil for the lower section, between points F and G.

**Same Methods**

Using the same methods and techniques as described above, mark out the various distances from the reference (point A) as shown in Fig. 2. Once this has been completed, for the time being, just leave the two sections, B-C and D-E as shown in the diagram.

Next, beginning at point F, using the dowelling method I’ve already described, wind the section F-G into a four turn coil. The coil must be wound with about 7mm between the individual turns.

**Repeat The Process**

Now we have to repeat the bending process. This is done to form the 'J' match section, just as we did for the first antenna.

The next job is the bending of the two phasing lines. These two sections of the antenna are formed...
as shown in the diagram in Fig. 3.

The diagram in Fig. 3 demonstrates the most compact method of bending the wire, and the overall diameter of the phasing section should be about 20mm. The antenna elements run centred through the phasing sections.

Another method is to wind the whole section around a length of 25mm (one inch) dowelling to form an almost complete loop. However, this method is slightly less compact, and the loop formed is off to one side of the antenna, making the 'potted' project quite large in diameter.

Setting Up

As with the first antenna, we have to set up the feed-point to achieve the lowest s.w.r. possible at band centre, 434MHz. Once again, this is done by moving the feed-point on the 'J' match section so as to provide the lowest s.w.r. reading at 434MHz.

Note: There's an important point to remember, if the antennas are to be mounted on a metal pole, as shown in Fig. 5. When mounted in this way, you must make sure that the cross support plastics tube, is in-line with the feed-points on the 'J' match section of the antenna.

Radiation Pattern

I make no claims for the gain or radiation pattern. As the results achieved will vary between antennas, I only offer these designs as a basis of experimenting with antennas at u.h.f. frequencies.

Even though I've qualified my results, they've worked for me. In my location, using either antenna, I can gain access to repeaters that a 'Slim-Jim' design is unable to do under the same conditions.

These two projects are fun to build, cheap to make and they work. Go on, have a go yourself!

How Much? How Difficult

Shopping List

Copper wire (see text), coaxial cable, crocodile clips, suitable length of 19mm plastics water pipe, mast clamps, plastics insulation tape, plastics filler material for sealing antenna into housing tube (fills such as Plastic Padding, available at car accessory shops are suitable for this job, but make sure that the material you use is not loaded with metal and that it's not a conductor). Warning: Many plastics filler materials give off inflammable vapours that can be dangerous in confined areas. Be safe, and follow the manufacturer's advice on where and how you mix the material.

For Sale

- **Racal RA171 h.f. receiver**
  - with service manual. Stave, Essex. Tel: (0730) 296285 after 7.30pm.

- **Swan 355 transceiver**, s.s.b., 3.5, 7.0, 14 & 28MHz with power unit, mic, handbook, 400W p.e.p. carriage paid. Tel: (0504) 46154.

- **Drake model DC-4 power supply**.
  - Your price on cash and carry. P. Gater, NB Halcyon, Orchard Marina, School Road, Ruthwell, Northwiche, Cheshire.

- **Any coils for HRO receiver**, mains p.s.u. and matching loudspeaker.

- **Mounting base** for BC-34-40 receiver's cabinet, Dynamotor DM29 and filter, two sprung loaded jack caps, any MCR receiver coils. A. J. Humphries. Tel (9696) 40387.

- **Panasonic RF-865 short wave receiver** features include 36 memories, b.f.o., scanning and l.c.d. display, c.w. soft case, a.c. p.s.u. and long wire. Boxed as new with manuals, £190 and p.n. Tel: Ian (0354) 668080.


For Sale 6ft tower, including winch, a home-brew tower in the same style as Versatower. Full mount but can be converted to post mount. Needs tidying up and cleaning etc., £150 buyer collects. John GEHT, Leeds. Tel: (0530) 879784.

- **For Sale D100 deluxe converter**, bands 1, 2, 3, 4 & 5 - wideband reception, £50, buyer collects.

- **Yaesu FT-200RII**, 18 months old complete with Nicad batteries and carrying case, £275. Tel: (0884) 72680.

- **For Sale Masthead Amps**, UHF CM706, CM721, v.f.h.o. fringers 1220-3, v.h.o. 40-2300MHz, 12V p.s.u., £10 each item. DXTV D100 deluxe converter, bands 1, 2, 3, 4 & 5 - broad sound variable, £200. Sat dishes + mounts, 600mm, £40, 600mm, £20. Tel: (0729) 79318.

- **For Sale Realistic PR-2001 v.h.f. u.h.f. scanner**, 16 channel, very good condition, boxed with manual, £75. Tel: 051-407 5911.

- **For Sale Working PW49'er in-car short wave receiver** to medium wave converter for 6MHz to medium wave converter for 6MHz band to specifications - see PW January evenings. Offered for the two, both in good condition. Diamond D130N discone antenna for multimode mobile, fist mike, two mobile mounting brackets, two power leads, workshop and operator's manuals, 12-element ZL special antenna with rotator. All in good condition, £200 the lot. Tel: (0562) 515305.

- **For Sale Yaesu FT-290R multi-mode transceiver** with accessories. Microwave linear amplifier MM1, 144/100S. Toyo s.w.r. meter 144/430MHz, 12-element ZL special antenna with rotator. All in good condition, £300 the lot. Tel: (0393) 21126.

- **For Sale Kenwood 231E 144MHz mobile**.
  - £200. Kenwood 43IE 430MHz mobile, £145. Dantone 144MHz mobile, £100. All as new - base unit only. Clark t.n.c. (v.5.8 Eeprom available), £140. Paul G4KOF. Tel: (0203) 515201.

- **For Sale Panasonic RF3100 32-band radio** communication receiver, very little used, e.g. with earphones, mains p.s.u. and long wire antenna, boxed with instruction book, £135 inc p&p. 3000L, Cumbria. Tel: (0940) 912092.

- **For Sale Kenwood 431E 430MHz mobile**, £290. Komtec 123MHz mobile, £40. S11E 1233MHz mobile, £400. As new - use base only. W4RGM, £199. Paul G4KOF. Tel: (0203) 515201.

- **For Sale Yaesu FT-290R multi-mode transceiver**
  - with accessories. Microwave linear amplifier MM1, 144/100S. Toyo s.w.r. meter 144/430MHz, 12-element ZL special antenna with rotator. All in good condition, £300 the lot. Tel: (0562) 515305.

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The Nelson Electronics
21 and 28MHz Cubical-quad Antenna

Rob Mannion G3XFD, who bumps his head at just over two metres, pictured standing next to the cubical-quad antenna.

Rob Mannion G3XFD has been using the kit-form Nelson Electronics cubical-quad for over a year. He says, that despite its size the cubical-quad has got a lot to offer the h.f. enthusiast, even when they’ve only got a small garden.

The cubical-quad antenna has a fascinating history, which started high up in the Andes mountains in South America. In fact, I recommend that you read the book All About Cubical Quad Antennas by William Orr W6SAI and Stuart Cowan W2LX.* The book is compulsive reading, and there aren’t many technical books that fall into that category! You’ll also learn a lot about the antenna and just what you can and can’t do with it.

Without any doubt, the cubical-quad must be one of the most well-known amateur radio antennas. However, unless you read the book already mentioned, you’ll probably never realise it started life as an answer to a broadcasting engineer’s prayer over 50 years ago!

What Is A Cubical Quad?

Those readers who may not know much about this form of antenna, are probably asking ‘what is a cubical quad’? So, to answer the obvious question, I’m going to quote the most concise reference to hand.

William Orr W6SAI says in his Radio Handbook (21st edition) that “The cubical-quad beam is a parasitic array whose elements consist of closed loops having a circumference of one wavelength at the design frequency.

The loops may take a diamond, square or triangular shape. The cubical-quad beam has proven to be a very effective antenna, and provides somewhat enhanced gain over a Yagi having an equal number of elements”.

I think that the W6SAI definition is excellent, but as this is a review, I’m going to share my experience of building, erecting and using this kit-form antenna. After all, that’s what a review is all about and I’ll leave the full theoretical treatment to our antenna specialists.

Well Packed Kit

The Nelson cubical-quad for 21 and 28MHz comes in a well-packed kit form. Ernie Quinnell G4JEV, the designer and manufacturer of the antenna, has produced a good quality kit, complete with fibre-glass spreaders, aluminium alloy spider (it’s a boomless design) and everything you need.

Tex Swann G1TEX and I already own the excellent little v.h.f. cubical-quad produced by Nelson Electronics. This version of the antenna covers 50, 70 and 144MHz, and it has proved to be an ideal small space antenna to get going on v.h.f.

The longer-established 21 and 28MHz cubical-quad kit was just as easy to assemble and adjust. In this case, G4JEV’s homespun, and user-friendly instruction booklet proved to be very helpful with the assembly of the antenna.

For best results, all antennas have to have fine tuning carried out, and the cubical-quad beam is no exception. In fact, G4JEV points out to all his customers that experimentation is necessary. There’s no need to worry though, as the adjustments are extremely simple, and even easier to carry out.

Easy To Assemble

The cubical-quad I’ve had on loan from Ernie G4JEV, is well travelled. Fortunately, it’s very easy to assemble and the components are robust. It’s also proved to be capable of withstanding the British climate!
Although it's a 21 and 28MHz antenna, this cubical-quadrant is still large. Each of the fibre-glass spreaders is almost 2.5m long when mounted into the central spider.

The four spreaders (these are coloured a light shade of green) are fixed into the central spider by stainless steel screw. They're a tight fit at first, but once in place they are quite secure.

I replaced the self-tapping screws supplied by Nelson Electronics, for larger versions. Although this meant that I had to drill a bigger hole for each of the four spreaders, I ended up with a larger screw to take the load. (It was also easier to screw in and out.)

The wire for the loops comes ready cut. All you have to do is to attach the loops using the supplied small plastics cable-ties on the spreaders.

The cable-ties are held in place by circular hose-clips on the spreader itself. They can be adjusted and slid up and down the spreader.

Setting Up

The job of setting up the cubical-quadrant was very simple, but it takes some time because of the sheer size of the job. As recommended by G4JEv, I assembled the reflectors first.

All the spreaders are marked with a coloured band, showing the recommended starting points for the appropriate element. This is helpful, as you then have an idea of where to begin.

Ernie Quinnell says in his instructions that "at my location the 28MHz reflector comes out at eight foot four inches". Then he concludes by reporting the 21MHz reflector length "came out at 11 foot two inches".

Included in the kit are two very useful little aids to setting up the reflectors. They're in the form of small, pre-formed (and clearly marked for each band) diameter loops of heavy gauge wire.

Although they aren't depicted in a circuit diagram of the antenna, the coils are placed in the appropriate reflectors. Tuning the antenna, and adjusting it for either maximum gain or front-to-back ratio is then made much easier.

When you're ready to tune the reflectors, all you have to do is to squeeze the coils gently, or pull them out. In other words you compress the coil to lower the frequency, and stretch it out (lengthen the coil) to increase the frequency.

Maximum Forward Gain

I adjusted the antenna for maximum forward gain, using my dip-meter to help tune the driven element. As I wanted to use the antenna on the c.w. portion of both bands, I had a loop coupling on the end of the coaxial cable connected to the driven element.

The loop coupled into my dip-meter. I tuned the driven element to the centre of the c.w. band. All I had to do then was to adjust the loop on the reflector, while my wife was watching the field strength meter needle moving. This was necessary as I had placed it almost 50 metres away, down the garden!

One of these days, I'm going to make myself a field strength meter with an audio indicator. It's much easier to listen for a peak on a distantly-placed field strength meter this way.

The audio technique is especially useful if you arrange it (with a suitable voltage to frequency chip) so that the highest output in voltage from the meter provides the highest frequency output on the audio indicator, in the same way blind radio amateurs tune up a transmitter.

Busy On The Bands

Once I had set up the cubical-quadrant, it was time to get busy on the bands. It was a new experience to me, to be able to null out interfering stations and pull the DX out of the noise!

To make any sense out of a review such as this, the antenna on test must be compared to a known standard. In my case I already had a 28MHz dipole, and all I had to do was to erect one for 21MHz.

Both comparison antennas were mounted approximately seven metres above the ground, with the main lobes firing east and west. For the tests, I mounted the cubical-quadrant on a short mast which made the lower parts of the elements loops clear the ground by only two metres or so.

I've always been told that one of the biggest advantages of the cubical-quadrant, is that it works extremely well when mounted almost at ground level. So, I kept it at a convenient height, and this enabled me to turn the antenna by hand.

Excellent DX Antenna

The late Charles Shirley G3PZO, was a source of constant envy in the Southampton Radio Society of Great Britain Group. Charles, despite only having a very small garden and using a 14, 21 and 28MHz cubical-quadrant antenna mounted less than a metre above ground, consistently worked the most exotic DX imaginable.

I'm now referring back nearly 30 years, to the days of amplitude modulation. It was when most DX hunting amateurs seemed to be running around 150W into their p.a., trying to work those exotic calls.

However, dear old Charles scored every time, and his rotund little figure used to swell even more with justifiable pride when he told us the latest news. He was doing even better, running 50W d.c. input, and using a cubical-quadrant in his tiny garden!

Band Conditions

So, with G3PZO's success in mind, I got busy. I started on 21MHz first, as band conditions weren't so good on 28MHz.

Using a KW2000C running into the cubical-quadrant, I was soon working into the east coast of the USA. It was late on a Saturday afternoon and I could have filled my log-book with QSOs.

Using c.w., I asked several stations to provide me with comparisons between the cubical-quadrant and the dipole. That was when I came unstuck, because none of the stations I was working could hear me on the 21MHz dipole.

In fact it was only after a period of several days operating that I found an American station who could hear me on either antenna. The station I worked, gave me a report of RST589 on the cubical-quadrant, and a wavery S-5 on the dipole.

Although I couldn't prove that the dipole was orientated to best advantage, I was running the cubical-quadrant horizontally polarised (fed at the bottom). In my opinion, the test was entirely satisfactory because without the cubical-quadrant, I would have only been heard by one American station during the test period.

Conditions Improved

I had to wait some days before conditions on 28MHz improved. It was worth the wait, because I found that not only did the cubical-quadrant bring the DX out of the noise, it greatly reduced QRM from the many European stations chasing the same DX.
Conclusions

Following the extended loan of the antenna, I came to several conclusions. The first, and most important, has got to be the success of the antenna when it was operating only just above the ground.

The second conclusion, drawn from the first, is that the cubical-quad can be considered as a viable directional antenna for a smaller garden. The only problem prospective buyers will have is whether or not their families object to the antenna.

Personally, I find the cubical-quad to be an attractive antenna. When they’re well-constructed, the cubical-quad doesn’t seem so obtrusive (provided they’re not mounted too high) as a Yagi array.

The cubical-quad antenna in theory also has a gain over an equivalent Yagi array, and occupies less space. This theoretical gain however, can be lost easily if the antenna is not maintained properly. How many cubical-quad antennas have you seen with wires that are loose and dangling in the wind?

Summary

During the loan period of almost a year, I’ve had plenty of time to observe the effects of the weather on the Nelson Electronics cubical-quad. The only comment resulting from these tests, is that I recommend that the connecting boxes be fully weather-proofed.

The connecting boxes are made from ABS plastics. They are supplied with PL259 sockets on one side and terminals (for the wire element loops) on the other side.

For long-term operation they need to be fully waterproof, and I used self-amalgamating tape for the plug and socket. The terminals on the other side posed another problem, but this was solved by moulding bee wax around the connections.

I have no hesitation in recommending the Nelson Electronics 21 and 28MHz cubical-quad antenna kit to readers. They’re great fun to use, and if you don’t have room for a Yagi array in your garden, the cubical-quad antenna could be the answer for you. Among other products (including the new JEV a.t.u.) Nelson Electronics also produce a three-band version of the cubical-quad which includes 14MHz (costing £270).

My thanks go to Ernie Quinnell G4JEV of Nelson Electronics for the loan of the review antenna. The 21 and 28MHz version can be obtained from them for £210 plus £15 post and packing at 36B The Green, Stubbington, Fareham, Hampshire PO14 2LE. Tel: (0329) 668080, FAX (0329) 668068.

* Available from the PW Book Service, cost £6.75 plus £1 p&p.
s we've got a rather special antenna theme to PW this month, I've been rather busy working with antennas. In fact, one or two of the reviews I got my teeth into, have whitened my appetite for further antenna experimentation.

You may remember that I said last month, in the first of the 'In The Workshop With...' articles, my workshop is equipped with only what I consider to be basic equipment. In fact, since then, I've lost my oscilloscope as the p.s.u. started to imitate a coal-fired power station for a short time!

Despite only having a basic collection of tools and equipment in my workshop at home, I'm always on the lookout for labour and time-saving gadgets. My wallet (barely seen in the office) came out several times at the recent RSGB NEC show.

Among the items I bought there, were a set of one-handed operation wire strippers (very useful for me), a tiny gas-powered soldering iron, and a set of six Cyclon 2V rechargeable cells. When I bought the battery pack, I didn't have a specific use in mind, but I quickly found them to be very useful.

**Antenna Analyser**

Following all the testing and preparation I have been involved in recently, I think the idea of a suitable antenna analyser would be useful. So, it was a remarkable coincidence that when I had the chance to borrow the MFJ-247 h.f. antenna analyser, at the same time as I was working on the antenna reviews.

It's not often you get a real innovation, such as the combined instrument available in the form of the MFJ-247. In one unit you get the facilities to find the resonant frequency of your antenna, the s.w.r. of your antenna at a particular frequency and the frequency at which the antenna provides the lowest s.w.r.

I soon found that there was one possible problem to this useful item of portable equipment, and that was the power consumption. As the analyser comes with its own built-in frequency meter, it consumes a fair bit of current.

Although MFJ recommend alkaline batteries, I decided to use the external power supply socket to feed 12V d.c. from the 12V Cyclon pack I'd bought at the NEC. End of problem!

**Practical Use**

As I was evaluating various antennas, including an h.f. cubical-quadr and an h.f. vertical, I found the analyser very useful. It covered all the h.f. bands from 1.75 to 33.75MHz.

The analyser is a dream come true for frustrated antenna experimenters. I managed to make the measurements of the antenna under test at the input to the feed-line, and thanks to a prepared chart (supplied by MFJ) was able to determine the s.w.r. at the antenna. It proved to be simple to use. All I had to do was to connect the coaxial cable feed-line into the antenna socket, set the appropriate band, and then adjust the frequency dial of the analyser to the frequency I wanted to check.

I then read the s.w.r. measurement from the meter on the analyser. This provided the s.w.r. measurement at the input to the transmission line looking towards the load (the antenna).

Previously, I had already determined the loss involved on the cable between the input and the antenna. I then used the prepared chart provided by MFJ to determine the s.w.r. at the antenna.

**Useful Plotting**

After a little practice, I realised that the analyser was very useful for plotting s.w.r. versus frequency results with antennas. It became obvious to me that the analyser would enable a great deal of time to be saved, for anyone doing regular antenna checks.

Intrigued with my results, I put the unit through other tests. To do this, I connected my trapped dipole up, and used the MFJ-247 to find where the best s.w.r. was for that antenna. I was surprised at the results, although on reflection (forgive the pun) I should not have been.

My trapped dipole had showed far more 1:1 readings than I had expected to see, as I had tuned the analyser over the bands. I was interesting to then verify these results against a transmission test using a standard s.w.r. meter. I soon realised that a test such as this, would enable anyone to quickly evaluate alterations and modifications to multiband antennas.

**Adjusting Antenna Tuners**

I've got several antenna tuners, and I'm often to be found adjusting and modifying the various units. Following the manufacturer's suggestions, I discovered an easy way of setting up and testing a.t.u.s with the help of the analyser.

With a one metre length of coaxial cable connected between the a.t.u. transmitter input and the MFJ-247's antenna connector, the test was ready to go. I then switched the 247's frequency to 7MHz (the band I was checking on my a.t.u.) and adjusted the a.t.u. for best results:

It was a simple process, and I was able to determine the very best setting on my home-brew a.t.u., without causing the p.a. to overheat or even having to be on the air at all!

**Frequency Meter**

The MFJ-247 is equipped with a frequency counter, and this "extra" makes it a very useful item indeed. In normal use, the counter measures the analyser's own oscillator frequency, although an external probe allows external measurements to be made.

The frequency counter, with an input sensitivity of approximately 600mV, covers from 100kHz to 150MHz. This means that the MFJ-247 is a versatile little instrument.

**Club Investment**

After I had completed my tests, I had time to sit and think about this little unit. I came to the conclusion that buying an MFJ-247 would be an ideal club investment.

I'd like one of these analysers myself, but could I justify buying one? Although I think most amateurs would like something like the MFJ-247, they would probably be in the same position as myself.

If a club did buy one, they'd soon recover the outlay by hiring it out to members. So, perhaps that's the answer for this particularly useful instrument. In the meantime, I suppose I'll have to start saving up to buy one myself. I wonder what other fascinating new instruments, tools and gadgets are on their way from MFJ and other manufacturers?

If you know of something useful in the workshop line, let me know, and I'll gladly try it out. Perhaps together we might get more people back into their workshops and building more projects!

My thanks go to Waters and Stanton for the loan of the MFJ-247.

It costs £189 including p&p and is available from them at 22 Main Road, Hockley, Essex SS5 4QS.

Tel: (0702) 206835.

This month, while busy in his workshop, Rob Mannion G3XFD has been using the MFJ-247 h.f. s.w.r. analyser while testing antennas.
PW SPECIAL OFFER

Portable Mast Special Offer - £59 plus £8 Carriage.
A Saving Of £20 On The Normal Price!

To coincide with the magazine's antenna theme, we’ve got a rather unusual offer, in the shape of the Extendamast portable mast.

Going on holiday? How many times have you wanted a simple, easily erected portable retracting mast so you can enjoy the hobby away from home?

Operating a demonstration station at a local event? We all know the problems involved when trying to rig temporary antennas at shows and other events. It’s hard work climbing trees and ‘making do’.

Now, your problems are over! The inexpensive, portable and easily-handled aluminium 10 metre retractable mast can be yours for only £59 plus £8 carriage. At this price you can afford two and be entirely independent of trees, buildings and the other ‘last resort’ antenna rigging points. The steel parts on the mast are corrosion-protected and they will provide many years of useful life.

As the Extendamast system is so flexible, and individual requirements are different, the mast does not come with a guying kit. However, rope and other guying materials of your choice are available at rallies, hardware stores and marine chandlery shops.

HOW TO ORDER

Complete both coupons, in ink, giving your name and address clearly in block capitals. Coupon (2) will be used as the address label to despatch your mast.

Send the coupons, with your cheque, to: PW Special Offer (September), FREEPOST, Enefco House, The Quay, Poole, Dorset BH15 1PP.

If you wish to pay by credit card (Access, Mastercard, Eurocard or Visa only), please fill in your card details and sign the coupon where indicated.

PW Publishing Ltd., Poole, Dorset
(Reg. No. 1980539, England)

32 Practical Wireless, September 1992
### Reg Ward & Co Ltd.

**Address:** 1 Western Parade, West Street, Axminster, Devon, EX13 5NY. 
**Telephone:** Axminster (0293) 34918

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**Instant credit available**

Mail/telephone order by cheque or credit card. Cheques cleared before goods despatched.

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I’ve provided the following notes to try and encourage more radio amateurs to experiment with antennas. Of the many facets of amateur radio, in my opinion antenna experimenting is the most fascinating.

The appeal of this aspect of radio lies in its practical simplicity. Working antennas can be constructed from materials obtainable from the junk yard, hardware store or garden centre.

So, without further ado, let’s explore the possibilities that a bit of ingenuity, experimentation and the practical approach can do for our signals.

Let’s experiment with antennas.

**Beam Antennas**

If you want to upgrade your h.f. antenna from a dipole, long wire or G5RV type, I’ve no doubt that you’ll have probably considered various forms of beam antennas. However, the difficulty for most enthusiasts is that even a 2-element beam at 14MHz has a span of some 11m.

To mount such an antenna up some 10 or 12m high is a complex civil engineering undertaking. Unfortunately, for radio amateurs this is a fairly universal problem.

The solution would appear to make a compact version of a 2-element beam. This can be done by either using loading inductors or linear loading to shorten the physical length, or to use full length elements and to bend them. The 2-element metal and wire beam antenna, shown in Fig. 1, is my solution to the problem, and I call it the Double-D. The driven element is fed with coaxial cable via a gamma match, and the other element is a parasitic reflector.

The antenna uses bent elements, thereby reducing the overall span. When compared to a full size 2-element beam the size is reduced by 50%.

**Compact Antennas**

Just how effective are these compact antennas? Unfortunately, because of the perceived difficulties of measuring antenna performance, it’s rare to find relative gain figures and directivity measurements (radiation patterns) included with articles on a particular antenna design.

The difficulty of experimenting with a radically new h.f. antenna configuration, is that even a compact antenna is rather large. However, an antenna for 28MHz is half the size of one for 14MHz, yet it’s performance is the same.

The performance is the same, because wavelengths, capacitances and inductances are reduced in proportion to the linear dimensions, while gains, impedances, dielectric constants and permeabilities are unchanged.

This can be taken a step further, by studying the performance of a model of the proposed antenna at v.h.f. If this approach is adopted, your antenna test range can then be accommodated in the back garden!

**Most Practical Band**

The 144MHz band is the most practical for experimenting with a new and different antenna configuration. On the 430MHz band, the antenna size is too small to accurately model the antenna construction detail, and the scale factor is rather large.

Unfortunately, the 50MHz band has its own problems. It would not normally be possible to perform the tests in the average size garden.

The antenna performance is measured by exciting an antenna with r.f., and measuring the resulting field strength. Because of the reciprocity between transmission and reception, it’s not important which antenna is energised and which is used as the receiving antenna.

On most antenna measurement ranges, the transmitter (source) is used to energise an antenna that floods the area with r.f. The antenna under test (a.u.t.) is coupled to the receiver or field strength meter (f.s.m.).

When making antenna polar diagrams in the back garden, I prefer to use the test equipment the other way around and energise the a.u.t. I then use a simple antenna at the receiver or a f.s.m. There are two reasons for doing it in this way:

1. The s.w.r. of the a.u.t. can be monitored. This ensures the antenna is matched to the feeder in the first place. Any subsequent change in s.w.r., as the antenna is rotated, could indicate coupling into nearby objects, that may affect the results.
2. The s.w.r. meter can also be used as a sensitive indication of transmitter relative power output.

**Items Required**

The following items are required to test v.h.f. antennas:

1. A transmitter, with variable power control. The source transmitter should also be stable and free of spurious outputs. In practice, it can be an amateur radio transceiver whose transmitter power output level can be controlled, such as the FDK Multi-700EX.
On the other hand, any surplus commercial or military transmitter will do, with the proviso that it covers the amateur bands. The most important feature it should possess is that the r.f. power output should be variable.

2. A diode field strength meter (f.s.m.) with remote analogue or digital field strength level indicator.

3. Loop or dipole antenna for field strength meter.

4. The antenna under test (a.u.t.).

5. A suitable a.u.t. mast and rotator mechanism.

If you want to make radiation patterns, then you also need to have some sort of indication of the directions to which the a.u.t. is pointing, relative to the test f.s.m. A suitable system can be made from a wooden base, painted white, (or use white plastics covered wood) with a direction indicator drawn on it with a black felt-tip pen.

A bolt can be fixed to the centre of the indicator and the mast, with a length of copper or alloy tube, slid over the bolt. An indicator pointer can be then be fixed to the bottom of the mast with a screw type hose-clip.

6. You will also require a s.w.r. meter, coaxial cable and connectors.

**Measuring Field Strength**

To begin the measuring of the antenna field strength you should position the diode f.s.m., with a suitable antenna, approximately eight or 10 paces from the a.u.t. Place it at a point where the maximum signal strength is likely to occur, at 0° on the rotator indicator. Don’t forget to put the f.s.m. level indicator where it can be clearly seen from the operating position.

Set up the transmitter, feeder, s.w.r. meter and the a.u.t. Switch on the transmitter. Then set the power level to, let’s say 30% of maximum, and check that the antenna matching is at the optimum (lowest s.w.r.).

Tune the diode f.s.m. for maximum meter deflection. Fix the height of the f.s.m., so that it is well inside the main vertical lobe of the a.u.t. radiation pattern.

Re-adjust the transmitter power if necessary. The test range itself can then be tested with a dipole and a 3-element beam.

By measuring the radiation patterns, you can check that they are similar to those found in antenna books. You can then start experimenting with the antenna that’s on trial, and compare it with a standard antenna.

Don’t be afraid to be adventurous with various configurations. When you have found a design that appears to be efficient, you may then want to plot a full polar diagram.

**Plotting Polar Diagrams**

Plotting polar diagrams isn’t difficult. All you have to do, is rotate the a.u.t. for maximum signal strength on the f.s.m. signal level indicator. Next, you should adjust the transmitter power level for about 75% of f.s.d., if using an analogue meter, or for about 2V, if using a digital meter.

Then set the s.w.r. meter to forward reading and adjust the level to a clearly defined re-settable point. Fortunately, the meter scale on most s.w.r. meters is red at levels greater than 3:1. This is a good point to set the r.f. power level at, for reference.

Record the reading on the f.s.m. level indicator, and then rotate the a.u.t. in both directions, to ensure the point of maximum gain is near 0°. Then rotate the antenna through 360° while watching the f.s.m. signal level. In this way, you can gain a mental picture of the a.u.t. pattern.

**Useful Testing Tip**

Here’s a useful antenna testing tip. You’ll find it’s helpful to make the following preliminary check to ensure the antenna is working reasonably well, before going through the routine of recording the data.

Here’s what you should do: Set the a.u.t. to 0°, and record the level. Switch off the transmitter. Then you should rotate the a.u.t. to a new heading. I usually take a reading every 10° at the main lobe maximum to identify the point of maximum gain, otherwise readings every 20° may suffice. Additional readings can be made to identify the nulls.

If you are using the simple antenna rotator, rotate the a.u.t. to the new heading. Then move away from it before making any further measurement.

The transmitter is switched off and on between measurements because most transmitters are not continuously rated. Also, the channel should be monitored, and identification announcements made periodically. This is good operating practice, and it’s a licence requirement in the United Kingdom.

**Plotting Automated**

The polar diagram plotting process can be automated, by using a computer. This method takes much of the work out of plotting polar diagrams, and it speeds up the process considerably.

Storage of data and the application of functions for normalisation and conversion from linear to log scales, etc., are tasks ideal for computerisation. Additionally, very complex polar diagrams can be plotted, which would otherwise be difficult using the manual technique.

A method of converting the analogue data from...
the f.s.m., to a digital form, is required. A computer possessing a suitable built-in analogue-to-digital (A/D) converter is preferable, otherwise a special A/D converter has to be bought or constructed.

Suitable software is also required. The software should enable the computer to take the analogue data from the f.s.m., and display it on the screen as an evolving polar diagram while the a.u.t. is rotated.

The a.u.t. rotation must of course, be motorised. Provision can be made for linking the computer to the rotator to supply heading information for the software. This can be done with a positioning digital encoder and input through the I/O port.

Alternatively, the system is simplified by having an adjustable polar plotting time. This is set so that it is equal to the time taken for the rotator to make one complete revolution. A minor disadvantage of the polar plotting method, is that the operator must ensure the rotator and plot routine start simultaneously.

Far more detailed descriptions of these measurements are given in my book The Antenna Experimenter's Guide. Additionally, the book covers measurement of impedance and resonance, together with a chapter on the use of computer modelling such as MININEC.

The book also contains construction details of antennas and listings of all the programs used in the computer antenna measurements. The Antenna Experimenter's Guide is available from the PW Book Service. The book is also obtainable through your local library, quote ISBN number 0 9516024 0 3 if you have to order it.

Whetted Your Appetite?

I hope that in this short article I've whetted your appetite. Perhaps, now that you've seen what's involved and that it's not so difficult, you'll have a go.

I'd like to hear how you get on, and maybe many PW readers will be building their own 'Backyard Beams'. I can guarantee it's fascinating!
Antenna

Have you ever been stuck for guy wires, or not been able to find that special heavy-duty antenna rotator? Do you need an antenna mast suitable for your small garden, or are you after a portable mast? If so, our showcase can help you.

A&A Ltd., Unit 28 Penley Industrial Estate, Penley, Wrexham, Clwyd LL13 0LQ.
Tel: 0948) 7717 or FAX (0948) 74728.

Look out for the three peaks logo of this new company at rallies. If you can't see the logo, look out for the biggest tuned loops in the hall, as they are suppliers of magnetic loop antennas, a.t.u.s, and the VFA antenna. They can also supply, through Dee Comm, capacitors and roller coasters for making your own a.t.u.

Aerial Techniques, 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH.
Tel: (0202) 738232.

Many amateurs enjoy an evening watching television, or you want to cure TVI by providing a better antenna. Aerial Techniques have a catalogue full of antennas, lashings and accessories.

Antenna Accessories.

antennas.

Lake Electronics.

They have a catalogue full of antennas, a.t.u.s, and the VFA antenna. They can also supply, through Dee Comm, capacitors, coils, roller coasters, turns counters and cable for making your own antennas. Alternatively, you can purchase one of their finished antennas.

C.M. Howes Communications, Eydon, Daventry, Northants. NN11 6PT.
Tel: (0327) 60178.

Well-known for quality transmitting and receiving kits, Howes have now launched an active air band receiving antenna to their range. Designed specifically for the air-band, this antenna features a low noise i.c. pre-amplifier. Send an A5 sized s.s.a.e. to the above address to receive a catalogue of antennas, a.t.u. s.w.r. meters and other radio-related kits.

Barencos, 27 Park Road, Barnstone, Nottingham NG13 9JF.
Tel: (0602) 60067 or FAX (0949) 60773.

Barencos may be found at many rallies selling cables and accessories, rotators and hardware plus other products. Barencos manufacture much of the hardware they supply. Send an A5 sized s.s.a.e. for their catalogue.

ICS Electronics Ltd., Unit V, Rudford Industrial Estate, Ford, Arundel, West Sussex BN18 0BD.
Tel: (0903) 7331101 or FAX (0903) 731105.

More usually associated with the supply of equipment for reception of FAX, and weather satellite information, ICS are also the importers of the Isoloop 10-30. This h.f. antenna will fit in the smallest garden, and an earlier model was reviewed in the November 1990 issue of PW.

IFW Technical Services, 52 Abingdon Road, Drayton, Abingdon, Oxford OX14 4HP.
Telephone or FAX (0235) 535981.

This company are program support specialists. It may seem strange to include this small firm in an antenna special, for it doesn't make or supply antenna bits and pieces. They are however, the UK support services for both 'MN' and 'YO'. These are antenna optimisation programs to run on IBM, or compatible computers. More details from IFW at the above address.

Lake Electronics, 7 Middleton Close, Nuthall, Nottingham NG16 1BX.
Tel: (0602) 382509.

Already well-known for his "Kits With All The Bits", Alan Lake G4DVW also produces a range of antenna tuning units, s.w.r. meters and a power meter in kit or ready made form. The Lake Electronics TU2 a.t.u. is to be reviewed in a forthcoming issue of PW. Further details on Lake Electronics from the address above.

Maplin Electronics, PO Box 3 Rayleigh, Essex SS6 8LR.
Tel: (0702) 554161.

The Maplin Electronics new 1993 catalogue, will be...
available through many newsagents from September 4, price £2.95. It contains many pages of antennas, fixing brackets, other hardware, cables and coaxial switches. The catalogue also contains many other radio and electronic products, including s.w.r./power meters, active antennas and tuners.

M. Richards G3WKF, Wayside, Penwithick, St. Austell, Cornwall PL26 8UH. Tel: (0726) 850808.

An interesting series of photographs arrived on the editorial desks a few months ago. The photographs show a multi-element h.f. beam on top of a novel, easy-to-erect mast design. With this mast it's possible to go up as high as 25m, with minimal guying. For more details contact G3WKF at the above address.

The easy-to-erect mast produced by G3WKF.

Nelson Electronics, 36B The Green, Stubbington, Fareham, Hampshire PO14 2LE. Tel: (0329) 668080 FAX (0329) 668068.

Ernie Quinell G4JEV, is well-known for his cubical quad antenna designs, including the antenna reviewed in PW this month, and the v.h.f. model for 50, 70 and 144MHz reviewed in the November 1991 issue. Nelson Electronics also manufacture a.t.u.s and associated equipment.

Nevada Communications, 189 London Road, North End, Portsmouth, Hampshire PO2 9AE.

Dipole traps produced by Q-Tek.

Tel: (0705) 662145 or FAX (0705) 690626.

Already well-known for radio equipment, Nevada also stock an extensive range of antennas for transmitting and receiving. Their latest receiving active antenna, the Scannmaster, covers from 25-1500MHz, with reduced sensitivity down to 500kHz. A catalogue is available for £2 from the above address.

PDSL, Winscombe House, Beacon Road, Crowborough, Essex TN6 1UL. Tel: (0892) 663298 or FAX (0892) 667473.

The PDSL (Public Domain and Shareware Library) can supply, from an extensive library, many programs to run on IBM PC or compatible computers. Among these programs are: 'Wire' and 'Yagimax' version 3. Both programs can help you to improve your antenna set-up and you can also use the prediction programs. A catalogue (£2) is available from PDSL at the above address.

QRTI, The Aerial Centre, 156 Reid Street, Glasgow G40 4PH. Tel: 041-551 8226.

This company is especially well-known for supplying antenna equipment to the remotest parts of the UK. They have a particularly well set-up posterior and parcel service, for even the largest antennas and poles. Although not specifically involved in amateur radio, they are distributors for many makes of antenna and accessories and can supply brackets, clamps and hardware. In fact, QRTI can supply all the paraphernalia needed to erect an antenna, and they're also specialists in satellite and TV distribution equipment.

Q-TEK, R. Benham-Holman G2DYM, Cobhamden, Uplowman, Tiverton, Devon EX16 7PH.

Tel: (0398) 6215.

This company are suppliers of resin-encapsulated, pre-tuned dipole traps for the 3.5-28MHz bands. They also manufacturer and supply the G2DYM Aerial Matching Unit. Contact G2DYM direct, for more information about the products.

RF Engineering, Main Street, Coln St Aldwyns, Cirencester, Gloucestershire GL7 5AN. Tel: (0285) 75665 or FAX (0285) 75657.

Gloucestershire-based RF Engineering are distributors of Barker & Williamson products from America. These antenna and associated items are designed and built to a very high standard. The company supplies silver-plated air-wound coils (as featured on this month's front cover) and high flash-over rated capacitors, suitable for a.t.u. use. They also produce a suitcase-sized antenna for the h.f. bands. A catalogue is available by sending in an A5 sized s.s.a.e. with a 35p stamp to the above address.

South Midlands Communications Ltd., S M House, School Close, Charders Ford Industrial Estate, Eastleigh, Hampshire SO5 3BY. Tel: (0703) 255111 or FAX (0703) 263507.

Although best known for their Yaesu amateur radio equipment, SMC are active throughout the world in the communications and antenna field. The company supplies commercial masts, towers and hardware in conjunction with a design service. In the amateur radio context, this company has many years of antenna expertise to offer, backed by a large choice of specialised hardware, including the famous Strumtech Versatower.

Specialist Antenna Systems Ltd., Radford Fields, Maesbury Road, Oswestry, Shropshire SY10 8EZ. Tel: (0691) 670440 or FAX (0691) 670282.

Formerly known as Western Electrical, SAS Ltd. are suppliers of antennas from h.f. to s.h.f. Their range includes the famous Cushman antennas (see RS review in this issue), Mirage/KLM M2 and Down East Microwave. This company also has facilities for small scale manufacture of special or commercial antennas. For more details, send a large, A4 sized, s.s.a.e. (35p stamp) to the above address.

Sandpiper Communications, Pentwyn House, Penyward Llwycchoed, Aberdare, Mid Glamorgan CF44 0TU. Tel: (0685) 870425 or FAX (0685) 876104.

This company is a manufacturer of antennas for all bands and situations. They are particularly well-known for their rally attendance. Their range of antennas is growing all the time, but they can supply an up-to-date catalogue on receipt of an A4 sized (35p stamp) s.s.a.e. to the above address.

S.R.W. Communications Limited, Astrid House, The Green, Swinton, Malton, N. Yorks Y017 0SN. Tel: (0653) 697513.

More usually known for the SRW Killowatt loudspeaker linear amplifier for the h.f. bands, SRW have added the G3TPW CoWb on antenna. This small (about 3.5m diagonal) antenna covers the 14, 18, 21, 24 and 28MHz bands. As it's horizontally polarised and omni-directional, no rotator is required. Contact SRW for more details.

Tennamast (Scotland), Mains Road, Beith, Ayrshire KA15 2HT. Tel: (0505) 83824.

If you fancy a mast, but thought they were expensive, then the new Adapt-A-Mast from Tennamast starting at £127, may just be the thing you're looking for. This is the latest in a long line of masts and towers to come from this company (the Adapt-A-Mast is to be reviewed in PW in the near future). For further details on their products, contact Tennamast at the above address.
A Simple Antenna Tuning Unit And RF Bridge

I've just completed another transmitter using the drawing-pin construction technique employed in the PW 'Challenger' receiver, published earlier this year. This very simple system is easily understood by novice enthusiasts, and it's also a good bread-board prototyping method.

Because of the success of this simple technique, I thought it would be a good idea to try and build a complete amateur radio station using drawing-pin and a board technique. So, as part of this idea I produced the antenna tuning unit (a.t.u.) and radio frequency (r.f.) bridge to help get that precious energy up into, and out of, the antenna where it's needed!

Many Combinations

With the sort of circuit I'm going to describe, there are many combinations of coils and tuning capacitors that could be tried. I've tried Z-match, T-match, Pi-match (π-match), but I have had consistently good results with a simple L-match.

If first tried this idea out using a project written by the Rev. George Dobbs G3RJV in the Short Wave Magazine in 1980. Since then, I have made many forms of the L-match, and the smallest uses a toroid as the coil. Readers may be interested to know that the design I've just mentioned, using the toroid, was originally published in Sprat, the official journal of the G-QRP Club.

Radio Frequency Bridge

The standing wave ratio (s.w.r.) device used in this project is an r.f. bridge. I prefer this method because the ordinary, cheap, CB radio s.w.r. meters aren't much good with QRP (low power) on the h.f. bands.

Another problem is that the ordinary s.w.r. meter does not present a constant load to the transmitter. If a serious mis-match occurred, there's a good chance that the power amplifier (p.a.) transistor could be zapped.

Another problem is Murphy's Law. This law almost invariably means that it's the most expensive transistor that's zapped, not the 10p rally job!

The Circuit

If you take a look at the circuit, Fig. 1, I'll explain how it works. Firstly, you'll see that there is always a load to the transmitter, and this can save you a lot of bother.

Now let's take a closer look at the problem of mis-matching. The two worst forms of mis-match are an open circuit and a complete short circuit. In the case of an open circuit R1, 2 and 3 are in series. So, in this particular pathway the load is 57Ω. With a short circuit, R5 would go to earth as it's in parallel with R2 and 3.

Students of resistor networks (in other words those of you who are reading 'Maths For The RAE' by Ray Fautley G3ASG), will see that the load provided by the combination of R5, 2 and 3 is now 46Ω. Both values are near enough to 50Ω in practice to be quite safe.

Readers may be interested to know that this attenuator circuit originally appeared in Solid State Design For The Radio Amateur. This useful book was written by Les Hayward W7ZOl and Doug DeMaw W1FB, and is published by the American Radio Relay League (ARRL).

Building The Bridge

Building the bridge and the a.t.u. is simplicity itself. All you have to do is to solder the components and linking wires onto drawing-pins which are pushed into a wooden base-board.

Before you start, you may like to draw the circuit out on a piece of paper, and then lay it out onto your board. Then you can push the pins into the board, finally tinning them with a soldering iron of around 25W capacity.

Alternatively, you can use the diagram in Fig. 2, as a basis of your lay-out. However, before you start, take note that the aluminium front and back panels (attached to the appropriate edges of the wooden base-board) are only shown flat for clarity.

Soldering Tips

If you haven't used the drawing-pin method before, you might like to take advantage of the

It's time to go back to the drawing-pin board! Steve Ortmayer G4RAW has a clever, but very simple idea to help you get the most out of that hard-earned r.f., in the form of a project using drawing-pins as soldering points.

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Practical Wireless, September 1992
Fig. 2: The simple r.f. bridge and a.t.u. laid out on a wooden baseboard, using brass drawing-pins as soldering points. The aluminium front and rear panels are shown flat for clarity. See text for L1 winding details.

Following soldering tips. You can save yourself time, burnt fingers and frustration, by taking advantage of my experience.

When using the drawing-pin method, a larger capacity soldering iron is advised (around 25W). This is because the drawing-pins absorb a lot of heat at first, because of their relatively large surface area.

I thoroughly recommend that the entire flat top of the drawing-pin is tinned. This job only takes a moment or two, but it can save a lot of time when you’re soldering the connections to the pins.

Over the years, I’ve found that by pre-tinning the entire top of the pin, it’s far easier to solder to during the building process. Although it means that you have to use more solder, you end up with a soldering point where you don’t have to melt all the solder, and any other joints already made won’t come off.

You can melt and flow the solder where you need it in this way, because there is so much solder on the drawing-pin! With a little practice you’ll be able to melt the solder just where you need it, and nowhere else.

Warning: If you do pre-tin the drawing-pins as I’ve suggested, don’t touch them for a while, as they can remain hot for several minutes. However, once they’re done, you can save a great deal of time and frustration during the soldering process.

Testing The Project

Testing the r.f. bridge part of the project can be done before the a.t.u. section is built. To start the test, all you need to do is to apply some r.f. into the unit.

Next, you then have to adjust the 10kΩ variable resistor, R6, until the meter reads full scale. Once you’ve proved everything’s okay with the meter circuit, connect a 50Ω dummy load across the output and it should then read zero.

Antenna Tuning Unit

The antenna tuning unit is straightforward and easy to build. I used an off-cut of some plastics piping, sold as ‘inch and a quarter’ (inside diameter) waste pipe. Although this form of piping is very common, the dimensions are not very critical and you may like to use something else that’s handy.

Using the coil former I’ve suggested, you need to wind the coil, L1, so that it has a total of 70 turns using enamelled copper wire. As you wind the coil, you should make one tap every turn between turn one and 10.

A tap, by the way if you’re not sure, is a short loop, just long enough for a crocodile clip to grip. The tapping is drawn out from the coil winding.

When making taps, it’s perhaps best to wind to the point where you’re going to make the tap, and then bend the wire out at a right angle. After you have made the little loop (just large enough for the crocodile clip jaws) continue the winding by completing the loop back to the coil former surface.

Make a further turn, and then gently twist the loop you have made. Once the loop is locked by the twisting action, you can continue the winding and repeat the process at the next point.

Continue winding the coil onwards, making a tap at every 10th turn. This will leave you with 10 tappings between the start of the coil and the 10th turn, and another six between that point and the 70th turn.

Tapping Loops

Finally, when you’ve carefully completed the coil (and it really does pay to take care when winding the coil) it’s time to prepare the tapping loops. To prepare the loops for use, the enamelling has to be scraped away carefully, and you can then lightly tin the bare copper to provide a good contact for the crocodile clip.

Some modern enamelled wire has a coating that melts when you apply the soldering iron tip. It’s a simple job to check to see if you’re lucky enough to have some of this wire.

To test the insulation, just apply the soldering iron and a little solder, if there’s a bit of smoke and...
you can see it’s tinned...you’re in luck. If not, using a small piece of sandpaper, you’ll soon get the wire clean and ready for soldering.

Using The Tuning Unit

The tuning unit can be used with a counterpoise of a quarter-wavelength for each band. In practice, I’ve found that two lengths of wire, one five metres long and the other of 20 metres work well on all the H.F. bands. Connect the counterpoise to the earthy side of the antenna output socket on the a.t.u.

Set up the a.t.u., and adjust it by selecting turns on the coil and by turning the variable capacitor control until the meter reads nearly zero. Note the positions of the variable capacitor and the tappings selected for each band for future reference.

To help you set up your a.t.u., here’s a note of what tappings my unit required:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Tapping Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.95 to 2MHz</td>
<td>16 turns</td>
</tr>
<tr>
<td>3.565 to 3.585MHz</td>
<td>8 turns*</td>
</tr>
<tr>
<td>10.13 to 10.14MHz</td>
<td>3 turns</td>
</tr>
<tr>
<td>21.1 to 21.149MHz</td>
<td>4 turns</td>
</tr>
<tr>
<td>28.1 to 28.19MHz</td>
<td>1 turn</td>
</tr>
</tbody>
</table>

*The results above were achieved when I was using a 20 metre length of wire. This is a quarter-wavelength on the 3.5MHz band, and so it didn’t really need the a.t.u. in circuit.

Switched Out

The s.w.r. bridge must be switched out before you start operating unless you want to start milliwatting. The switching-out is most important, because when it’s switched-in a three watt transmitter will only radiate one tenth of a watt or 100mW!

Having warned you of what should be done, I must admit I have had a QSO with a similar bridge switched in. However, the 0.5W resistors get rather hot and I got comments like “sig vy weak OM”!

Sunspot Years

I’ve already tried the a.t.u. and bridge project on the 21 and 28MHz Novice bands. In years of good sunspot activity, these bands could offer a novice world-wide contacts with their three watts of r.f.

My first QSO on 21MHz brought me a report of RST599, from Uri UA3PV in Moscow. I was using three watts from a home-brew rig in conjunction with the r.f. bridge and a.t.u.

There’s also a good chance of a QSO with American stations. The USA has a Novice band from 21.1 to 21.2MHz and this overlaps the British 21.1 to 21.49MHz Novice band. I wonder who will be the first UK Novice to work an American Novice?

But of course, I mustn’t forget that the American Novices are allowed 70W! So, perhaps that QSO has already taken place.

* Solid State Design For The Radio Amateur is available from the PW Book Service @ £10.95 plus £1 p&p.

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Shopping List

<table>
<thead>
<tr>
<th>Resistors</th>
<th>Values</th>
<th>Capacitors</th>
<th>Values</th>
<th>Potentiometers</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5W 3% Carbon Film</td>
<td></td>
<td>Disc Ceramic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15Ω</td>
<td></td>
<td>10μF</td>
<td></td>
<td>1kΩ log</td>
<td></td>
</tr>
<tr>
<td>27Ω</td>
<td></td>
<td>20μF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51Ω</td>
<td></td>
<td>33μF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2kΩ</td>
<td></td>
<td>1nF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10nF</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Semiconductors

<table>
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<tr>
<th>Diode</th>
<th>Values</th>
<th>Miscellaneous</th>
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</thead>
<tbody>
<tr>
<td>OA91</td>
<td></td>
<td>Coil former</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(see text), 22a.w.g. enameled copper wire, wooden base-board</td>
</tr>
</tbody>
</table>

200 x 80 x 15mm suggested size, aluminium strips to suit base-board chosen 200 x 80 x 15mm suggested size, aluminium strips to suit base-board chosen.

Moving coil meter movement, a 200µA f.s.d. movement removed from scrap tape recorder (battery and signal level indicator), or signal level meter will do (Cirkit type ref. 37-09007, 200µA f.s.d. marked in $ units will do).

Crocodile clips, and miniature coaxial cable (RG174 suitable).
Cushcraft
R5 Five Band Vertical Antenna

The PW technical staff are very conscious of the fact that many radio enthusiasts have very limited space for antennas, so with this in mind, Rob Mannion G3XFD tried out the Cushcraft R5 vertical antenna on the 14, 18, 21, 24 and 28MHz bands to see just what it could do.

Over the years since I've been licensed, I have used many different antennas. Before I was married, I was fortunate in having parents who tolerated wires everywhere, and nowadays my wife also puts up with amateur radio too.

Wherever I have lived, antenna erection has never been a real problem, but not everyone is so fortunate. So, following several letters from readers who aren't able to erect large antennas, I decided to include a review on what should be an ideal antenna for anyone in this situation.

In this special antenna theme issue of PW, I have already looked at a cubical-quad antenna. Although I consider the cubical-quad as being (perhaps surprisingly) a possible antenna for a relatively small garden, what about enthusiasts only having pocket handkerchief-sized plots or even balconies as antenna sites?

I know of at least two amateurs who dangle long wires (with the co-operation of their neighbours I might add) from their flat windows. However, the vertical antenna must be one of the few choices towards the efficient radiation of that hard-earned r.f. from difficult locations.

Without Radials

The Cushcraft R5 vertical antenna is an electrical half-wavelength radiator on each of the bands it covers. The R5 is designed to work without ground radials and Cushcraft claim that the R5 will work effectively from a roof top, balcony, porch and motor-caravans.

The technical staff on PW are aware that many radio enthusiasts only have limited space for antennas. With this in mind, I thought it best to take a specific look at a small-space antenna that could prove useful in this respect. However, I soon realised that a compact antenna of this type has many advantages.

I took delivery of the Cushcraft R5 at the London Amateur Radio Show at Pickett's Lock in March, with the aim of trying it out on a long-term basis. It was ironic that within a few weeks of collecting the antenna, I heard of the death of the founder of Cushcraft.

Fortunately for everyone concerned, Cushcraft are forging ahead with new ideas, and I was keen to try the antenna out and see just why this American company has such a good reputation. So, with the R5's box stowed in my Ford Escort estate (yes, the box is as compact as that) I headed for home.

Assemble It Yourself

The Cushcraft R5 comes in kit form, and you have to assemble it yourself. Bearing in mind my artificial hand, I wondered how difficult the assembly would be, but I need not have worried as it was fairly easy...thanks to the comprehensive instruction booklet.

There's always a worry that kits may have bits missing. As the R5 had come from America, I was worried that some vital parts might have gone missing. Again, I was worrying for nothing as Cushcraft have cracked this problem by weighing the antenna before despatch.

I haven't come across this form of checking for missing bits and pieces before. I don't know why I hadn't thought of the idea, because it's so simple. Each box is weighed and provided with a special certificate before dispatch to the customer.

If, when the stout box is opened, parts are found to be missing, a claim (quoting the weighing certificate) has to be made. Using this method, they
can tell you whether or not the kit left the factory complete with all components. In my opinion, Cushcraft have got a good idea with this technique for quality control.

**Extra Instructions**

In my case, the Cushcraft kit was complete, and I'm pleased to say (considering how many times I tend to lose them) there were three extra copies of the instruction booklet. Perhaps they knew that this particular antenna was on its way to G3XFD!

Everything in the box was packed extremely well. It was as if the box had been packed that very day. The quality of all the components was excellent and the instructions were very clear and concise.

The assembly turned out to be very straightforward. However, I thoroughly recommend that you lay the whole set of components on a light coloured blanket or something similar. I nearly lost several important small pieces.

I cannot stress enough, how important it is to keep track of the many R5 components. This is because a large proportion of them are specialised, and it could take time to get them replaced. I've got to thank my wife's timely advice, telling me to use the blanket on the lawn, for the fact that I didn't lose anything (this time).

**Antenna Location**

Cushcraft recommend that the antenna be mounted away from trees, and as far as possible, away from any obstructions. Trees warrant a particular warning, and I'll return to this when discussing how it worked on the air.

The manufacturers also suggest that the antenna is mounted as high as possible. Nearby power lines, buildings and wires (including the garden fence) can all affect efficiency.

With this form of antenna, bearing in mind how close to the ground they can be mounted, the application of safety precautions is of paramount importance. To this end, Cushcraft go to a lot of trouble to emphasise the operator's responsibility for other people's (and four-legged friends) safety.

The antenna is supplied with special warning stickers to be attached to the antenna's built-in counter-poise ground radials. But don't forget, unlike the 'Snoopy' and 'Garfield' dog and cat cartoon characters...your furry friend is highly unlikely to be able to read!

**Many Locations**

Once I had assembled the R5, I decided to try it out in as many locations as possible. In fact, I thought it best to try it out in what I considered to be the best location, and several of the worst possible sites I could find. All in the name of an unbiased and honest review.

The first location was with the R5 mounted on my garage roof, completely in the clear and erected on the top of a pole, approximately four metres high. The 50Ω coaxial cable feed was then taken directly into my shack in the garage.

Once the antenna was up, I stepped back to admire my handiwork, only to be disappointed because the antenna was so difficult to see. I was very surprised, considering how bright new aluminium was. The antenna would not doubt become much more difficult to see, after the metal had been exposed to the air for a longer period.

**Antenna Adjustments**

Before I went on the air, I carefully read the section of the instruction booklet dealing with the initial adjustments to the antenna. Fortunately, the setting-up procedure turned out to be very simple.

When it comes to reading (and understanding) printed instructions with kits, machines and word processors, my wife and other people will tell you that I'm not at my best! However, with the Cushcraft R5, all I had to do was adjust the clearly defined sections for the lowest s.w.r.

Using my s.w.r. meter, I obtained better results on all the bands, than the manufacturer's specification said could be achieved. On the 24MHz (12m) band, there's no need to adjust the antenna. So, that job was easy, and I was ready to go on the air. I decided to use my trapped dipole and my 12, 21 and 28MHz dipoles to compare results with when working from my home QTH.

**On The Air**

For my tests at home on the air, I used the Kenwood TS-450SAT transceiver (reviewed in April issue of PW) and my old KW2000B, which now belongs to G0RSC. This is the school club, at Clayesmore School between Blandford and Shaftesbury in Dorset, that I help to run (more about this later when I mention trees and s.w.r.).

Adjustment of the lengths of the various tuning sections for a good s.w.r. was a simple task. Only the length of the (clearly defined) sections need to be adjusted. Tuning up was then straightforward.

In practice, like many other operators, I tend to stick to certain sections of the band. Because of this, I was pleased to discover that the s.w.r. was always well within acceptable limits over the areas I'd chosen during the setting-up process.

On 14MHz I tuned the antenna so that I got the best s.w.r. in the c.w. section of the band. However, I was very pleased when I found that the s.w.r. was still very acceptable well up into the s.s.b. section.

The working bandwidth was best on 14 and 28MHz. I found that with the installation I had erected at my home QTH, 21MHz bandwidth was narrower than expected, but this still meant I could work the whole c.w. section as I pleased.

Working c.w., I found that the DX potential of the vertical antenna has not been over-emphasised. I spread the testing period out over several months, with several days on each band, consistently getting good reports.

**Compared Favourably**

Without exception, I found that the R5 compared very favourably with my trapped dipole and better than my half-wave dipoles on all bands except the two WARC bands. This is not to say that the R5 is not so good on the WARC bands, it's just that I reverted to using a long wire antenna on 18 and 24MHz.

I have to report that I didn't work much DX on either 18 or 24MHz, even when using the excellent little Kenwood TS-450SAT rig. But I can say that the vertical provided better signal reports than my long wire antenna, which was used in conjunction with my a.t.u.

On 28MHz, I discovered that the R5 came into its own for inter-G working. I was surprised at this because I've always thought of the vertical as being a DX antenna. The omi-directional working also proved to be very useful for QSOs into Europe and to listening out for f.m. operation.

I have only ever worked into Hawaii on two occasions before, and I managed it for the third time on 28MHz s.s.b. using the R5. Once I had established contact, I changed over to the trapped dipole and the station in Hawaii couldn't see any...
The assembled Cushcraft R5 vertical antenna, ready for use on the 14, 18, 21, 24 and 28MHz bands.

**Manufacturer’s Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>14MHz, 18, 21, 24 and 28MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency coverage</td>
<td>1.2:1 typical</td>
</tr>
<tr>
<td>Electrical wavelength</td>
<td>400kHz on 21MHz</td>
</tr>
<tr>
<td>Voltage standing wave ratio</td>
<td>100kHz on 18MHz</td>
</tr>
<tr>
<td>2:1 v.s.w.r. bandwidth</td>
<td>100kHz on 24MHz</td>
</tr>
<tr>
<td>Power rating</td>
<td>1.7-2MHz on 28MHz</td>
</tr>
<tr>
<td>Radiation angle</td>
<td>1.5kW p.e.p.</td>
</tr>
<tr>
<td>Frequency selection</td>
<td>Automatic</td>
</tr>
<tr>
<td>Horizontal radiation pattern</td>
<td>360°</td>
</tr>
<tr>
<td>Height</td>
<td>5.2m</td>
</tr>
</tbody>
</table>

difference in the signal strength (S-8).

Using the half-wave dipole cut for 28MHz, I received a reasonable report of S-6/7 from Hawaii, but as the R5 is omni-directional and my dipole may have been disadvantaged by its orientation, this can only be a crude comparison.

I spent a long time on 28MHz, and enjoyed myself. It’s a great pity you can’t rely on a long DX contact to carry out all the antenna trials you would like to do!

Despite the problems of time and varying propagation, I found that the R5 always got me a QSO. It definitely seemed to have an advantage on the really long distance pathways.

**Less Than Ideal Locations**

After I had satisfied myself that the Cushcraft antenna was working well, I decided to try it out in less-than-ideal locations. To this end, I mounted the R5 almost underneath a large silver birch tree in our front garden.

I noticed an immediate difference with the s.w.r. reading on all the bands. In particular, as the tree moved, the s.w.r. would fluctuate quite dramatically. Despite this, the signal reports were still good and compared well with the half-wave dipole.

For the next tests, I took the R5 to the home of G zero Radio-Society-Clayesmore (GORSC). The radio shack at the school is located in attractive grounds, and we’re lucky enough to have a large wooden hut.

The problem, is that the radio shack is surrounded by really enormous Cedar of Lebanon trees. These trees are close on 30 metres high, and it’s difficult to overcome the problem as the trees are very much loved, protected and needed!

Despite the problems of the trees, the R5 worked very well indeed. The s.w.r. did swing about a great deal, especially when the wind was affecting the trees, but signal reports on 14, 21 and 28MHz were no different to those gained by using the club station’s usual long wire antenna.

The long wire antenna by the way, is slung between two of the giant trees already mentioned. In a way, I suppose I’m fortunate to get any QSOs from GORSC.

**Summing Up**

In summing up my lengthy trials of the Cushcraft R5, I must be honest and say that I’m surprised at the results. I started the tests off, regarding the vertical antenna as being nothing but a compromise. I ended up thinking that at times it would be most useful to have a vertical antenna of my own.

Apart from h.f. mobile working, my trials with the Cushcraft R5 were the first time I’d seriously used a vertical antenna. Following the successful review, I’m thinking about using a vertical antenna on my favourite h.f. band, which is 7MHz.

There are obvious safety drawbacks when using a vertical antenna of this type. But providing the instructions provided by Cushcraft are followed, I don’t think anyone using one of these excellent antennas can be considered to be in any danger.

By following the manufacturer’s advice, and mounting the antenna as high as possible and in the clear, there won’t be any difficulties whatsoever. Even the very high field strengths developed around the antenna during the test period didn’t cause TVI or BCI, except on our (very) susceptible telephone.

Finally, if the R5 is to be mounted on or near a balcony, I suggest that it’s mounted as far out from the building as possible. I suggest this because, as you would expect, the antenna detunes rapidly as it moves (in a wind) towards the building.

**In Conclusion**

In conclusion, I must congratulate Cushcraft for a well-made, easy-to-use antenna. I started the review tests regarding the R5 as (unfairly perhaps) a compromise antenna. I ended up realising that verticals of this type are exceptionally useful.

If I lived in a house or flat with little or no garden, on a boat, or in a motor-caravan, I would certainly consider one of these antennas. They’re also useful for anyone requiring a portable, lightweight antenna, that will work on five bands without switching or re-tuning.

Provided the Cushcraft R5 is maintained carefully, and the coaxial cable feed point is sealed with self-amalgamating tape, these antennas should provide years of good service. Having tried one for myself, under some difficult conditions, I can see why they’re popular with amateurs having only small gardens.

My thanks go to Specialist Antenna Systems for the extended loan of the review antenna, which they can supply for £269 including VAT plus £3.22 (three day delivery) or £11.74 (next day delivery) post and packing from their address at: Radfords Field, Maesybryn Road, Oswestry, Shropshire SY10 8EZ. Tel: (0691) 670440, FAX (0691) 670282.
R7

**HF VERTICAL**

Amazing seven band performance is yours with the all new R7 halfwave vertical. Whether you are digging out the weak ones, rag chewing, or breaking through the pileups, R7 has the performance you demand to make operating a relaxing pleasure.

R7 halfwave design which does not require ground radials, is only 22.5 feet high with a low angle of radiation for DX-ing on 40 through 10 meters. R7's small footprint and ground independence allow you to select any location from ground to tower top.

R7 will make ham radio more fun!

**SPECIFICATIONS**

- **Frequency, MHz:** 28, 24, 21, 18, 14, 10, 7
- **Electrical Wavelength:** Half-wave
- **SWR 2:1 Bandwidth:**
  - 10m-2 MHz / 12m-100 KHz
  - 15m-450 KHz / 17m-100 KHz
  - 20m-150 KHz / 30m-25 KHz
  - 40m-75 KHz
- **Power Rating, Watts PEP:** 1800
- **Radiation Angle, Deg:** 16
- **Frequency Selection:** Automatic
- **Horizontal Radiation Pattern, Deg:** 360°
- **Height, ft (m):** 22.5 (6.9)
- **Mast Size Range, in (cm):** 1.5-1.75 (3.8-4.4)
- **Wind Load, ft² (ms):** 2.25 (21)
- **Weight, lb (kg):** 12.3 (5.6)
- **Counterpoise Radials Supplied:** 7

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- TEN-3 ...10m 3 element Beam
- A4S ...20-15-10m 4 element Beam
- A3S ...20-15-10m 3 element Beam
- A3WS ...17-12m 3 element Beam
- D40 ........40m Rotary Dipole
- D4 ........... 40-20-15-10m Dipole
- D3 ..........20-15-10m Dipole
- DSW .......30-17-12m Dipole
- R7 .......40-10m H/W Vertical
- R5 .......20-10m H/W Vertical
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TH-78E

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Fred Judd G2BCX was certainly a giant in the normal sense of the word. Despite this, he had a giant-sized reputation that had encircled the globe.

Fred's well-deserved reputation as a radio and electronics engineer, audio equipment designer, author, radio amateur, antenna designer and friend, was legendary. However, although he was such a long-established creator and author, Fred avoided the limelight whenever possible. He was happy to be busily working away in the background.

Who Is Fred Judd?

So much did Fred keep his nose to the grindstone, that readers, fascinated in his work, wrote in to ask "Who is Fred Judd G2BCX?" In answer to this question, Fred cheerfully agreed to allow us to feature him in one of our occasional 'Radio Personality' series of articles.

Unfortunately, it was not to be, as Fred passed away very suddenly just before Easter this year. He'd been unwell for some time, but had a giant-sized reputation that had encircled the globe. Unfortunately, it was not to be, as Fred passed away very suddenly just before Easter this year. He'd been unwell for some time, but...
When Joan and I visited Exbury gardens, near Southampton, on May 20, we noticed a large section of tree trunk, adorned with 51 coloured plastic labels, Fig. 1. What a shame that this gigantic tree, most likely a mere sapling in the 17th century, had to end its life during that big storm in 1990.

Each label indicates the size of the trunk, at the time of a specific event in history. For example the tags scribed for 1876, “Dr. Alexander Graham Bell invents telephone” and, 1879, “Thomas Edison invents electric light bulb”, can be seen at the centre of Fig. 2.

The 12 tags in Fig. 3, show the state of the tree’s growth at the time of notable happenings between 1901 and 1934. Such records include the death of Queen Victoria (1901), the first powered flight by Orville Wright (1903), the loss of the Titanic (1912), and 1934. Such records include the death of Queen Victoria (1901), the first powered flight by Orville Wright (1903), the loss of the Titanic (1912), the “First public demonstration of TV” (1926) and the visit of the Prince of Wales to Exbury in 1934.

Pigeon Post

Archives tell us that when the telegraph lines were first installed a number of carrier pigeons from Reuter’s ‘pigeon post’ were killed through colliding with, to them, the ‘invisible’ overhead wires. There are similar problems today, but on a much larger scale.

The mains electricity to many parts of West Sussex are fed by overhead 11kV cables which, if damaged, can cause a loss of supply over a large area. On several occasions during the past decade we have lost supply due to swans colliding with the lines. This may well be the case in other parts of the UK, however at vulnerable points near us, the electricity authorities, trying to solve this problem, have hung a number of orange coloured spheres on their cables, Fig. 4, so that the birds can see them.

Unusual Morse Key

Thinking more about the electric telegraph, some years ago I purchased a rather unusual Morse key, Fig. 5, which has no electrical connection posts. The 103x90mm, brass, rocking-bar is mounted on a polished wood base measuring 140x87x10mm.

The only identification is a plate under the operating knob which reads, “J.H. STEWARD, 406 STRAND, LONDON.” Ample adjustment is provided at both ends of the bar to suit the users’ fist and, although unusual, the return spring (rear left) is very efficient. I wonder, was this key a traveller’s sample, an office, or made just for practice. Any ideas?

The AR88 Receiver

From telegraph to telephone to TV” (1926) and the visit of the Prince of Wales to Exbury in 1934.

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which is coupled to the drive mechanism and four gang tuning capacitors by a gear train. A touch of oil on each of the gear wheel bearings and on each of the tuning capacitor shaft bearings, will put new life into this precision made tuning unit.

The AR88 has 11, metal cased, valves, plus a plain glass type audio amplifier (6K6G7T), rectifier (5Y3G7T) and a voltage regulator (VR-150). Finally readers, please beware, there are high voltages employed in this receiver, so do not attempt to repair one unless you really know what you are doing. Ask a qualified radio engineer first.

Reports And Observations

Now it's on to reports and observations. For some time I used two AR88s as tunable i.f. amplifiers on my solar radio telescope. One of these stood in the same position for about 10 years, by which time the set was around 35 years old.

However, when I came to move it, the original mains lead was as stiff as a board, and when touched the hardened rubber insulation just collapsed. Apart from its general stability over long periods of work, I chose this set because the designers included a diversity terminal on the rear tag panel. Although the 'information' voltages at this point were small, they were strong enough, with the aid of a d.c. amplifier, to drive a pen recorder.

Solar Activity Recorded

Among the main features of solar activity recorded during May by Cndr Henry Hatfield (Sevenoaks), with his spectrohelioscope, were one sunspot group, 11 filaments and seven quiescent prominences on the 11th; 1grp, 8fs, five small qps and a faint eruptive prominence on the 13th and similar on the 14th.

Although Henry saw nothing active on the 16th and 17th, he did locate 9fs and 8gps, but, next day, he saw a 'hot spot' in a group near the N. E. limb. He looked again early on the 19th and saw an active plage and counted 16fs and 7gps.

The following morning, at 1125, Henry found that the group "has developed very much since yesterday. It is active, but no flares." His observations on the 22nd, 24th and 25th revealed an average of 13fs and 7gps. The sunspots around the 20th were also watched by Patrick Moore (Selsey) who kindly sent a drawing, Fig. 7, of this large group as he observed it on his projection screen at 0900 on the 22nd.

Observations by Ron Livesey (Edinburgh), using a 2.5in refractor and a 4-in projection screen, revealed three active areas on the sun's disc on May 12, 15 and 16 and four on days 1, 2, 10, 11 and 13. At his observatory in Bristol, Ted Waring counted 12 sunspots on the 19th and 20 on the 22nd.

The radio telescope used by Henry Hatfield, recorded individual bursts of solar radio noise at 136MHz on May 18 and June 2, 6 and 8. As a matter of interest, Henry's original instrument also included an AR88. A high background noise level, with several very loud bursts were reported by Fred Pallant (Storrington) at 0900 on May 20 on the 20th, he found the 28MHz band "incredibly quiet."

Auroral

Ron Livesey, the auroral coordinator for the British Astronomical Association, received reports of 'gloves' and 'arcs and odd rays' overnight on May 1st, 'ray structures' on the 7th, 'active storm' on the 3rd and 'major storm' on the 10th, from observers in North Dakota and Scotland.

Many Canadian Met. stations reported "aurora across Canada". Auroral sightings on the 11th, 18th, 19th, 28th and 25th came from observers in such places as Cold Lake, Churchill Falls, Edmonton, Goose Bay, Lynn Lake and NW Territory.

In New Radnor, Simon Hamer received auroral reflected television pictures on Bands I (48-68MHz) and III (175-230MHz) on May 10 and Tony Hopwood (Upton-on-Severn) noted tone-A signals on the h.f. bands from 2030 to 2130 on the 8th and from 2015 to 2100 on the 28th. Beacon watcher Gordon Foote (Didcot) reports hearing weak auroral warnings from the German beacon DK0WWC (10.144MHz) on May 14, 15 23 and 24th.

Magnetic Activity Reports

The variety of magnetometers used by magnetic activity reporters Tony Hopwood (Upton-on-Severn), Karl Lewis (Saltash), Ron Livesey, David Pettitt (Carlisle) and the late Doug Smillie (Wisbeach), between them, recorded magnetic storm conditions on May 1, 7, 8, 9, 10, 11 and 22. My thanks to Ern Warwick (Plymouth) who tells me that the German beacon DK0WCY (10.144MHz) "has changed its style" and is sending solar and magnetic activity forecasts every 10 minutes.

I regret to report that Doug Smillie passed away unexpectedly in May. His dedicated work will be sadly missed by all in the worlds of radio and astronomy. We extend our deepest sympathy to Doug's family and his many friends.

Canon Palmer Diaries

Joan's further studies of the diaries kept by Canon Palmer revealed that while he was in Huntingdon, on 16 January 1859, he found the weather over the previous days fine and warm. However, on the 16th he walked with the Rector in the cold moonlight and noticed the moon had a large halo.

The following day the weather turned cloudy and mild, and on the 18th stormy. My weather records show that wind and rain followed the lunar halo that I witnessed at 2200 on 20 October 1989. For your interest, Fig. 8, is my reproduction of the sketch that the Canon made in his diary.

Over The Tannoy

Many ex-RAF 'bods', from WWII, will remember the phrase, "it came over the Tannoy". The phrase is very true, because the majority of airfields and stations had a public address system which carried that famous name on their loudspeakers.

The story of Guy Fountain and the Tannoy company is currently being researched by Julian Alderton, for a book, and he would like your help. If any of you have any such information, Julian would be pleased to hear from you at Pear Tree Cottage, Bellwether Lane, Outwood, Nr. Redhill, Surrey RH1 5DD.
Satellite Challenge

Since the early days of OSCAR-6, when both G6RH and myself achieved the first European DXCC Satellite awards, the pursuit of DX by satellite has been a challenge. Somehow the awareness that you are using v.h.f. or u.h.f. frequencies, upon which 100 miles can be considered DX, provides additional stimulation.

Satellite DX?

People often ask what is satellite DX? As the actual satellite path range to a fellow G, is much the same as that to a VK, the concept of distance to the other country is not a DX qualification. It is just as easy (or difficult!) to have a QSO with a near neighbour as it is with the other side of Earth.

Furthermore, some countries considered rare on v.h.f. or u.h.f. are not limited time to devote to QSOs, within the period that they can be worked as many stations as possible. This is often not enough to provide the DX station. The intent being to consider quite mundane.

Satellite DXpeditions

Most DXpeditions have short stay durations, the intent being to work as many stations as possible within the period that they can be active. Resident stations of most of the rare inland countries also have unlimited time to devote to QSOs, often not enough to provide the many callers with a contact.

Satellites also have distinct but finite times when they are within mutual range of the DX station, and those who wish to QSO the said DX station. For these reasons it is essential that quick and effective operating methods are developed that not only enhance your own chances of working the DX, but permit others to work the expedition also.

Andre ON1AIG sends some hints and tips on working these DXpeditions and rare DX-stations provided by John KL7GRF/6, who organises many satellite DX events.

"The most important habit to develop" says John, "is listening, listen, listen and listen again before transmitting. Satellite operations are unique in that you must match your uplink and downlink frequencies. The worst thing you can do is match your uplink and downlink on top of the DXpeditions downlink frequency. I have heard many stations talking themselves in on top of the DX downlink with the standard drawn-out 'hi 1100 o o' or by swishing a carrier across the downlink, thereby interfering with the QSO between the expedition and a station, further slowing down the expedition operator.

By listening to the DX station instructions you may ascertain that he may be working split frequency, e.g. transmitting to one downlink and listening on another, by announcing that he is listening 'down ten' or the like.

Hints And Tips

John provides hints and tips for satellite success, as follows:

1. Don't tune up and 'find' yourself on DX station downlink. It is a very simple matter to find yourself without causing QRM to the expedition downlink by:
   a) Tuning your receiver on the DX station.
   b) Listening to the DX station without causing QRM.

2. "Finding" yourself on the receiver downlink.
   a) Moving your receiver down exactly 10kHz from the DX-station.
   b) By swishing a carrier across the downlink.
   c) By using a frequency counter.
   d) By monitoring the DX station downlink with a receiver tuned just above the downlink area.

3. Don't transmit on the DX station downlink, as the DX station will hear you, and you're only causing QRM to others trying to work the station.

4. 10kHz.
   a) The result will be that you are now on the DX station frequency without causing QRM. If however, the DX station is working split, take the time to calculate the proper uplink frequency to fall in the downlink area that they are listening in. Don't transmit on the DX station downlink, as the DX station will hear you, and you're only causing QRM to others trying to work the station.

2. One of the worst habits you can develop, is to transmit while you are listening on the station speaker. This is bad practice at any time on the satellites. Use headphones! Listening to yourself using the station speaker is bad practice.
   a) On 145MHz, we have mixer products from the many high power users of frequencies just above our truncated space band, satellite spread spectrum transmissions giving high noise backgrounds.
   b) There's also the constant intrusion of inexperienced amateurs on a.m., f.m. and even packet, who have not bothered to read 'the rules'.

The 430-438MHz band, devoid of signals when I first came onto the band in 1953, now seems to be full of them, both amateur and 'others'. Military, research and commercial satellites seem to frequent the whole band. Nico PA0DLO, heard a weak slowly dopplering plain carrier on 430.900MHz. "This satellite is obviously very high, and is not continuous in operation" said Nico, who has no idea of the object number or type that is the source of the signal.

Brian G1NXS wrote: "I’ve just heard a satellite transmitting on 432.200 MHz Doppler. It was sending what sounded like 1200 baud p.s.k. data with a duty cycle of..."
two seconds on and six seconds off.

I first heard it on a heading of 100°. The signal stopped (switched off rather than LOS) at 1930 GMT on a heading of 350°. Yet another was heard by many observers as a weak plain shifting carrier on 435.100 MHz whilst the elusive UoSAT-OSCAR-15 microsat was being sought.

Other Users

Our 432 MHz amateur band, and the contained specific amateur space service allocated section of the band, is shared with numerous other users. These include civil, military, research, and a few more difficult to categorise.

It is not surprising that we should often come across other signals while looking for those that we need. The satellites are all good for tracking, relating to element sets, and for the study of the space to earth propagational anomalies.

What is not good, is the presence of highly disruptive wide-band signals that have been either intentionally or thoughtlessly placed into the band. The first menace, often severe in areas adjacent to the coast, was SYLEDIS. At first it was in the lower section of our band, but now it is in the satellite section.

Serious Source

Nowadays, we have another far more serious source of QRM, in the shape of Raytheon 'PAVE-PAWS' Radar system. This 180 billion Dollar US system replaced the old four minute ballistic missile early warning system 'golf balls' at Fylingdales on the North Yorkshire Moors.

It is not felt to be entirely disconnected with the strangely-often-know publicised UK Government December order prohibiting all but very weak amateur transmissions on the lower end of the 430 MHz band over a wide area of north-east England.

The PAVE PAWS system consists of microwave time electronically phase steered dual 1792 radiating element arrays either side of a pyramid 120° apart, as seen and published by the Scientific American photographs in Figs. 1 and 2. Each radiating element is fed by four 100W transmitters 'mean power', so the peak pulse amplitude is many MegaWatts e.r.p.

The resultant signal can be heard at S8 to S9 on a triplot of staggered channels each 300 to 500 MHz wide, by stations hundreds of kilometres from the site. It is a horrific signal in North Yorkshire, where it can be heard over 80 km away on receivers with the antenna disconnected!

Formal complaints were made by Ken G4FIP and other affected stations, but after 10 days of the usual bureaucratic round, the reply from the Radio Communications Agency was that they were aware of the problem, but that "... the Ministry of Defence was the primary user ... we suggest that G4FIP uses another band" (!)

Little Interest

Ken attempted to bring in the liaising committee of the RSGB, but met with little interest and no action. Basically what emerged was that they had decided to 'let sleeping dogs lie' for fear of upsetting someone up there, or, in other words, do nothing.

What is worse is that they consider this approach as being 'a success'! Ken feels that "...where they have got it wrong is that from my own past experience there will be someone in the MOD waiting for complaints and positive feedback.

This person will get some satisfaction from being able to assist both the amateurs and his/her own department".

Concern Expressed

Concern has been expressed by US Generals regarding the USA based installations on the environmental hazards. They are concerned about the possibility of the high power pulse triggering explosive devices on passing aircraft and the hazard to aircraft on nearby airfields.

Spyros SV8ALQ reports that the American military have put another on his island on 435 MHz and that the system is causing severe interference to the PACSATs. Further installations exist at Cape Cod and California, and they are also operational from land mobiles and large converted cargo ships.

Command Problems

The OSCAR-10 and 13 command station Peter Gulzow DB2OS, says that the radar systems are seriously affecting global AMSAT operations. He writes "For the past year I have encountered extreme problems with commanding OSCAR-13 by the 430 MHz uplink. If the satellite is in good view of the northern hemisphere (i.e. good pointing angles) I often need 10-20 tries to upload a single command block (512 Byte at 400 Bit/s) and mostly only a few bytes (sometimes only 1 Byte!) are uncorrupted. I have tried to use high power, but there is no difference if I run my 500 W p.p. or if I use 25 W. I confess these (radar) pulses are extremely powerful compared to what I can produce!"

Leonid Labutin UA3CR, head of the OSCAR-21/RS-14 command group, also finds this to be the main problem in the 432-432.2 MHz analogue command failure difficulties of AO-21, with blocking and sweep pulsing misdirecting the on-board command computer.

Hear It Yourself

Despite the incorporation of radar 'blankers' in the satellites receivers, you can both hear and see these pulses. These can be seen on a scope in the 1455 MHz downlink passbands of OSCAR-10, 13 and 21, if you place a single unmodulated carrier into the 435 MHz uplink passband. When the OSCAR-21/RS-14 RM-1 or 2 transponder is on, this strong radar can produce considerable QRM.

Wind Profile Radar

Another high power radar system, used to measure air movements by satellites has now come to 'share' the North American repeater band at 449 MHz, by using a bandwidth of up to 2 MHz. When on the 404 MHz COSPAS/SARSAT listening frequency, these wind profile radars caused severe problems, so the amateur equipment had to be turned off when such satellites passed through the main beam. This same consideration is felt to be unlikely with our amateur users on the newly allocated frequency, whilst WARC-92 agreed that WPR should not be on 404 MHz, it was strangely silent when it came to considering the effect upon the amateur sharers of the band.

Not Alone

John Braneegan GM4HJJ points out that PAVE PAWS is not alone. The Russian version referred to as PESCHORA from the site in the Soviet Arctic where it first appeared, is also a possible QRM source. John adds "There is however another potential offender which worries me even more. This is the constellation of 'super over the horizon u.h.f. terrestrial TV stations', which has begun to appear as the advent of very advanced tetrad and Klystron techniques allows US TV stations to inundate our static coverage by using MegaWatts to antennas up to 1000 m high.

Theoretically, these giant radio cookers should have a near horizontal polar diagram, but I suspect that any amateur satellite regularly flying Georgia USA (as RM-1 does) could have recently begun to experience a lot of r.f. Given the shape and power of the sync pulse of these video monsters, all sorts of non-linear mixing products may be entering our satellites front ends". John also notes that "these u.h.f. TV transmitters might just perhaps get their signals direct into UK at times.

John suggests "In the real world we have to accept that there are people on 430 MHz in the UK we are the secondary user, but we are users. It is also true, that in the north-east we have effectively, through increased arc coverage of the new Fylingdales facility and its mode of operation, lost the top 8 MHz of 430 MHz. As we are not allowed to use the bottom 2 MHz, then for some amateurs it means a complete cessation of their 430 MHz activity. This could mean, in some cases, for the remainder of their lives".

Both Ken and John are convinced that if sensible proposals are put to the primary user, a compromise solution could be found which would enable both parties to really share the band in the true spirit of the WARC.

Launches Postponed

The two coming amateur satellite launches mentioned in last month's column have both been postponed. The KITSAT was due for a 2345 UTC launch on August, 10 while the French ARSENE, due to some incompatibility with the major satellite, has now been postponed to the ARIANE V-55 mission, scheduled for November.
It's nice to see all this shiny new equipment in the mags, isn't it? However, we know that the latest gear doesn't always appeal, especially to those with tight budgets. Thus we have a growing selection of pre owned equipment, all fully tested and warranted so you have the opportunity to indulge without incurring the wrath of the bank manager - send a large SAE for the latest up-to-date list.

Opening Hours:
Monday-Saturday 1:30pm-6pm
Monday Closed
Tuesday Open 10am

Best part exchange deals in the country KW - your one stop amateur shop.

KW has been serving radio amateurs in Kent for many decades - a tradition the new KW will be continuing! Be you man of Kent or Kentish Man, everything for the amateur is right here in the heart of the country. A quick look at a map will also show how easy we are to get to from other areas. Sussex Man and Surrey Man will find us via the M25/M20 network and convenience for the M2/A2 route makes it ideal for London Man to leave the problems of the City behind. The Queen Elizabeth II bridge at Dartford also means that Essex Man can reach us very quickly.

Our showroom is bright, warm and comfortable, allowing you to relax whilst browsing through our latest books, checking out the latest accessories of trying out a new rig on air before you buy. For those unable to visit we offer a speedy mail order service to get goods to you quickly. Unfortunately you will miss out on the refreshments and the charm, wit and experience of our sales staff! Rest assured we always do our best however you contact us!

We look forward to serving you. 73's Tom G6PZZ

Practical Wireless, September
Mathematics For The RAE

Before delving into this month's subject, I'll give you the answers to last month's problems. As you will remember, I left you with seven questions covering three capacitor combinations.

For the first set, I asked you to consider the total capacitance when the three capacitors are in parallel. Here are the answers:

i) 79µF
ii) 3.23mF
iii) 13.2nF

Then I left you with three more questions. The task this time was for you to find the effective capacitance of three capacitors in series. The answers are:

iv) 6µF (5.999µF)
v) 228.9pF
vi) 643pF

Finally, there was a combination of two capacitors in parallel, in series with a single capacitor. The answer to that tricky one was:

vii) 1.32mF

I'm sure you got them all right didn't you? Those of you who are interested in the whole working out, or were unable to get the right answers, can send an s.s.a.e. (a big one please) to the editorial address, marked RAE Maths Queries (Sept 92). The office will send you the worked questions and answers.

Capacitive Charge

Now it's time to get down to this month's business. In this part, I'm going to deal with calculating the charge held by a capacitor.

The charge in question is the amount of electricity that a capacitor is able to hold, or store. This stored charge depends on the value of capacitance and the voltage applied across the capacitor.

If you're unsure how to imagine this, I suggest that you think of the capacitor value as a car tyre! Because of its size, the tyre has a certain volume, and this is physically limited.

Let's take a closer look at our imaginary tyre. Its volume can be considered as the amount of air inside the tyre at one atmosphere. One atmosphere is equal to 1Bar or 15 pounds per square inch (p.s.i.).

Now it's time to swim a few lengths by yourself, and have a go at a real question! Let's calculate the charge, Q, in a 100µF capacitor connected across a 100V d.c. supply.

From the equation, we know the stored charge (Q) will be found by multiplying the capacitance (C) by the voltage (V). Don't forget everything must be in basic units (Farads, Volts and Coulombs).

\[ Q = CV \]

\[ Q = (100 \times 10^{-6} \text{F}) \times (100 \text{V}) \]

\[ Q = 10^{-2} \text{Coulombs} \]

That's enough of the dry mathematics, let's now put some figures into the equations, and have a go at a real question! Let's calculate the charge, Q, in a 100µF capacitor connected across a 100V d.c. supply.

From the equation, we know the stored charge (Q) will be found by multiplying the capacitance (C) by the voltage (V). Don't forget everything must be in basic units (Farads, Volts and Coulombs).

\[ Q = CV \]

\[ Q = (100 \times 10^{-6} \text{F}) \times (100 \text{V}) \]

\[ Q = 10^{-2} \text{Coulombs} \]

This value may also be written as 0.01C or 10mC.

Simple Relationship

Because it's such a simple relationship, we can calculate the voltage, if given the charge and capacitance. Alternatively, if we are given the charge and voltage, we can calculate the capacitance needed to hold that charge. So, now let's find the voltage if we're given the charge and the capacitance.

Example: What would be the applied voltage across a capacitor, if the capacitance was 680µF and the stored charge 30mC (or 0.03C)?

From \( Q = CV \), we need to re-arrange the formula to isolate the term V on its own.

\[ V = \frac{Q}{C} \]

\[ V = \frac{30 \times 10^{-3} \text{C}}{680 \times 10^{-6} \text{F}} \]

\[ V = 44.1 \text{V} \]

A Few Problems

Now it's time to swim a few lengths by yourself, and I've set a few problems for you:

(i) If the voltage across a 1000µF capacitor is 400V, what is its stored charge?
   
   (a) 40C
   (b) 0.4C
   (c) 4C
   (d) 0.25C

(ii) A capacitor has a stored charge of 1mC. What voltage would be necessary to produce this charge if the capacitance was 1µF?
   
   (a) 10V
   (b) 100V
   (c) 1000V
   (d) 10kV

(iii) A capacitor has a voltage of 50V across it, resulting in a stored charge of 50µC. What's the value of the capacitance?
   
   (a) 10nF
   (b) 0.1µF
   (c) 0.25µF
   (d) 1µF

As usual, I'll give you the answers in the next part of this month's column.
Summer is a time of outside activities, and the shack seems to be the last place to be when temperatures are in the mid 80s. It's a time to renovate one of the most important components of an efficient amateur station, namely the antenna system.

Holidays also take their toll of activity on the air, and events like National Field Day and barbecues takes a tremendous strain on keyboard activity. This accounts for the lull in news coming in for the column, but hopefully this will change again soon!

**Kantronics Up-graded**

Kantronics have up-graded their firmware to version 5. This is available for the KAM, KPC-2, KPC-4, KPC-2400 and the KPC-1. The up-graded software is of particular interest to the user, rather than the main BBS sysop. The upgrade includes a new EEPROM, a 24C16, providing greater storage capacity, a commands manual, an operator's manual and some extra pages for the installation manual.

In addition to the features already mentioned, a new version of Host Master (Host Master II+) will be released in the near future. Present Host Master owners will be sent a notice for an up-grade package. The new Host Master II+ will include binary file transfers and other features.

**Changes In Version Five**

There are changes in version 5. The PBBS now supports bulletin IDs (BIDS), message IDs (MIDS) and hierarchical forwarding. The PBBS now keeps track of message type, i.e. bulletin, private or traffic and also displays the status of each message, i.e. forwarded, read or held. The mail indicating l.e.d. parameters on your Kantronics TNC at home, while you are in the field.

There's a new command called MYREMOTE. This is your remote callsign and can be set to Xxxxxxxxxx. That's a six character callsign and SSIC. There is another Command associated with MYREMOTE call RTX.

RTX Command is actually your password and is case sensitive. Kantronics have come up with an ingenious method of sending a password back to the TNC. To connect to your Kantronics TNC for remote sysop functions, you connect using your MYREMOTE call. The TNC will respond by sending back three lines of numbers. After you've done that, you then select the correct combination and your TNC will then allow you to choose any parameter. If you send the wrong combination, another three lines of numbers are sent.

Three attempts are allowed, and then you are disconnected. You will then wait for 15 minutes before the TNC will allow a connect with the MYREMOTE call.

**Remote Sysop Functions**

Now we'll look at remote sysop functions. As a remote sysop, you can control what comes and goes into your PBBS. To sign on as the sysop, you must have your password in the RTX.

Next, you connect to the PBBS using your MYPBBS call. After closing this you send the word SYSOP to the PBBS.

The TNC will send the three lines of numbers for you to decode. You then send back the correct password and that's it!

You can then edit the message headers as necessary. The messages can be edited in much the same way as a full-blown BBS. You can alter the type of message: B-Bulletin, P-Private, T-Traffic. The Status of the message: Y-Yes, (It has been read) N-No, (It has not been read) H-Held (Not available for reverse forwarding) T-To call From-call @BBS (Destination BBS) Hierarchical address.

**Popular Line**

This latest up-grade has provided remote sysop status to a popular line of TNCs which should prove useful. Now, if only we could have 1200 baud packet on the h.f. port as well! In rounding off this item of news on the up-grade, I would like to pay credit to our Canadian friends in the Victoria Amateur Radio Packet Association (VARPA), and in particular, Paul Johnson VE7DHM and Al Dawson W7YVL, for most of the above information.

**LAN-Link Again**

Now it's time for more news of LAN-Link. Those of you who run LAN-Link, the very popular terminal program written by Joe Kasser G3ZCZ will probably be using version 1.59.

Well, version 1.60 has now been released and is available for several different sources. Peter Hunter GO0GZS, is the beta tester for LAN-Link in the UK. He'll be happy to supply version 2.00 providing you supply a disk, return addressed mailer and enough return postage. You can contact Peter at: 2 Mayes Close, Bowthorpe, Norwich, Norfolk.

**Up-date On Roger**

I suppose that I ought to call this next bit of news 'Roger's up-date on Roger', as it's an up-grade to Roger. The main news is that I have been quite busy lately, installing a satellite gateway station.

With the help of several 'Elmers', namely Dave G4WFO, John GM4HJ, Andrew G8TJZ and James G3RJI, I am now up and running on the satellite UU-22. Using the satellite software, PB/PG, it's quite fascinating watching the data come in at 9600 bauds and receiving packet over again.

It's unlike any terrestrial packet, and I have had several problems along the way! However, the auto-tracking is working fine, and I can copy most of each pass without using a pre-amplifier.

The new system is in its infancy at present and I'll report progress as I become more efficient. The new system should provide some really fast prime routes to places which at present have only terrestrial routes, dependent on propagation. My thanks in the meantime to my 'Elmers', who I pest most frequently!

**Looking At Cloverleaf**

I'm going to look at Cloverleaf now. This is the latest h.f. data communications mode, which will have to be catered for in our wonderful non-existent h.f. bandplan for data modes.

High frequency packet operation is susceptible to QSB, and its performance over the polar route is hopeless, unless the baud-rate is reduced to an unacceptable level. Cloverleaf offers some very worthwhile improvements over h.f. packet, Amtor and even c.w. modes.

The throughput versus bandwidth figures are typically 10 times higher than any other data mode. Whether this will catch on or not is another matter.

I understand that HAL Communications will be manufacturing a PC plug-in card called PC-Clover. However, at $995.00 it's quite an expensive experiment. It's especially expensive, bearing in mind that the exchange rate for amateur equipment is currently 0.8 for 1.0 British pound, making it a £1,000+ investment.

Designed by Raymond Pettit W7GHM, Cloverleaf could provide a considerable saving in frequency usage on h.f. Conversely, more stations could occupy the same amount of frequency that's available.

Interested? To further enlighten you, here are its main performance features:

1. The system is extremely compact in bandwidth. For practical purposes, a Clover signal is entirely contained in a channel only 100Hz wide. Clover signals are designated for channel spacings of 100Hz, and need no guard-bands. The actual
Amateur Clover

What about amateur Clover? To this end, I've heard that Ray Pentt and HAL Communications have filed for a Clover patent with the US Patent office.

However, this is merely to protect Ray, as the inventor, and HAL Communications as both have invested a lot of time and money in the project. Eventually, it's proposed to license other manufacturers, when a finished product is available.

The CCIR emission designator for Clover has been agreed as either 500H2BEN (RTTY) or 500H2D2EN (Data). In order to identify a Clover transmission, and to prevent any mistaken assumption that the new system might be an intruder, initial Clover software will include an automatic c.w. identification feature complete with a 10-minute timer.

The c.w. identification facility is being regarded as a temporary feature only. In my opinion, it really is about time that c.w. identifiers stopped being mandatory for packet radio too, and relegated to the history books.

Initial Hardware Base

The initial hardware base will be a plug-in card for the PC, and not a stand-alone unit. The card will be called PC-Clover and the model number is PCI-4000.

The host processor will be a 68000 device. The Clover software required to run the 68000 and DSP56001 on-card processors will be down-loaded from the PC rather than placed in ROM on the board.

The down-loading technique will avoid the hassle of ROM-based software upgrades. The interface between the PC-Clover card and the PC bus will be compatible with windowed software. This is the new architecture being adopted by most system programmers, and should assure a long life for PC-Clover hardware.

Since the Clover-card is full size, it must be used with a PC-AT. However, if you use the windowed software, a PC-386, with a lot of memory is recommended.

Increased Use

With the increased use of modes such as Clover, I think that space on the h.f. bands is once again going to be in demand. Data modes are increasing in popularity, as shown by the Clover project itself.

Indeed, Clover is designed primarily for the user, so as such it's not designed to replace h.f. packet as a means of passing traffic. Instead, it's there to enable the user to have a more efficient means of using a data mode as a direct contact.

Although the initial investment in a Clover system is high, it is much like the early days of packet. Initially here in Norwich on the eastern side of the UK, four of us spent well in excess of £250 on our TNC-1 (in 1985!). Since then prices for better (and smaller) units have tumbled!

The increased use of digital signal processing (DSP) techniques will probably have the same effect. But I'm wondering who will be in the first batch to spend nearly £1000 on a Clover based system?

Regular Link

It's time to break out the champaign! When I was in Victoria in Canada, last year, I watched a demonstration of 56k baud linking via a short-haul r.f. link at a local 'ham happenings'. I'm pleased to report that progress has been good since then, and a regular link has now been established.

The Faster Packet Radio Group in Victoria, is extremely pleased (not to mention relieved) to announce the successful linking of ve7frg.ampr.org to ve7gnu.ampr.org at 56 kilobaud!

The circuit is though a full-duplex digital repeater, at about 500m a.s.l. approximately 10km from ve7gnu.ampr.org and about 15km from ve7frg.ampr.org.

The repeater receiver is on 220.450MHz and transmitter is on 430.550MHz at about 20W. Ground plane antennas are in use at the repeater and at both stations.

The 220MHz power output at the user stations is also around 20W.

Configuration Similar

The configuration of the system I've just described, is similar to the 56k LAN in Ottawa, including the frequency plan. The repeater consists of a modified Hamtronics R220 220MHz f.m. receiver, feeding its 10.7MHz i.f. into a GRAPES 56k r.f. modem receiver board, modified to accept 10.7MHz input.

The demodulated digital signal is fed to a FIFO circuit, delayed several bits, and fed to a GRAPES encoder board. The r.f. output of the modem is fed to a Hamtronics XV-4 u.h.f. up-converter, which converts to 430MHz and amplifies to 1W.

This output is amplified by an amplifier, which is built out of a Mitsubishi M57745 linear p.a. module, giving 20W.

User Stations Identical

Both user stations are identical, and are also built out of Hamtronics components. The receiver is a CA432-2 u.h.f. down-converter and the transmitter is an XV-2 v.h.f. up-converter producing 220MHz at 1W.

The 220MHz output is fed to another Mitsubishi p.a. module which produces 20W of r.f. output. Interface to the computer is through the Ottawa 802 board, though a modified PacketComm Tiny2 TNC has also been used.

The software is the GRI_20j version of NOS, which inter-operates smoothly with SCO Unix in a machine linked to NOS through ethernet, thanks to the firmly-standardised TCP/IP protocol suite.

I'm pleased to hear that it's all working extremely well at the moment. As evidence, this note is being composed using the 'vi' editor through a 56k telnet connection!

Questions Or Enquiries

Both George VE7FRG and Doug VE7GNU will be pleased to field any questions or inquiries about the new high-speed system. George is george@ve7frg.ampr.org on the internet. Doug is samisen@dpj@sol.uvic.ca and VE7GNU@VE7VBBASLAND.B.C.CAN.NOAM.

So, that's it for another month. Volunteered information can be left on my answering machine: (8998) 70373. I would like to have YOUR news so it can be shared with others, PLUS a few pictures for the column. You can see (from last month's picture) how interesting it is to see other people's photos! Get your camera, and don't forget (I'm QTHR, or you can leave a FAX on (0603) 787534.

73 and happy packeting de Roger G3LDI @ GB7LDI
## YAESU

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**Ham Radio Equipment Pricing**

**Inside Story**

*RADIO SHOPPER have placed several investigators at strategic locations throughout the country. Their job is to report any peculiar activities from *INSIDE* the industry. This month's report comes from Mr Wood operating somewhere near Nottingham. Apparently, R**

---

**Top Secret**

**Special Offers**

**Yaesu**

- FT890AT: 1050.00

**Kenwood**

- TS850AT: 1375.00

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Please note that all our special offers are brand new equipment and fully specified and are in no way inferior to other products within the market place, indeed our warranty is the best.
There has been a shortage of sunspots since the beginning of the year, with the effects that inevitably follow. Perhaps we have seen the end of the good times, so we can all sit and suffer through the minimum or could there be a secondary peak around the corner?

Of course, this is being written almost at the last day of the year, so summer conditions and static are also there to amuse us. It's almost enough to make one try gardening, washing-up or even v.h.f.!

**National Field Day**

For 25 years I was kept away from National Field Day by either magazine schedules or belonging to a club that didn't enter. This year I came back.

What differences did I see? Disregarding the rule changes of the past two decades, the most noticeable thing was the sheer lack of numbers. I estimate there were no more than a third of the entries compared with the early sixties. Secondly, how easy it all is: never a sniff of antenna, equipment or power problems.

Thirdly, thistles are just as pointed as ever they were to sandalled feet! But as a fun day, it's still the best thing since sliced bread.

A real low-power enthusiast comes next; Eric G0KRT in Worcester Park, with a Lake OT7R, and the top half of a W3EDP antenna, operated against a quadrature counterpoise. Two-way G8 contacts were made with G3HYO, GW0NTX and N3ELD, while other contacts included E15DR, F5BM, F6EZY, F5DPOE, eight Gs, DJ5CU, DL1BL, DL2AI, DL4SCH, DL8FECX, Y41HL, YLZKJ, Y04RDW, Y1UAVO, Y0UCAB, G3GJN, OK1AVO, ONALAGLP, ON4AQZP, ON4AUZ, ON4DST/P, ON4VM, ON6MS/P, ON6P6S/P, OR0DS/T and U0ACM.

Now we must head up north, to Don G3MUD at Auckinigill who keyed with 41ZF and 9J7Z.

**The WARC Bands**

The WARC bands all c.w. at G2HKU. Ted tried his full power on 10MHz for VK4A, 41JFS, Z2AGY, EA9/F9VN, dropping to 5W to deal with F8UTF/EMB, OK3TGK, 41JFS and ZL4HB. Top whack on 18MHz saw off P4/W1XK, ZA/5BAD and 41JFS, while the 5W handled GA4GZC, SV9KB, SM7JMS, 41JFS, Z8BAD, SM0CPD and JW0D. The low-power was used always on 24MHz, where it produced SM9ZAX, HB9FT, I3BLF and SM6AUO.

*Vince H1IP (M Scala, Malta)* stuck to sideband, and on 24MHz it netted G05DFR, VO1XC, FS/W1FC, H92FK, 41JFS, TK2H, 8X2AD and 8Z2OM; down to 18MHz and the tally was G05DFR, T77T, FS/W1FC, YN1MF, YS1RRD, N47TM, ZD8MS, 8Z2OM, 4J0/SOM0NZZ and OD5RAK.

Turning to *Andrew G3WVC* in Bath, who heard 9K2MU calling CQ, and going back to G3WVC, Andrew hadn't heard of G3WVC since they were buddies some 23 years ago, so it was frustrating that G3WVC didn't hear G3WVC's call. Some 18MHz key-bashing yielded 7P9RO, 41JFS, TM5CHA, W7MBJ (Nebraska), K5YH (Arkansas), KD6WV and WABUDR. A first report from G2DRT in High Wycombe, who has a two-band rotary dipole, with which he connected on sideband with 18MHz signals in the form of PJ8AD, A44ZZ, VE7XN, CU1AC, 41JFS, AHOM, VK3ACC and 9K2OT, while on 24MHz the log shows U8MDP, 7X2WYX, RW9FW, 7X2DG, VO1DNE and J1AOY.

*It seems Don G3NFO* in Yeovil has deserted 10MHz, but on 18MHz he notes G1SN6A, H29PK, 4J0/SOM0NZZ and GJ8/SOM0FVV. As for 24MHz, he managed G05/SOM0NZZ again, plus S92OM, ZZ1IH and 8ZBAD.

Finally in this section, SM3JDR, Don operated on 10MHz to collect YS6AZC, 3A/DF2TU, S79FI, 41JFS, UA1RV/MM, UJ8KA, 4X4F and R8JMJ. Up on 18MHz for the big killing, by way of YU/VK2DI, SV5/SV1AH, RQ7W, FS8G and U80AGN, KP4YD, 8J1OK, 3D2OB, 4K2OLO, AH6JE, EA9/OK7ZB, U9AZC, UJ8KA, W6HASS/W1K7, ZL1MH, SV8HS/K5S, VP2EOD, 4K4/UA9OPA, RK9S, G71Z/MM near 9V1, V85AA, V89KX, K7LF, K5SD, VK7AA, LUIEN, VK4VR, UD0DVW, ZA1TAE, PY7DH, NL1LXU, AU7ITU, UA0KCL, UV9UX/U8ZEA, Y81QO, E8MC, R8B2U, KH2FT and S79FI. After that, 24MHz was a bit of anti-climax with just H21ZHZ booked in.

**Miscellaneous**

Time for the miscellaneous station now! Perhaps the first G to operate from Albania is G3MW, who, with XYL KA6ZYF, are currently signing ZA/Own call.

Talking about Gs, we have our first three novices locally, 2W1AUM, 2W1AUL and 2W1AVC, of whom the former is already at work upon the prefix what the DXCC country is. The latter is operating - now lets get it into the series before the end of the year.

DXpedition News

A note from Andy Chadwick G4ZJY, to say he will be G4V as KH8/G4ZJY, between August 12 and September 8, ZK2, Niue between August 26-September 2, and even a short blast from 5W1 - c.w. and RTTY. Cards direct to Andy at 3 Park Village, Cheadle, Stafford. ST10 1HJ.

Reports to

Paul Essery GW3KFE

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The 28MHz Band

The answer here on 28MHz is undoubtedly - a lemon! However, I do try hard. Don G3NOF found 13TH/R3 (IOTA EU-131), IK9WU/61 and YI1BD.

At G6HKU, Ted managed to raise PY20C and VU2BK before going on to the six-flap-pig, with which he tangled with HG0NAR, YUTFM, HA5QG and OK3TRE.

2045 UTC, by a satellite proton event. This caused the geomagnetic field to become unsettled for the next few days.

The 4GDS log has rather more, by way of VU20Z, RABAUF, I5KSPWU, AM5WM, AM25SRO both by Sporadic-E, E7FJL, DL4DH and AM6EQ.

Activity on 28MHz for Andrew G3VWC meant c.w. forays to swap up KM6EHN, ZA1SES and UF6AK.

Up north again, to Don GM3JDR, who found SV0HS/SV5, 8V8SKX and U73NMW.

The 21MHz Band

Trade seems to have been better on the 21MHz band. Don G3NOF reports his sideband going to EL2PF, HSSSTT, HB0/DJ1BP, H1TFLF, H1RTRMB, J4s, KH8DR, LX0R1, RZ0Y/UAOMV in CG Zone 23, S923M, T20AA, TUXP, TUAB1, VP8CLC (Falklands), VQ9WM, AM5WM, AM25SRO both by Sporadic-E, E7FJL, DL4DH and AM6EQ.

Some of his more interesting 144MHz contacts (c.w. of various Civil War sites in this 250th anniversary year. We would have thought Chris might have done better to move to Shetland where daylight hours in summer are continuous. For Andrew G3VWC it meant c.w. to VE7C, W1/GE0EH, 4K/A6USA and U88Z2Z.

The 14MHz Band

Lastly this month, it's time for the 14MHz band and Rich G6HJK/N7YC kicks off. He notes s.s.b. with UB4XXL, HB0/DJ1A1W, 4J1FS, 4N2AA, CZARAF, AA2BE, WAZCT2, WD4DUG, H1EL, 9KDT, C42Y, 9K4Z, 9K2IC and Y01KP, while the c.w. attended to the needs of AA6A, HA0HH, HASSAD, V6XBY, VK3DQS, P40WF, YS1EJ and 4N4PH.

Full-power c.w. was the mode for N7M, A7A7V, while for the rest Ted G6HJK stuck to 5W to raise K4/A6USA, W6DMO, 4J1FS, SM5GA (EU-081, SK3IK/3 (EU-081), 4K4BVI, PP2RR and 3XOHNU.

Alas for Chris G4LDS, who is 'running out of daylight hours to everything' wiring up a caravan for 14MHz Sporadic -E! It took a little time to start but once it kicks off. He noted s.s.b. with UB4XXL, HB0/DJ1A1W, 4J1FS, 4N2AA, CZARAF, AA2BE, WAZCT2, WD4DUG, H1EL, 9KDT, C42Y, 9K4Z, 9K2IC and Y01KP, while the c.w. attended to the needs of AA6A, HA0HH, HASSAD, V6XBY, VK3DQS, P40WF, YS1EJ and 4N4PH.

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For a final-final on this band, Ron Pearce of Bungay has built another of his one transistor plus crystal piece ear jobs, and put it first on 14MHz to copy sideband from VK5AFA, W5KNK, PA3PQ, VE3RM, LA8OW (JP50) for a new country. At 1500UTC, Ela moved to the 144MHz band and managed to fill a couple of pages in the log with stations from DL, F and PA. Her s.s.b. contacts also included I4W4BAI (JN4S) and 3EUS (JN87).

Turning to sideband, this is the mode at Don G3NOF, where contact via auroral openings, openings still continue to exist. On June 8, 11, 12 and 18 events were recorded in central England which extended up to the 144MHz band.

In my opinion the best one occurred on June 8, and between 1545-1725UTC I made 10 c.w. contacts on the 144MHz band, including FI9H (IN57), FT8TN (JN18), DL4XX (J043), DL6EBW (J031) and SP2OFW (J031). It was interesting to note that during this time I heard no activity whatsoever on the 50MHz band, although the GB3LZR and GB3RMR beacon were very audible.

An event on June 11 was quite weak, with only the 50MHz beacon GB3LZR (IP80) being reported at 1716UTC. But on June 12 Richard Gardner G4WKN (1082) heard the 144MHz beacon GB3LZR peaking 56N at 1523UTC, and then worked at 1615UTC 5SM5MIX (J078) on c.w.

Yet another auroral opening on June 18 with Tony Ascombe G4APA (1083) working SM0ER (J088), DK1K0 (J053) and GM0GCF. All activity was on the 144MHz band between 22215-2300UTC.

John Hoban GOEVT (J001) had me up with dates openings earlier in the year. Some of his more interesting 144MHz contacts (c.w. of course) have been R6SPA (K012) and SP5EFO (K002) on February 8, 22Z5FA (K04A) on February 20, ESXMK (K029), LA3NGA (J049) and LA5BO (JP50) on February 29, SP3DCS (J091) and UA1NAW/MM (I035LW) on May 22 and 5SM5MIX on June 12.

Reports are still trickling in about the widespread aurora of May 10. First details come from Laci HA6W (10351W) on May 22 and SM5MIX on c.w. 11TH, including G3IMV, G4ASR, 4L6HMC, 9H3JR, ZY2YN, 7X2CR, CE3DNP, UM8QDX, RAOFN, UA0OFZ, 4K4/UA6WCG, TK2MQ, VK3DQS, P4OWF, YS1EJ and 4N4PH.

Turning to sideband, this is the mode at Don G3NOF, where...
with him at 113OUTC. Incidentally, GM4YXI, GM4ZUK and GM6BEG. He other contacts with G3BW, GI4KSO, the island of Corsica. (1067), uses a Trio TS830 into a 4N2RD.

Between 1009-1206UTC he made contacts to be made far into Eastern Europe and Russia. The main opening appears to have been between 1800-1845UTC, although Colin Morris G0CUIZ (1082) did hear SP4MPB (K030) on 144.30MHz as early as 1730UTC. At the station of GOEVT, s.s.b. contacts were made stations in 14,15 countries, including over 150 x DL, 46 x I, 18 x HB9, 9 x YU, 6 x F and 6 x OE. Altogether, a total of 28 locator squares were worked with the best distance being IK7MO1 (JN80) at a distance of 2481km. Phew!

Southern Europeans Excited

At the other end of the path, the southern Europeans were getting equally excited. Silvio IW1AJZ worked G0E6WX (1067), GM0HBK (1077), GM3X00 (1099) and GM4PK (1109) and also heard the Faroe Island beacon OY6VHF (1P62) but no MG2QG (capable of over 1kW output), MGF1302 l.n.a. and 4 x 11-element Yagi. He also heard EIBE, GI1VAZ and GM4UF0 and the station closed with him at 113OUTC. Incidentally, IW1AJZ runs 180W into an 11-element Yagi and a CF300 low noise amplifier. Tom DL2JAN (JN49), using an FT726R, 106W and a 17-element Yagi worked G1RIC and G10AO at 1037UTC and also heard packet radio signals from G and GW on the 70MHz band.

Another German operator, Norbert Goetschi DL1LAA (J043), using an IC202 and 3CX400 amplifier running 350W into a 17-element Yagi, made s.s.b. contacts, between 1113-1122UTC, with E32BK, E53FX and E18EF.

At the station of G6VE7, s.s.b. contacts were made stations in 14, 10 and 10 in locator squares JQ53, 54, 61, 63 and 64, all between 1041-1109UTC.

Conditions on Sunday June 20 again seemed to favour stations situated in northern G, GM, GI and El. Calum GMOEWX reports an opening lasting from 1647-1818UTC in which he worked many s.s.b. stations including EA, CT1WW and ZB0T (IAM7) at 2386km. Stations located in central England were heard working into EA7 around 1845UTC, but it seemed very patchy.

Without a doubt, the best opening occurred during the evening of Monday June 22, between 1825-2010UTC, although for some GM stations the opening started at 1730UTC and continued through to 2100UTC! Steve Potter G1JHZ (1082) reckons that Sp-E propagation is a great leveller, and that his 25W and 7-element ZL antenna was beating many of the big stations to the DX. His QTH, in Ledbury, is only at 70m with rising ground within 500m obstructing the horizon from north-east to south-east. He was therefore very pleased to report s.s.b. contacts between 1838-1958UTC with IN3DOV, IN3G50, I4KHCX, O2ZUK, O6XDF, 4N2KZ, YJ3KAB, YJ3ES, YJ3OR, YU3TS and YU3UAR.

Lyn Leech G3WLV (1081) using an Icom IC275E and a Microwave Modules 200W amplifier, throttled back to 60W and a 13-element F9FTI Yagi made 67 QSOs into DL, HG, I, OE, SP and YU, from what he describes as a site of un-special interest! At my QTH, also in I0, I had been following the buildup in the m.u.f. for some hours and was therefore prepared for the opening. Between 1827-2007UTC (100 minutes) I made 103 s.s.b. QSOs in 29 countries and nine locations including 60 x VU, 17 x I, 12 x OE, 5 x DL, 4 x SP, 2 x HG, L2F0 (1109), Y0SOA (KN16) and SV1ALS (KM98) at 2256km. During the event, whilst beaming at 135°, I made side-satellite contacts with SP5FEO (K002) SP2LYR (J092) and SP4CPB (K013). All my contacts were nothing compared to that worked by Calum GMO6WX. Between 1734-2100UTC he made 250 s.s.b. QSOs which included over 150 x DL, 46 x I, 18 x HB9, 9 x YU, 8 x F and 6 x OE. Altogether, a total of 28 locator squares were worked with the best distance being IK7MO1 (JN80) at a distance of 2481km. Phew!

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At the other end of the path, the southern Europeans were getting equally excited. Silvio IW1AJZ worked G0E6WX (1067), GM0HBK (1077), GM3X00 (1099) and GM4PK (1109) and also heard the Faroe Island beacon OY6VHF (1P62) but no other amateur activity! Wolfgang IN0TWX (JN56) has a very good station consisting of an Icom IC275H, 3CX400 amplifier (capable of over 1kW output), MG5F1302 l.n.a. and 4 x 11-element O6/LWY Yagi. Unfortunately, he has a very poor take-off towards the UK and although he's been active for more than 10 years, 144MHz contacts into G have been few and far between. The Sp-E opening on June 22 was a new experience for him, as he discovered that by reflecting his signals off some mountains on a bearing of 240°, he could work into the UK.

Between 1940-2025UTC he contacted G4APA, G4XEN, G0MPJC and GI4KSO. He also heard G3IMV, G0GRC, G4GVS and GMOEWX. Giuliano Tesero IN0K10 (JN56) uses an Icom IC725, a home-made transverter, 200W, CF300 l.n.a. and a 17-element Yagi. Between 1845-1948UTC he made s.s.b. contacts with G40DH, G4SPY, G4ZTR, G0EY, G0GRC, G0MPJC, G60CR, GA4SO and GMMVJ.

Eastern Europe Contacts

Although the 144MHz Sp-E opening on Tuesday June 23 was not as intense as the one on the previous evening, it was very welcome. The event allowed contacts to be made far into Eastern Europe and Russia. The main opening appears to have been between 1800-1845UTC, although Colin Morris G0CUIZ (1082) did hear SP4MPB (K030) on 144.30MHz as early as 1730UTC. At the station of GOEVT, s.s.b. contacts were made with SP4MPB at 1817UTC and SP4KMO (J083) at 1842UTC. Other Polish stations reported included SP2OFW (J093) by G4CLA and SP4CHY (KN03) by G6APA.

I first heard the activity from SP at 1805UTC, and then moved to the c.w. end of the band at 1815UTC to work UC2CBZ (K034). He created a terrific pile-up and was being worked by many c.w. ops such as G3IMV, G4PIQ and G4WKIN. Following my contact I called CQ and was immediately answered by RA3LW (K054) for a new country, at
a distance of 2261km. It was a good 144MHz day!

**Meteor Scatter**

Now I'm going to look at meteor scatter, and David Law GOLBK passes on details of a mini-experiment which he and Geoff G7KQW made to J003 on May 30-31. The site, on the coast just south of Cleethorpes, Lincolnshire, has a very clear horizon and, although not essential for meteor scatter working, had a good take-off into Europe.

The photographs in Fig. 1 and 2 shows the site and equipment which consisted of a Yaesu FT-767, Microwave Modules transverter, BNO5 amplifier running 85W output and a 15-element Cudee Yagi. Using the callsign G7KQW, a total of six 2w contacts were made with IWI1AZJ, OH2BAP, OH2BYJ, OH3EX, SM4P0B and SP3EWU. Stations heard, but not completed with, were HBGC8, IK1LV5, IE5US, LAA4KGA and SM9CJJ.

**John-Pierre Marty FD1FDMP**

(JN1380) is looking for s.s.b. tests to call for 70MHz operators. Or you could operate on or around 70.185MHz and indicate to other operators where you are going to listen for a reply.

Most European operators seem to be using simple antennas, such as dipole or verticals for 70MHz reception. **Heinrich Halb DJ3CY** uses a ground plane antenna and converter, whilst **Rolf Niefland DK2ZF** uses a dipole into a Microwave Modules converter, feeding a Trio TD120V.

Michael DL1GHN uses an F03 antenna into a home-made F81 transmitter. On June 7 he heard GM3WOJ, G3AAMF and 44ASR on s.s.b., and packet radio transmissions from G4ADD, G4MSF, G7BYM-4 and G4LKG-4.

**Expedition Update**

Clive O'Hennessy GW6VXX has an expedition update and reports that both he and Steve Jones GW6TX are working with the callsign GB2XS from 1078WA between August 16-30. They'll be operating in the 144MHz band.

Clive and Steve will initially meet up with Charlie Baird GM7ASS to be active from the Laig Crofters Show (GB0LCS) in I078A on Saturday August 16, before moving to 1078WA later in the evening. Clive mentions that the respective families are not going with them this year, so they can now run amok with less of skeds and play radio all day long!

The intrepid pair will be using a variety of equipment, ranging from 10W to a dipole on the 50MHz band, 160W and 2 x 17-element Yagis on the 144MHz band to 10W, and a 21-element Yagi on the 430MHz band. Most activity will be concentrated on the 144MHz band, with 14222MHz being designated as their working frequency. They'll also be QRV on the v.h.f. net 14.345MHz for those wanting meteor scatter schedules.

The site in Highland Region is quite good, and Clive reckons that he can quite often hear the GB3VHF beacon in Kent, but gets few replies to CO calls because most people are beaming to the south. Earlier in the year, from April 8-14, he was active from the site encountering some of the worst conditions for seven years, but despite that, GB2XS still managed to work down into I082 and JO0Z on tropo and JN48 on meteor scatter.

A first attempt at e.m.e. operation was also made, but with only 160W, 16m of RG67 feeder and a battered 9-element F9F7 Yagi, results did not look optimistic. However, one sked with K2GAL produced several periods of weak but readable call-signs and other signals of which the content was unclear. On returning home after the trip, he read an item on e.m.e. operation and realised that K2GAL was sending 000 (indicating that both call-signs had been received) and that the GSO was very nearly complete. Next time he'll know better!
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The next 144MHz event is the IARU Region 1 contest, being held between 1400-1400UTC on September 5-6. You can expect to find a very high level of activity during this contest, as most radio societies throughout Europe organise their own national events at the same time.

Last years winners of the multi-operator section (of which there were 332 entries) were TW1C/P (470495 points), third place, were 332 entries) were TW1C/P (240937 points), third place, were 332 entries) were TW1C/P (201758 points). F6HPP/P (249846 points), runner up (470495 points) and in second place, were 332 entries) were TW1C/P (240937 points), third place, were 332 entries) were TW1C/P (201758 points).

The WAB group are holding a high power 144MHz contest on September 13, between 0900-1700UTC. For those of you that want to participate, the contest exchange consists of callsigns, report, serial number, WAB area and county. Stations located outside of the UK substitute their country in place of area and county.

If you want details of all WAB contests and rules, send an A4 s.a.e. and three first class stamps to the Contest Manager, G. Horsfield 4G5KQ, 2 Linden Road, Ecclesfield, Sheffield, South Yorkshire S30 3XL.

To round off the month of 144MHz events, the German AGCW-DL group are holding their c.w. activity contest between 1900-2300UTC, on Saturday September 26. It is open to three classes of stations, depending on your output power, A = less than 3.5W, B = less that 25W, C = more than 25W. Operators call "CL AGCW TEST" and exchange report, serial number, class and locator, for example 59605/C/01HMKX.

Other bands haven't been ignored either during the period. On Sunday August 23, between 1600-2000UTC, the RSGB are holding a 430MHz contest for both single operator and multi-operator fixed stations. In addition to the normal contest exchange, the country must also be given.

The 70MHz Trophy contest will be held on Sunday September 20, between 0900-1600UTC, and has classes for the single operator fixed stations and all others. Look out for increased activity from GM and EI during this event.

Finally, don't forget the Scandinavian activity contests, which are held between 1800-2200UTC on the following dates, August 25 and September 12, 224MHz on September 1 and October 6, 430MHz on September 8 and October 13. Microwaves on August 19 and September 15. A full set of rules can be obtained from myself on receipt of an s.a.e.

**Thought For The Day!**

The next time you turn your 144MHz packet radio system on, make sure you don't have the 600kHz repeater shift in. It plays havoc with the c.w. calling frequency on 144.000MHz!

**Many Letters**

I've had so many letters recently that I only managed to mention 25 or you this month. I'm just sorry that Bob G3XFD won't allow me to have more pages, but that's life I'm afraid, (Editor's comment: We'd like to give you more space David, but can only help by making the typeface smaller at the moment). Thank you everyone for writing in and congratulations to 2E1AUJ, ON4AN, G4IJCQ, GM4CKP, GWM1MV, G60JA, G0HVQ, G05SW, G0PJJC, G1THG, G1UUGH, G3IMW, G3KIP, G3ZPF, G40UT, G6MXL, G7CLY and G7EYJ who didn't make it this time. I suggest you all lobby the editor to get me more space!

**Deadlines**

As usual please send your letters to reach me by the end of the month at the very latest as I normally write up the column around this time. Don't forget that I can also receive messages via packet radio at my mailbox GB7TCM or at my DX cluster G8DBXG.
No Explanation

Alan says that all are in f.m. mode and so far no North American DXer has an explanation for these. They have been heard between 1230 and 0230 GMT and the information is accurate as of June 11, when Alan wrote to me. And as he wrote the letter he could hear weak audio on 26.299MHz. Does anyone else note these signals, or offer a reason why and how they can be heard?

European Stations

Radio Budapest's English language service can be heard daily at: 21:00 on 14.526MHz. Kazakh Radio's English service is carried on the frequencies used by the domestic Second Programme, daily at: 13.725MHz.

Kazakh Radio's English service is carried daily on the frequencies used by the domestic Second Programme, daily at: 14.526MHz.

Radio Yerevan in Armenia has a daily 10-minute news cast beamed to North America at 0230 heard on 15.625MHz, 14.526MHz, 14.525MHz and 14.525MHz. French news can be heard daily at 2150 to Europe on 11.92 and 9.45MHz.

North, Central and South America

The RDN de Colombia service has continued to be heard on a fairly regular basis on 17.9644MHz (variable) in parallel with 11.2244MHz, usually from 2300, but signals are very changeable and only occasionally exceed SIO 243. Clear identifications have been noted around 0200 when the signal is reasonably clear. La Voz Evangelica in Tegucigalpa, Honduras, can often be heard with strong Spanish signals up to SIO 343 at around 0300-0430 with frequent clear idents, but the religious programming is fairly distinctive anyway, reports Roy Merrall.

The Voice of America has increased transmissions to Serbia and Croatia. Croatian is now heard at 2000 for three quarters of an hour on 792kHz medium wave, and on short wave at 5.965, 9.65 and 17.705. A feeder operating on upper sideband is noted on 14.526MHz. Serbian has a more extensive schedule:

- 0345-0400 on 6.04, 6.125, 7.125, 9.505 and 7.651MHz, u.s.b.
- 0500-0600 on 6.125, 11.845 and 15.725MHz
- 1900-2000 on 792kHz, 5.965, 9.56, 14.526MHz and 17.705MHz.

The WRNO service in New Orleans frequently gives good signals on 15.42MHz from around 2000 onwards. The station usually carries pop music but the World of Radio programme is heard on Sundays at 2000, whilst during the week Spanish programming can sometimes be heard at this time. Recently a strong Russian transmission has occupied the channel for long periods.

The World Service of the Christian Science Monitor operates Monday to Friday, with religious and foreign language programmes at weekends. The present schedule for Europe is:

- 0600-0800 on 9.84MHz
- 0800-1000 on 11.705MHz
- 1400-1600 on 15.665MHz
- 1800-2000 on 15.665MHz
- 2200-2400 on 15.665MHz

All transmissions from Scotts Corner, Maine except those marked # from WSHB in Cypress Creek, South Carolina and * from KHBI in Saipan, Northern Marianas Islands.

The African service airs:

- 0000-0200 on 9.85MHz
- 0200-0400 on 9.35MHz
- 0400-0600 on 9.84MHz
- 1600-1800 on 17.51MHz
- 1800-2000 on 21.545MHz
- 2000-2400 on 15.665MHz

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The new p.c.b.s, generated since the March issue this year, are now available. The boards have been improved and now include a silk-screened component overlay on the top side of the board. The component placement now matches the article in PW, and so the assembly is made easier for everyone.

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Other p.c.b.s are as shown on page 65 of the November 1991 issue of Practical Wireless.
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