GETTING THE BUG
FOR MORSE
WITH A LAP-TOP COMPUTER

BUILD - THE BADGER CUB 2 METRE TRANSMITTER
ALSO - A 2 METRE COLLINEAR ANTENNA

REVIEWS - ICOM 901A VHF/UHF MOBILE TRANSCEIVER
AND THE AEA PK-88 PACKET TERMINAL

PLUS
PACKET RADIO - COMPETITION - TEN SPOT
AND LOTS, LOTS MORE INSIDE YOUR BIGGER,
BRIGHTER PRACTICAL WIRELESS
Introducing Yaesu's FT-4700RH dual-band mobile. Choose Yaesu's FT-4700RH, and you open the door to a lot of tight spaces. While other dual banders just won't fit in today's small cars, the FT-4700RH utilizes a versatile "remote head" design. So you can mount the "brains" on your dash, visor, or door, and hide the "muscle" under your seat. Optional YSK4700 required for remote operation.

High-performance package. Packing a solid 50-watt punch on 2 meters (40 watts on 70cm), the FT-4700RH includes Dual-Band Watch for simultaneous monitoring of both bands, with independent squelch settings on the main and secondary bands. When you transmit, opposite band monitoring goes on in a full-duplex mode.

You can adjust the relative volume of the two receive channels with the balance control, too. And with Yaesu's bright LCD display, transceiver status is clearly visible in sunlight or shade.

Convenience on the road. Human engineering, long a Yaesu specialty, is an important aspect of the FT-4700RH design. The ten-button front panel keypad includes a "do-re-mi" audible command verification, and all important controls are backlit for night operation.

Frequency range 144-146MHz on 2m and 430-440MHz on 70cm. Nine memory channels on each band. High/low power selection (low power five watts). One-touch reverse repeater shift button. Optional CTCSS module. And 16-key DTMF microphone.

Optional accessories. FTS-8 CTCSS unit. MH-15D8 DTMF microphone with 10-telephone number memory. SP-3 or SP-4 External Speakers. And YH-1 Headset/Boom Mic or MF-1A3B Flex-arm Boom Mic, both with SB-10 PTT Switch Unit. YSK4700 Remote Kit.

Discover Yaesu's FT-4700RH today. And see what "high performance" really means. For dual-band mobile operation Yaesu's FT-4700RH really fits! Call us today for details of your nearest authorized Yaesu dealer.

South Midlands Communications Ltd,
S M House, School Close, Chandlers Ford Industrial Estate, Eastleigh, Hampshire, SO5 3BY. Telephone (0703) 255111, Fax (0703) 263507, Telex 477351 SMCOMMG.
## Contents March 1990

### Regular Features

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>Advert Index</td>
</tr>
<tr>
<td>88</td>
<td>Backscatter</td>
</tr>
<tr>
<td>106</td>
<td>Book Service</td>
</tr>
<tr>
<td>23</td>
<td>Competition Corner</td>
</tr>
<tr>
<td>71</td>
<td>Errors &amp; Updates</td>
</tr>
<tr>
<td>104</td>
<td>Heilines</td>
</tr>
<tr>
<td>17</td>
<td>Keylines</td>
</tr>
<tr>
<td>70</td>
<td>Newsdesk '90</td>
</tr>
<tr>
<td>72</td>
<td>PCB Service</td>
</tr>
<tr>
<td>43</td>
<td>Radio Diary</td>
</tr>
<tr>
<td>18</td>
<td>Receiving You</td>
</tr>
<tr>
<td>36</td>
<td>Services</td>
</tr>
<tr>
<td>19</td>
<td>Subscriptions</td>
</tr>
<tr>
<td>36</td>
<td>Wanna Swap</td>
</tr>
<tr>
<td>68</td>
<td>Wireless-Line</td>
</tr>
</tbody>
</table>

### Special Features

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>PW Review</td>
</tr>
<tr>
<td></td>
<td>Icom IC-901E dual-band rig</td>
</tr>
<tr>
<td></td>
<td>Rob Mannion G3XFD &amp; G1TEX</td>
</tr>
<tr>
<td>33</td>
<td>The PW Badger Cub</td>
</tr>
<tr>
<td></td>
<td>Mike Rowe G8JVE</td>
</tr>
<tr>
<td>41</td>
<td>A Collinear for 144MHz</td>
</tr>
<tr>
<td></td>
<td>G4WUP</td>
</tr>
<tr>
<td>42</td>
<td>Understanding Circuit Diagrams - 23</td>
</tr>
<tr>
<td></td>
<td>Ray Fautey G3ASG</td>
</tr>
<tr>
<td>48</td>
<td>Ten Spot</td>
</tr>
<tr>
<td></td>
<td>John Petters G3YPS</td>
</tr>
<tr>
<td>51</td>
<td>No Linear - No HF DX!</td>
</tr>
<tr>
<td></td>
<td>Peter Barville G3JIS</td>
</tr>
<tr>
<td>53</td>
<td>Practically Yours</td>
</tr>
<tr>
<td></td>
<td>Glen Ross G8MWR</td>
</tr>
<tr>
<td>59</td>
<td>Receiver Sensitivity Signal and Noise</td>
</tr>
<tr>
<td></td>
<td>Gordon J. King G4VFK</td>
</tr>
<tr>
<td>66</td>
<td>Keyed-in Morse</td>
</tr>
<tr>
<td></td>
<td>G1TEX</td>
</tr>
<tr>
<td>70</td>
<td>PW Irwell QRP Transmitter Part 3</td>
</tr>
<tr>
<td></td>
<td>Rev. George Dobbs G3RJV</td>
</tr>
<tr>
<td>73</td>
<td>Radio Personality</td>
</tr>
<tr>
<td></td>
<td>Ron &amp; Joan Ham</td>
</tr>
<tr>
<td>77</td>
<td>Packet Update 9</td>
</tr>
<tr>
<td></td>
<td>Roger J Cooke G3LDI</td>
</tr>
<tr>
<td>82</td>
<td>PW Review</td>
</tr>
<tr>
<td></td>
<td>The AEA PK-88 TNC</td>
</tr>
<tr>
<td></td>
<td>Chris Lorek G4HCL</td>
</tr>
<tr>
<td>86</td>
<td>G’day - News from Down Under</td>
</tr>
<tr>
<td></td>
<td>Greg Baker</td>
</tr>
</tbody>
</table>
With 99 programmable memories the IC-R7000 covers aircraft, Marine, FM Broadcast, Amateur Radio, television and weather satellite bands. For simplified operation and quick tuning the IC-R7000 features direct keyboard entry. Precise frequencies can be selected by pushing the digit keys in sequence of the frequency or by turning the main tuning knob. FM wide/FM narrow/AM upper and lower SSB modes with six tuning speeds: 0.1, 1.0, 5, 10, 12.5, 25KHz.

The IC-R7000 has 99 memories available to store your favourite frequencies including the operating mode. Memory channels can be called up by pressing the memory switch then rotating the memory channel knob, or by direct keyboard entry. A sophisticated scanning system provides instant access to the most used frequencies. By depressing the Auto-M switch, the IC-R7000 automatically memorises frequencies that are in use whilst it is in the scan mode, this allows you to recall frequencies that were in use. The scanning speed is adjustable and the scanning system includes the memory selected frequency ranges or priority channels. All functions including the memory channel readout are clearly shown on a dual-colour fluorescent display. Other features include dial-lock, noise blanker, attenuator, display dimmer and S-meter and optional RC-12 infra-red remote controller, voice synthesizer and HP 1 headphones.

Icom (UK) Ltd.
Dept. PW, Sea Street, Herne Bay, Kent CT6 8LD. Tel: 0227 363859. 24 Hour.

Helpline: Telephone us free-of-charge on 0800 521145. Mon-Fri 09.00-13.00 and 14.00-17.30. This service is strictly for obtaining information about or ordering equipment. We regret this cannot be used by dealers or for repair enquiries and parts orders, thank you.
Datapost: Dispatch on same day whenever possible.
Access & Barclaycard: Telephone orders taken by our mail order dept., instant credit & interest-free H.P.

Practical Wireless, March 1990
We enjoy listening. It's part of what we do well. So when ICOM heard you talking, our engineers designed a transceiver specially for you — the serious DX enthusiast with worldwide contacts in mind. The result is the new super advanced IC-765, an HF all band transceiver built to expand your HF world.

The IC-765 is equipped with ICOM's exclusive DDS (Direct Digital Synthesizer) System, a fully automatic antenna tuner, an electronic keyer with iambic operation and a full break-in function.

**Fully Automatic High Speed Antenna Tuner**
A built in CPU automatically memorises the pre-set position of each band without pre-set controls. Tuner speed is ultra fast since tuning starts from a preset position. If the tuner cannot tune from the previous preset position, the re-try function changes the preset position and memorises the best position.

**10Hz Digit Display**
The large fluorescent display shows 7 digits for the operating frequency, the 10Hz digit is displayed.

**Band Stacking Register**
Each band memorises the last used frequency, mode and IF filter condition (narrow or wide).

**Complete System for CW Operators**
The IC-765 has many advanced functions for CW operators such as CW pitch control, a built-in electric keyer, a keying speed control and high speed full break-in capability.

**New PLL Circuit**
The advanced ICOM DDS System ensured high speed PLL lock-up times, clear signal emissions, and high C/N characteristics. A high speed PLL provides very fast CW full break-in performances.

**Convenient Miscellaneous Functions**
- 105dB dynamic range
- 10dB preamp and 10, 20, 30 dB attenuator
- 99 memory channels
- Split memory on channels 90-99
- Built-in FL32A and FL52A CW narrow filters
- Programmed scan and memory scan
- IF, shift and Notch filter
- Fast/Slow/OFF Selectable AGC
- RF type speech compressor
- Noise blanker
- DATA switch for advanced data communications

---

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**Datapost:** Despatch on same day whenever possible.

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MULTIMETERS from Cirkit

THEY'RE D-MM GOOD VALUE!!

Cirkit's new range of Digital Multimeters offer a quite unbeatable combination of features and value:

- Ranges include: frequency, capacitance and temperature
- Housed in strong ABS cases
- Overload protection on all ranges
- Full one year warranty
- 3½ digit, auto zero, auto polarity LCD, plus low batt indication
- 200 hour battery life
- All meters supplied with test leads, battery and manual
TO ORDER Phone for same day despatch (0992) 444111 or use the order form below. Postage and packing is 90 pence per order.

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- x TM5365 at £38.80 (£32.96 + £4.94 VAT + £0.90 p&p)
- x TM115 at £29.28 (£24.99 + £4.39 VAT + £0.90 p&p)
- x TM135 at £39.96 (£35.97 + £3.99 VAT + £0.90 p&p)
- x TM175 at £49.99 (£45.99 + £5.99 VAT + £0.90 p&p)

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Address: 
Post Code: 
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Access or Visa 

Expiration Date: 
Signature: 
Date: 

Cirkit Distribution Ltd,
Park Lane, Broxbourne, Herts EN10 7NQ

Practical Wireless, March 1990
The FT-747GX is a compact SSB/CW/Am and (optionally) FM transceiver providing 100 watts of PEP output on all hf amateur bands, and general coverage reception continuously from 100kHz to 30MHz. A front panel mounted loudspeaker and clear, unobstructed display and control layout make this set a real joy to use. Convenient features include operator selectable coarse and fine tuning steps optimized for each mode, dual (A/B) vfos, along with twenty memory channels which store mode and skip-scan status for auto resume scanning of selectable memories. Eighteen of the memories can store independent transmit and receive frequencies for easy recall of split-frequency operations. Wideband (6kHz) AM and narrowband (500Hz) CW IF filters are included as standard, along with a clarifier, switchable 20dB receiver attenuator and noise blanker. User programming for more advanced control by an external computer is possible through the CAT (Computer Aided Transceiver) System. The transmitter power amplifier is enclosed in its own diecast aluminum heat-sink chamber inside the transceiver, with forced-air cooling by an internal fan allowing full power FM and packet, RTTY, SSTV and AMTOR operation when used with a heavy duty power supply.

WARNING: If you buy FT747GX not designed for the U.K. market, these may not be fitted with AM/CW filters which you may not be able to obtain.

**IMPROVED PERFORMANCE AT NO EXTRA COST!**

Yaesu's FT757GXII is a HF compact transceiver which offers full featured performance just about anywhere, on holiday, on the road or in the shack. Remarkably similar to the FT757GX the FT757GXII has a number of improvements which enhance the pleasure and ease of operation with no detriment to the electrical performance. The improvements include memory storage of operation mode, slow/fast tuning selection, automatic step change according to mode, IF Notch filter, 10 memories and VFO to VFO scan.

Other standard features include RX coverage from 500kHz to 30MHz, TX from 160m to 10m (WARC bands included), 100W RF output, SSB (LSB+USB), CW, AM & FM, ambic electronic keyer and AF speech processor.

A whole host of options are available to increase the operating pleasure. So no matter where you are you are not likely to experience a better transceiver.

**OPTIONAL ACCESSORIES**
- FP75HD Heavy Duty P.S.U. £239.00
- FP702 20A P.S.U. £219.00
- FP751T Automatic ATU £349.00
- FL700 500W solid state linear amplifier £1600.00

Now even better the FT757GX MK2
Yaesu have upgraded this popular HF and V/UHF base station transceiver. The improved version is now available with enhanced synthesiser performance and VFO tuning rate. Read Chris Lorek’s review in “Ham Radio Today”.

For existing owners of the FT767GX who purchased their sets through Yaesu’s official UK distribution network, Yaesu are offering an upgraded local unit for a nominal charge. Please contact us for details.

The CV730-1 ‘V’ dipole is the latest in a line of dipoles from Creative Design. The use of the ‘V’ shape reduces the area needed for mounting the antenna which is reservant to changes in height above ground and surrounding metallic objects. All for only £149+ £8 carriage (inc. VAT).

The CREATE company has, for the past twenty years, been the leading manufacture of top quality commercial antennas (mainly HF) in Japan. Now available to customers in the UK through South Midlands Communications, the appointed distributor, are the popular CREATE HF beams to cover the 10/15/20 metre bands, HF baluns up to 10KW PEP and the exciting 10/15/20/40V dipole which has elements of only 19ft and is designed in such a way that it can be mounted in particularly awkward places. SMC also stock what must be one of the largest amateur antennas available, the 40 metre full sized beam, as well as 8 and 7 element and six metre yagis and professional quality log, periodic antennas for 50-1300 and 105-1300MHz. CREATE also manufacture rotators to exciting levels of precision and these have virtually no back lash, quiet gears, variable speed and large torque. All are now available from SMC stock. Please contact us NOW for full details.

SMC NORTHERN (LEEDS) CLOSED SUNDAY AFTERNOONS

FREE FINANCE ON SELECTED ITEMS
On many regular priced items. SMC offers Free Finance (on invoice balances over £100) 20% down and the balance over 6 months at 0% interest. You pay no more than the cash price!

Details of eligible terms available on request.

FREE INTERLINK delivery on major equipment
Small items, Plugs, Sockets, etc by post £1.75. Antennas, cables, Wires & larger items. Lyne up to £15. Interlink delivery available, upon request for items other than radios from £7.30 depending on weight. Same day despatch whenever possible.

YAESU DISTRIBUTOR WARRANTY
Imperial warranty on Yaesu Musical products. Abby staffed and equipped Service Department. Daily contact with the Yaesu, Musen-manufacturer. Tens of thousands of spares and test equipment.

PRICES & AVAILABILITY SUBJECT TO CHANGE WITHOUT PRIOR NOTICE

NEW
IMPROVED
FT767GX

The RC5 Series of rotators, Bearing RC5B-3
RC5-1, Manufactured with high quality components allowing continued reliable operation.

The RC5 Series of rotators, Bearing RC5B-3
RC5-1, Manufactured with high quality components allowing continued reliable operation.

All these antennas are the result of long and continued research to achieve the best possible performance whilst remaining both cost effective and extremely robust. C648 4DM vertical 2KW PEP Gain 500W PEP Radial Mounting Only £210

To suit the 10/15/20 metre bands, HF baluns up to 10KW PEP and the exciting 10/15/20/40V dipole which has elements of only 19ft and is designed in such a way that it can be mounted in particularly awkward places. SMC also stock what must be one of the largest amateur antennas available, the 40 metre full sized beam, as well as 8 and 7 element and six metre yagis and professional quality log, periodic antennas for 50-1300 and 105-1300MHz. CREATE also manufacture rotators to exciting levels of precision and these have virtually no back lash, quiet gears, variable speed and large torque. All are now available from SMC stock. Please contact us NOW for full details.

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**SMC TEMPO 3K PREMIER**
160-10m HF Linear. 3kW P.E.P. RF Input. 100W Drive. 1 x 3CX1200A Triode.
£2995.00
Also available 3002A 2kW O/P. 2m version. 100W Drive. 8877 Triode.
£2395.00

**TEMPO 5K CLASSIC**
80-10m 3kW RF O/P. 100-200W Drive.
£3895.00

**TOKYO HY-POWER HL2K**
160-10m HF Linear. 2kW P.E.P. RF Input. 60-120W Drive. 2 x 3-500Z.
£1425.00

**TEMPO 2002A**
2m Linear. Max. Input 2kW. 25-40W Drive. Typical. 1 x 3CX800A7 C/W Coax Relay.
£1395.00
70cms 2004A. Max. Input 2kW. 25-40W Drive. 1 x 3CX800A7 W/O Coax Relay.
£1395.00

**SAGRA 600**
2m Linear. 600W Output. 25W Drive. 2 x 4CX250B.
£769.00

**YAESU FL7000**
160-10m HF Linear. 500W P.E.P. RF. 100W Drive. Four FT757GX, FT747GX, FT767GX
£1600.00

**LINEAR CLEARANCE SALE – ONLY AVAILABLE WHILST STOCKS LAST**

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Frequency</th>
<th>Output</th>
<th>Drive</th>
<th>Price</th>
</tr>
</thead>
<tbody>
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<td>5W in 32W out RX Preamp</td>
<td>£289.50</td>
<td></td>
</tr>
</tbody>
</table>

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**AXMINSTER (0297) 34918**

**LEEDS (0532) 350606**
**BIRMINGHAM 021 327 1497**

For full addresses see previous page.

Practical Wireless, March 1990
Do you use an antenna tuner? Then you need the new Palomar Tuner-Tuner to tune it to your operating frequency without transmitting. Just listen to the Tuner-Tuner's noise with your receiver. Adjust your tuner for a null and presto! you have 1:1 SWR. It's as simple as that.

£99.95

PALOMAR TUNER-TUNER™

£124.95

The only meter that shows PEP output: directly, accurately, instantly.

Shows power and SWR on bright red light bars. See PEP and SWR while you talk! Automatic "hands-off" SWR reading. Ranges 20-200-2000 watts. Works from 1-30 MHz. Power required 12-V DC.

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I am delighted that the HF-225 has been a raging success worldwide, and I will just quote a letter received from one of our American customers:

"I received my Lowe HF-225 about a week ago. Since then I have enjoyed many pleasant hours listening to it. As a past owner of receivers such as the Sony ICF2010 and Grundig Satellit 650 and 500, I must say that none compare to your Lowe HF-225. Without question, for hour after hour listening, nothing compares. I especially like the Genie key pad. Why more receivers do not incorporate such intelligent ergonomics is beyond me. I also thought both the instruction manual and the shortwave guide were well written, with the shortwave guide particularly enjoyable."

The letter comes from Chris Williams in Massachusetts, but is typical of many letters we are receiving from all over the world about the HF-225.

Technically, the HF-225 distinguishes itself by having a low phase noise synthesiser, which gives a reciprocal mixing performance not far off that of "professional" receivers costing up to ten times the price, and that's not just advertising talk, it is really true. The synthesiser actually tunes in steps of 8Hz, which better's most other receivers and gives a smooth "VFO" feel when tuning. As one user has already commented "If you tuned the HF-225 with your eyes closed, you would believe you had a £5,000 receiver on the table".

The HF-225 has a range of low cost options which extend its appeal; such as a keypad for direct frequency entry, which simply plugs into a rear panel jack; an active whip aerial; a rechargeable battery pack for portable use; and an attractive carrying case which protects the receiver whilst allowing full operational use. The new D-225 detector option is really something special, because it gives true synchronous AM detection for dragging sensible programme quality out of a signal being affected by selective fading distortion. The same option also gives narrow band (communications) FM demodulation.

Every listener these days appreciates a receiver which offers facilities for memorising favourite or regularly used frequencies, and the HF-225 offers 30 memory channels for this purpose. Using the memories has been made particularly versatile, because the operator can review the contents of the memories whilst still listening to the frequency he is using, or alternatively in the "Channel" mode, can tune through the memory channels using the main tuning knob, listening to each frequency as it appears on the display. Just like having a bank of single channel receivers under your control. Terrific for checking HF airband channels for activity.

Unlike most HF receivers on the market, the HF-225 comes complete with all filters fitted for every mode: - 2.2kHz, 4kHz, 7kHz, and 10kHz. There is also a 200Hz audio filter for CW, and if the D-225 detector is fitted, a 12kHz filter for FM. The correct filter for each mode is automatically selected by the receiver mode switch, but further selection can be made by the user from the front panel and the receiver remembers which filter was last used. True versatility and all built in at no extra cost. When selecting filters in use, the filter bandwidth is shown on the main display.

The display itself is a high contrast liquid crystal type, and shows frequency, filter bandwidth, detector lock (when D-225 is fitted), and whether the receiver is in memory mode. Automatic placing of the decimal point takes place as the receiver is tuned, so there can be no ambiguity in reading.

At the end of the day, what does the HF-225 offer you as a user? I can do no better than quote what was said by Rainer Lichte about the earlier HF-125:- "The HF-125 is a serious piece of equipment; don't be deceived by the unassuming front panel and the lack of spectacular features. The HF-125 will outperform most competitors. If you like an honest approach to receiver design, this is it. British understatement at its best". The HF-225 is even better.

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Practical Wireless, March 1990
PW celebrates its 1000th issue with the publication of the July magazine and I would be most interested to hear from any of our veteran readers who have either taken PW from the early days, or from anyone who has memories from before the war. Our sister publication Short Wave Magazine has already put us in touch with some of our readers who have enjoyed the radio hobby with the help of both papers and I would especially like to hear your stories of those pre-war projects and how you built them.

Perhaps, out there somewhere, somebody has a receiver that they actually built themselves from a PW design which is still in their possession and is still in working order!

It's much more likely that we shall hear about a receiver that was built by Grandad, now in the proud ownership of a grandson who knows the history of the equipment. If you are one such lucky owner, write to PW and tell us about it, as your family heirloom also forms an important aspect of PW's heritage.

During the Second World War PW carried on publishing - despite the paper shortages and other restrictions. The magazine played an important role providing technical reading, information and training for the many thousands of new radio and radar technicians who were needed during the conflict.

Nowadays an enormous number of vehicles on British roads seem to be fitted with radio telephones of either the cellular selective ringing type or the older i.m. 'base station' system. The growth of 'in-car communications' has laid to rest any possibility of a radio amateur attracting much attention when mobile operating, but that very growth has drawn the attention of many road users and safety organisations to the dangers of using hand-held microphones while driving on our congested roads at high speed.

On motorways I am often overtaken by motorists exceeding 70 m.p.h. while they are obviously chatting on the phone at the same time! Driving home from London via the M3 recently another driver overtook me as he was using a car phone and was so engrossed in the conversation that he didn't notice the police patrol car directly behind! I don't know of course whether he got away with it or not, but it was a stark reminder to me to stay safe!

As I've got to be careful anyway because of the new restrictions the Healthkit HW7 c.w. transceiver mentioned last month I built this rig myself and used it for many years before passing it on to a friend. On reading January's Keylines, he asked me to say that the transceiver is now resting at the bottom of the Caribbean Ocean and can perhaps claim to be the first HW7 to be under water! (perhaps worth a special call sign? Reception reports please with two dollars for a QSL card!)

Anyway the rig was fouled to a radio amateur working on a remote missionary station on one of the islands it duly arrived and he had a few QSOs before a hurricane struck the island carrying the rig, boat and missionary somewhere complete with HW7 etc., into the sea. The loss of the transceiver was nothing compared to the damage to the island but I wish he'd been able to have a few more QSOs with it. Oh well, perhaps we'll send him a replacement suitably waterproofed!
Dear Sir

I am writing this letter to inform you that I shall not be renewing my membership with the RSGB this year as I think that the £4.50 increase to the basic subscription for home computer members is totally unjustified. This increase amounts to almost a 22% rise in the annual subscription. I know that the Society has not increased its membership rates in the last 20 months, but in the last 20 months the membership should have increased and should be higher now than ever before.

With the membership increasing every year and advertising rates in Radcom increasing in line with inflation, I can see no justification for such an increase. The Society should be looking for ways to increase its membership and not depleting it as they will do by raising the membership fees.

The Society should ask itself if it is so good, why are there so many radio amateurs and s.w.l. who are not members of the RSGB? My income, like many others, has not increased by 22% in the past 20 months - and please don’t go on about the price of equipment, etc. I don’t smoke or drink and my family and I have not had a holiday in years. In fact, our last holiday was 11 years ago and my car can only be described as a ‘banger’! So that I can get on h.f. I am having to sell other things that I own so I can buy a second-hand rig. There are many other amateurs like me who are on a low income.

The RSGB is no longer in the range of my pocket. I also have no wish to help fund a novice licence when we already have the RAE which is not that difficult to pass if the student puts their mind to it. So, like many other good amateurs, I will not be renewing my membership this year.

I know that I have no chance of getting this letter published in Radcom, as Radcom will not publish anything that is critical of the RSGB. It’s a well known fact that the Society does not like criticism and this is why I am writing to you in the hope that you may publish my letter.

M. G. Butler GW0MNP
Bridgend, Mid-Glamorgan

The RSGB replies

David Evans G3OUF, Secretary and Chief Executive of the RSGB, replies to Mr Butler’s letter.

"In replying to Mr Butler’s letter I have to say that I believe the RSGB’s new annual fee of £25 offers exceptional value for money. For £25 the RSGB defends and enhances the interests of all UK radio amateurs both nationally and internationally. A host of other benefits and services are available including: a monthly magazine, a free QSL bureau, planning permission and EMC advice, Intruder Watch, the Observation Service, discount book service, reciprocal licensing information, technical advice, slow Morse instruction, attractively priced equipment insurance, rallies, exhibitions and conventions, beacons and repeaters, RAYNET, special event call signs, propagation information, RSGB low interest rate credit card, GB2RS news, contests and awards, etc.

"In defending and enhancing the conditions under which UK radio amateurs operate, the RSGB has one of the finest records of any national society in the world. For example, the RSGB has led the World on packet radio licensing and was the first national society in Europe to negotiate permission for all of its amateurs to use the 50MHz band. Many other countries have since followed.

"Add to all of the above services the cost of the democratic process such as Council and committee meetings, the publication of an annual report and accounts, the annual meeting and elections for the Council and you will appreciate the costs in running a national organisation. However, like most national societies and countries in the world, membership and the numbers of licensed amateurs is either roughly static or drifting down at present.

"Mr Butler urges the Society to recruit more members as a means of helping to keep fees down, but does not support the concept of a Novice Licence. Such a licence is seen by a large proportion of members surveyed, and the RSGB Council, as the prime way of bringing more people into amateur radio.

"The problem which sometimes does not seem to be appreciated is that if the number of licensed amateurs worldwide falls, then sooner or later the argument to decrease the size of amateur bands becomes irresistible to Governments, especially at a time when there are enormous commercial and other pressures on the radio spectrum. Indeed, at the major ITU (International Telecommunication Union) Conference to be held in 1992, many of the amateur bands could well be under threat. The Society will be involved in using the resources of all its members to defend the status quo and if possible enhance it at the 1992 WARC (World Administrative Radio Conference). Extra funds are also needed for other work which will be needed to defend the position of the UK radio amateur against any European legislation which, as 1992 approaches, threatens the hobby.

"The above case was put to all members when the fee increases, due from 1 March 1990, were announced in the January edition of Radio Communication. Naturally we are sorry that Mr Butler has decided not to support the work of the Society. We are also sorry to note that Mr Butler felt that his reasonable letter would not be published, since in the same issue that the RSGB fee increase was announced, there is a letter from a member griping about the QSL Bureau.

"To all those who are not members of the RSGB, I urge them to consider membership. There is safety in numbers and the Society has a fine record in defending the interests of UK radio amateurs. When you join any organisation it is not only for what you get out of the organisation, but also for what you can put back into it. The latter is the knowledge that you are funding the work which is necessary to maintain the basis of the hobby itself - defending the amateur bands without which there would be no amateur radio - 1992 is just around the corner."

David Evans RSGB

G3XFD comments

"Those of you who read my ‘Keylins’ editorial in January PW, well realize I cannot support Mr. Butler’s objection to the Novice Licence proposal. Amateur radio needs new blood and the Novice approach is an excellent idea. I’ve often worked American Novice licence holders on c.w. on the h.f. bands and have been very impressed with the quality of the Morse and the standard of operating. I’ve often been very surprised at the age of the person on the key! One of the best c.w. ‘lists’ I’ve heard in many years came from a ten year-old girl in Wisconsin! However, I must state here and now that I regard that the RSGB has made a fundamental mistake by aiming the recruitment drive at the wrong age group. To be successful you have to encourage the young people at around the age of six or seven. Many children are happily using very complex computers at school by the age of seven! With guidance, a large number of youngsters can (and have!) built working radio receivers. I consider that if the approach is left to the ‘teens’ - it will often be far too late in the day as the young people will usually be engrossed in computers, other interests and exams. Think early, for our young people have far more to offer to themselves and us than we can possibly imagine!"
Dear Sir,

Following your 'Keylines' editorial in the February issue regarding valve circuits, I am hastening to write saying how much I would appreciate some valve circuits in PW. I have been interested in amateur radio since the '30s and am therefore, a valve man and find solid state work difficult. It's not only because of the small size of everything but because if it does not work first time it is difficult, if not impossible to 'get into it to check current drain etc. With valve circuits all you have to do is unsolder a wire. I hope you'll be able to arrange something for the likes of me.

H. H. Smith G3ARU
London E12

Keep looking Mr. Smith, we have one or two ideas 'up our sleeves' so to speak. Ed.

Dear Sir,

I would like to add a little history to the highly informative article entitled 'The Father of Amateur Radio' by G30XC in your January issue.

In the Admiralty Handbook of Wireless before 1939, the unit of capacitance was the 'Jar'. I cannot remember the electrical definition of the Jar or its relationship to the Farad. Perhaps an old timer amongst your readers could help?

G. R. B Wilson G3APV
Seascale, Cumbria.

According to the PW office copy of the Admiralty Handbook of Wireless Telegraphy (1938 edition) 1 microfarad = 900 Jars. The book also states that the term was obsolete even in 1938. I've no doubt readers will remind us of other units and terms we've forgotten about. Ed.

Dear Sir,

How about a write up on the large size rigs that are to be found on the second-hand market such as the Yaesu FT-102 (why so cheap?) and the FT-1 (why so dear?), etc. Some people don't want small 'pocket' h.f. rigs.

Brian Grimes G0LZ
Ventnor, Isle of Wight.

An interesting idea Brian. What other older equipment would any of you like to see reviewed in PW? Write and let us know. Ed.

Dear Sir,

I just had to put pen to paper after purchasing the new PW magazine. Having read the old style and finding it excellent, the new style is a thousand per cent better. With the paper being whiter, it makes the reading easier on the eyes, and stands out much more. And as for the increase in price, it pays for the excellent quality for which you have supplied us with, especially the superb colour pictures throughout the magazine.

An excellent improvement by your staff. Keep up the good work!

Paul Hawkyard, Newcastle

We are very pleased at the response from readers via the mail and telephone answering machine to the new -look PW. Obviously we are striving to keep costs down and provide you with a good magazine and are always pleased to receive your comments and ideas. Keep writing, we're receiving you! Ed.

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Practical Wireless, March 1990
Large Display Multimeter

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The meter offers f.s.d. measurements of voltage up to 750V a.c., 1000V d.c., direct and alternating current up to 20A, resistance from 200Ω to 20MΩ, i.e. audible continuity testing, transistor hFE, capacitance from 2000pF to 20µF and frequencies up to 200kHz.

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The 8th Annual Practical Wireless
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0900-1700UTC

Transmitter output power will be limited to three watts as usual. Full rules will be published in due course in Practical Wireless.

Contest adjudicator:
Neill P. Taylor G4HLX.

Special Event Stations

The British Amateur Television Club (BATC) has moved its annual convention to a new venue this year. The new location is Harlaxton Manor, near Grantham Lincolnshire. The Manor is ideally situated being only 2 miles from the A1. The committee spent a long time researching various sites, having received complaints about the lack of car parking space, the price of refreshments and the cramped exhibition areas. The new venue has none of these problems, with ample car parking space, and has good quality catering arrangements. The convention will be using a number of the large rooms of the Manor, which will allow more space for traders and the demonstration areas. As well as the exhibition, attended by many traders, there will be a full lecture programme covering several aspects of amateur television.

The Manor stands in many acres of beautiful grounds which will occupy the XYL whilst you browse the trade stands, or attend the lectures and demonstrations. There are several local attractions which will make a visit to the area worthwhile for all the family. Belvoir castle (8km), reknown for the jousting tournaments held there during the summer months is open to the public. Grantham town (5km), perhaps better known as Mrs Thatcher’s birth place, has more historical connections as it is also the birthplace of Sir Isaac Newton.

The BATC looks forward to welcoming you to its convention, and hopes that readers will join them there.

The DX Association of Great Britain

Due to ill health E.A. Rickett has had to resign as secretary of the association. He will of course remain a member of the DX Association. This is to take effect from 1 February 1990. Would those who wish to contact the society please address all mail to

Adrian Donaldson (DXAGB)
49 Arkaig Drive,
Crossford,
DUMFERMLINE, Fife KY12 8YW

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20
WX Satellite Decoding Module

Previously, the display of polar-orbiting and geostationary weather satellites has meant interface units coupled to framestores or computer systems, sometimes putting this fascinating aspect of radio reception beyond most people's means.

Now, the APT-1 module enables you to display these satellite pictures on any FAX system. It simply converts the APT transmission format into the FAX format but that isn’t all.

The module incorporates a VOGAD i.c. to give a.g.c. for the APT signal, completely eliminating the black and white level controls, which are such a tiresome feature of framestores, and allowing the module to be driven from any convenient source of audio without adjustment. To let you change the display for special effects, brightness and contrast controls are provided but these are preset for a standard display during calibration.

The clock frequency of the APT transmission is recovered in the APT-1 module and drives a divider chain to produce a synchronising signal. Thus eliminates the picture distortions due to Doppler effect and variations in tape speed on recorded transmissions. This signal can be reset by an external strobe pulse for picture phasing.

For users of our RX-8 multi-mode receive system, the module comes complete with everything to connect it into the existing RX-8 system and to control the functions and also a new software upgrade giving extra controls and facilities to make the best use of the module. Power to the module is supplied by the computer and no external supply is needed.

To receive the satellite transmissions, you will need a special v.h.f. satellite receiver as standard communication or broadcast receivers are not suitable. These satellite receivers are available quite cheaply from Maplin, Cirkit, etc. For Meteosat reception, a 1.69GHz converter is also required.

The price of the APT-1 module, assembled, tested and calibrated, is £59 including p&p and VAT. For RX-8 users, it comes complete with all connections and software upgrade for a very special price of £39 if purchased at the same time as RX-8.

Technical Software
Fron,
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Caernarfon
Gwynedd LL54 7RF
Tel: (0286) 881886.

Wide-band Pre-amp

The JIM M100 low-noise wide-band GaAsf.e.t. pre-amplifier covers the frequency range 24-2150MHz. To ensure best possible performance, three switchable band-pass filters are included. With full built-in r.f. switching, this pre-amplifier is suitable for both receive and transmit applications. The BNC connectors mean that it can be simply connected to the operators favourite transceivers, scanning receivers, hand-held, etc., and the existing antenna put on top of the unit.

The M100 will also be of interest to the technician where it may be used in line with oscilloscopes, spectrum analysers and similar test equipment. The cost £79.95.

Catalogues

The Vintage Wireless Company have sent us their December 1989 Antique Wireless Newsheet. This 28-page loose folded item contains news, views, editorial and readers pages including a test of the K.B. Kitten two valver of 1932. There are also lists of classic BBC radio programmes and their availability on cassette. Obtainable for the sum of £6.00 for twelve issues.

Also from The Vintage Wireless Company is their 48 page component catalogue detailing such things as accumulators, capacitors, chokes, coils, headphones and hardware, metal rectifiers, wires and cables, but the item that caught my eye was on the back page. This was a selection of material covering the period 1922 to 1934 including Nellie the Nudist Queen, by Stuart Ross and Joe Sargent. The above and their lists of valves, information sheets and books from The Vintage Wireless Company Limited, Tudor House, Crossham Street,
Miniature Push Button Switches

The Mekanisk Elektrisk Compagni of Denmark have sent us details of their new surface or conventional p.c.b. mount switches. These have been designed to give maximum key travel and tactile feedback, in applications using a flexible foil overlay.

The patented construction gives 1 mm movement with an operating force of 150 gram.

Sealing is to IP65 and the expected life is 5 million operations. The 10.1 mm square 6.4 mm high is suitable for SM or TH mounting using automatic pick up and place equipment. Interested? MEC A/S PO Box 26, Industrieparken 23 DK-2750 Ballerup, Denmark.

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Competition Corner

Wordsearch

**PRIZES...**
First prize will be awarded to the first correct entry drawn from a 'hat' on Monday 19 March 1990 and the winner can choose either a one year PW subscription or £20 in vouchers for the book service. The two runners-up drawn from the same 'hat' can choose from either a six month PW subscription or £10 in book vouchers.

Twenty different 'radio' 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 grids more than once for different words, and they're not all used. Once you have found all twenty words, mark them on the grid and send in your answers.

Send your entry to PW Publishing Ltd., March 1990 Wordsearch Competition, Enefco House, The Quay, Poole, Dorset BH15 1PP. Closing Date last post received Friday 16 March 1990. The Editor's decision on the winner is final, no correspondence will be entered into.

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

Please tick choice of prize if you win.

☐ Subscription ............................................................

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AT LAST THE "LONDON SHOW" IS ABOUT TO HAPPEN. EVER SINCE THE DAYS OF "ALLY PALLY" THERE HAS BEEN AN OUTCRY FOR ANOTHER AMATEUR RADIO EXHIBITION IN LONDON — SO AT LAST THE SOUTHGATE CLUB HAS

WHEN IT COMES TO BREAKING THE PRICE BARRIER — WE ARE RARELY BEATEN. NOW A SUPERB DUAL BAND TRANSCEIVER FROM STANDARD AT AN AMAZING £289.00 CASH/CHEQUE/CREDIT CARD OR NO DEPOSIT AND 48 MONTHLY PAYMENTS OF £9.70 PER MONTH

- Dual band operation 144–146 and 430–440MHz, Full duplex.
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- Programmable Repeater Offset on either band between 0–39.9MHz.
- Reverse Repeater facility.
- Dual Watch priority channel.
- Programmable Call Channel on both bands.

- Ten programmable memories, including repeater offset, tone squelch etc, on both bands.
- Four different scanning modes.
- Battery save facility.
- Switchable Frequency lock and TX inhibit, from keyboard.
- Switchable 20dB Attenuator.
- High or Low power control.
- Squelch defeat switch
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<td>TS950</td>
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<td>ICOM725</td>
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The NRD-525 from JRC
J.R.C. ARE RENOWNED FOR THEIR COMMERCIAL RADIO EQUIPMENT AND THEIR AMATEUR BAND EQUIPMENT ENJOYS THE SAME REPUTATION

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### Practical Wireless, March 1990

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<tr>
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<td>* Wide coverage: 26-30MHz, 60-90MHz, 108-180MHz, 210-260MHz, 380-520MHz</td>
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<td>* 50 memories</td>
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<td>* Scan, search, priority</td>
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<td><strong>JIL SX-200N</strong>&lt;br&gt;The Superior Scanner</td>
<td>* UK version</td>
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<td>* Car adaptors and other accessories available</td>
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<tr>
<td><strong>BLACK JAGUAR BJ200 MK III</strong>&lt;br&gt;The Value for Money Hand Scanner</td>
<td>* UK version</td>
<td>£199</td>
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<td><strong>REVCO PA3</strong>&lt;br&gt;Wide-Band Pre-Amplifiers</td>
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<td><strong>AOR 2002</strong>&lt;br&gt;The Wide Range Scanner</td>
<td>* Covers: 25-550MHz, 800MHz-1.3GHz</td>
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<td>* AM &amp; NFM on all bands</td>
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<td>* Up/down step control knob</td>
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<td><strong>AOR 800E</strong>&lt;br&gt;The Smaller Handy Scanner</td>
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<td>* AM &amp; NFM programmable on all bands</td>
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<td>* N/Cad, charger BNC whip antenna included in the price</td>
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<td><strong>AOR 900 UK</strong>&lt;br&gt;The Favourite Hand Scanner</td>
<td>* UK version</td>
<td>£199</td>
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<td>* Wide coverage: 26-30MHz, 60-90MHz, 108-180MHz, 210-260MHz, 380-520MHz</td>
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<td>* Quality crystal display</td>
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<td>* 100 memories (5 banks of 20)</td>
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<td>* N/Cads, charger, flexi whip antennas</td>
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<td>* N-type connector instead of the popular S0239 N-type connector</td>
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The Icom IC-901E Dual Band VHF/UHF Mobile Transceiver

Mobile operating today comes with the choice of many transceivers with multiple options. Rob Mannion G3XFD spent the Christmas holidays looking at a recent release from the Icom stable. GITEX then put the rig through its paces in the PW test lab.

When it comes to modem equipment, especially the 'all-singing, all-dancing' type found nowadays, I have great difficulty in understanding the masses of instructions and the fiddly controls. In fact, anyone at PW will inform you that I am certainly not 'computer friendly'. Sadly they're right - I just do not seem to relate well to any form of computer or microprocessor controlled system. This extends, unfortunately for me, to hand-held transceivers and other equipment that uses multi-purpose control switches. I can get into a terrible muddle before I get used to a particular system. However, the unusual IC-901E seems to have made friends with me in no uncertain way and I enjoyed operating it.

Driving out into the Dorset countryside to the high viewpoints near Blandford Forum I was able to listen and work many stations on 144MHz. The transceiver drew very favourable comments for audio quality on transmit and I found that, despite the very small size of the supplied speaker, the received audio reproduction was good and there was plenty of it to overcome the high noise levels in my work-weary Ford Escort estate. Despite being in an excellent location for v.h.f. and u.h.f., I did not hear much on the 430MHz band except packet radio bursts. Mind you, I have since found out from other local amateurs that this band is somewhat under-utilised in and around this area.

My biggest problem in using rigs such as the IC-901E is the physical size of the control switches. My extra-large hand and fingers seem to spread over controls, and without even realising it I can operate the wrong switch and cause problems for myself and the people I'm working. Despite the very small size of the rig - it's only fractionally bigger than the average car radio cassette-player - the transceiver really does pack a punch and (much to my surprise bearing in mind my difficulties with small-size modern equipment) I found it very easy to work on the air and made few mistakes. The switches were very positive, although they only required a light touch. The tuning control (the tuning is in 25KHz steps) felt rather odd at first (it felt as if the action were following my movements after a slight delay) but I got used to it very quickly and found it very pleasant to use.

There's no doubt in my mind that the most attractive option for most radio amateurs will be the complex facilities offered by the well designed remote control head. The detachable front panel was very clean and clearly laid out with a push-button either side of the front panel to release it. The eight function buttons on the right hand side of the box, although small didn't cause me any difficulty. Considering them in turn:

PWR is the on off button and successive presses change this state, as the front panel is operable remotely this button does not carry the full power of the machine.

V/M this toggles the v.f.o. control between one of the twelve memories available for each band, or for direct control using the main rotary control knob.

MHz pressing this causes each rotational click of the main control to increment in 1MHz steps instead of the pre-selected step. This allows rapid and easy frequency shifts on the 430-440MHz band.

CALL, this is a further memory which holds a calling channel on either band to control the transmitter.

H/L controls the r.f. power output of the transmitter stages switching the 144MHz output to either 5 or 50W and displaying an 'L' in the appropriate window. On the u.h.f. band the powers are 5 and 35W, and again there is an 'L' when in low power mode.

M/S changes the Main and Sub channels windows over. The main channel is the one on which transmissions take place and occupies the upper portion of the window. Physically, the characters of the main channel display are also larger, making them stand out distinctly.

SET allows the rotary control switch to be used to change the various parameters such as frequency, step rate, volume, squelch, on the basic IC-901, repeater shift etc. Repeated presses cause the various functions to be displayed in the window and the use of the rotary
control to change any of these that have several possible values. For instance if the SET button is pressed until the word *dUP* appears, (this is a representation of the limitations of all seven segment displays) rotating the main control knob then causes the display to cycle through the three transmitter offset possibilities. These, of course, are above, below or on the same frequency as that used for reception. This offset itself may be preset to other than the normal value of 600kHz on v.h.f. The offset has only three choices available. When setting the sub-audible tone frequency there are 37 of them to cycle through. These range from 67 to 250Hz and the chosen frequency comes into use when the *T* for tone squelch is enabled.

The final button to be described is the one that has the effect of allowing changes to be made to the 'SUB' band channel instead of the Main band channel. Under that main display are seven smaller switches marked **BAND, MODE T/J,T,SQ.L, TS CHECK, MW and S.MUTE.** These are used less often than the buttons described previously. With the bare IC-901E, only the last four have any real meaning. TS changes the frequency step, CHECK allows listen on input when in repeater mode. The one marked MW is Memory Write and used to transfer data to one of the memories of which there are 12 for each band. Finally S.MUTE mutes the SUB band audio. As either band may be MAIN or SUB this applies only to the frequency shown in the lower half of the windows. On setting the volume and squelch for both MAIN and SUB these apply to which ever is which.

The illuminated liquid crystal display is excellent and the option of the removable control panel - it detaches from the main unit very easily - is an innovation that I personally have not seen for a long while. Some years ago remote operating facilities were popular and necessary (due to the large size of the equipment and the power supplies which had to be hidden away in the boot) with early car radio receivers and v.h.f. radio-telephone equipment. Re-introduced in this way, the option brings many advantages to the modern mobile operator. Space is at a premium nowadays in cars. Gone are the days of large under-dash parcel shelves, door pocket and transmission tunnels and therefore the majority of the chances of finding a suitable place to mount your rig. Most modern vehicles seem to be fitted with oddly-shaped moulded compartments and the streamlined interiors leave the mobile operator with a real struggle to find a suitable location for the transceiver. When you have long legs and considerable bulk to go with it - the option to place the rig away from the possibility of knee and shin collisions is welcome.

While on air I found that the displayed control settings were very useful, especially the squelch and volume controls. I don't know about you but I've often left the squelch turned up too far and lost a QSO as a result. These display reminders are useful and must be an aid to safety, as there is no need to grope for the controls.

As the transceiver is fully capable of working on both 144 and 430MHz at the same time (the rig has a separate antenna input for the u.h.f. band) the receiver section of the rig on whatever band not being used for transmitting, is active. This does take some getting used to if both bands are active! In my case I was using 144MHz to transmit and receive on and had no antenna connected to the 430MHz socket. Not being used to full duplex facilities in an amateur radio transceiver, I was somewhat surprised that the speaker continued to emit receiver noise when I was transmitting and using one band. However, I soon got used to the effect and was only sorry that it was not possible for me to have a cross-band QSO with someone on 430MHz.

The facility to listen and monitor one band while working on another also proved to be a useful and interesting addition. The receiver seems to be very sensitive and I was able to hear (and work) several stations that would have normally been out of range of my usual transceiver operating into the cheap and cheerful mag-base quarter-wave 144MHz whip. During one evening of listening, I heard the Torbay repeater - although I could not access it well enough to work anyone. The Swindon repeater usually gets into Dorset very well - especially on the high ground. I heard it for the first time at my home QTH using this equipment - while the car was parked right up next to the house and screened by a wall and two thick hedges.

With the optional extra of a very long control lead (20m! Part No. OPC189) fibre-optics come into play here - caravanners can take the rig control panel into their living quarters and happily operate from there. This removes the bother of having to take the equipment out of the car every time you park up for the night. It's things like this that make the rig a multi-use piece of equipment for the operator who wants more than either a mobile or base station rig.

Reading the handbook was a revelation in itself. I was completely taken aback with the various possibilities of the equipment. If you do buy all the optional extras you can end up with a medium wave receiver, a 28MHz f.m. transceiver, a v.h.f. stereo car receiver and a rig capable of working over to 1000MHz.

**Technical Details**

The IC-901E is a combination of two transceivers in a common case. They each have their own antenna connections and r.f. stages, along with individual audio stages and speakers thus allowing independent reception of signals. This is not new, of course, as dual band rigs have been available for some time. What makes this stand out is the fact that it can become the centre of a complete system which may include not only the f.m. unit as supplied, but also add-on units to make the system into an almost fantastic array of other things. All the variations for the receiver can be seen in Table 1 which has been taken from the handbook.

Two of the additional band units allow monitoring or transmitting on secondary frequencies within each of the two main bands and could benefit from a little more explanation.
UX-R91E - this receiver unit has all the functions of a normal car radio and more, as it covers medium wave from 520kHz to 1630kHz with selectable step rates of either 10 or 1kHz. The v.h.f. broadcast band of 76-108MHz is also fully covered in 10kHz steps. This covers the frequencies used by some East European countries as well as our own domestic coverage of both national and local stations. The frequency of reception and also the stereo balance may be set from the IC-901E. Scanning rate in this band is 10kHz or 1kHz. From 108 to 137MHz, the air band is also covered using the a.m. mode of reception. From here the reception mode changes back to f.m. and continues up to 236MHz which encloses both the amateur and v.h.f. marine frequencies, not to mention the various small bands set aside for such things as radio microphones. The rest of the official v.h.f. band is misscd out and reception, using f.m., begins again at 300MHz and ranges up to 950MHz with a gap between 500 and 800MHz. This unit has the coverage of a scanner and could possibly replace one, especially as the frequency and mode are, controlled from the front panel of the IC-901E.

UX-S92AE is an s.s.b. or c.w. unit which extends the v.h.f. band allowing multi-mode working on 144MHz and f.m. on u.h.f. The v.h.f. antenna is coupled through this unit and then to the antenna proper. A connection is available for the Morse key on the back panel of this unit. Two further interfaces are available to enable the main body of the IC-901 to be mounted remotely in the boot of the car, leaving only the control unit, microphone and front panel in the passenger area of the vehicle. When this method of mounting is employed, the supplied interconnecting cable is no longer used, but is replaced with a fiberoptic link. This would give an excellent immunity to extraneous signals that could impinge upon a normal multi-way cable over this length. The booklet gives several suggestions for positioning the control unit remotely within this area of the car, including on the vanity mirror.

Also mentioned in the booklet are several other options, such as tone squelch for use in a selcall facility, which has an answer-back detect feature. This gives an indication that the other station is both operational and has received the call. As a further addition a d.m.t.f. (dual tone multi frequency) unit allows the use of the code squelch and pager functions. This paging function is not the same as the national system of paging, but is a beep tone to alert you to a call which has the sub-audlo tone present. This may be turned off by the user. By using this facility one person may call either a group or a single person on a common channel, without others being aware of the traffic going on at the time.

Summary

I found the IC-901 an unusual and excellent little transceiver, ideal for cross-band and duplex working. The rig is full of potential for the caravaning, camping, boating or motorcycling radio amateur. It really is versatile and I think the term 'mobile' does not do it justice. The IC-901E is available from Icom (UK) Ltd., Sea Street, Herne Bay, Kent CT6 8LD. Tel: (0227) 363859. The basic transceiver costs £799.00, the UX-R91E costs £179.00 and the UX-S92E costs £379.00. We would like to thank Icom for the loan of the review model.
WITH THE GRAND OPENING OF OUR NEW AMATEUR SHOP
RAYCOM ANNOUNCES NEW DIRECT PHONE NUMBERS
SALES HOTLINE 021 552 0073 and HELP LINE 021 552 0051 (73's and 51's)

JUPITER II
Save money when you buy this top-of-the-range scanner. 100 memories, coverage from 25-550/800-1300 MHz, priority channel monitor, channel lock-out delay and autol AM/FM switching go to make a great package and we add further value still.
Choose either a free broadband mag-mount or a free mast-mount SkyScan scanner antenna worth £14.95 and a free cigar adapter kit when you order your Jupiter II (and £20 off RPPI)
£299.00 .. save £39.90

SPECIAL OFFERS
With every scanner or HF receiver purchase made mentioning this advert we will give you a copy of HIGH IN THE SKY, a new listeners guide to the Aircraft Bands. Please ask for details of our extensive Second Hand Equipment List, there are many bargains to be found, and all the equipment has been tested by our workshop and carries a 3 month warranty.

STOP PRESS
Yupliertu MV7-600 is now available, 25 to 550 MHz and 800 to 1300 MHz, in a mobile / base scanner for only £349.00 including a free accessory pack II!

ICOM IC-R7000
An unbeatable offer from Raycom - £30 off the retail price and a free Bearcat handy scanner covering 29-512MHz (with some gaps) worth £99.95 - a total saving of an incredible £129.95! Can't believe it? Send SAE for an information leaflet and offer details.
Raycom Credit Card is available on this pack, just £96 deposit and monthly payments of just £36! Why wait, send for written details now!
£959.00 .. save £130.00

ICOM IC-3210
ICOM's popular dual bander, 25 watts on both bands, great looking and readable display, full duplex capability, 40 memories and input monitor for instant repeater check. All you need add is an antenna and we have taken care of that.
Regular retail prices:
- IC-3210 .................................. £499.00
- Broadband mag-mount antenna .......... £14.96
- Total regular price ........................ £513.86
- Raycom package price ..................... £479.00

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Raycom Credit Card is available on this pack, just £48 deposit and monthly payments of just £18! Why wait, send for written details now!

SAVE £116!
Raycom Credit Card is available on this pack, just £85 deposit and monthly payments of just £32! Why wait, send for written details now!

ICOM IC-725
ICOM's latest addition to the family, the 725 gives a full 100 watts of multi-mode power and is the second rig to use the DDS (Direct Digital Synthesizer) system. 10 Hz steps for smooth tuning, all mode squelch, 26 memories, and other features make the 725 the starter rig for those who want more than a starter rig - it's unbeatable value - just look!
Regular retail prices:
- IC-725 ...................................... £759.00
- FM TX/RX (AM RX) board .............. £40.00
- 20 Amp PSU ................................ £129.99
- G5RV V2 -sized antenna ................. £14.95
- Auto power off .............................. £21.00
- Total regular price ........................ £854.94
- Raycom package price .................... £819.00

SAVE £42!
Raycom Credit Card is available on this pack, just £45 deposit and monthly payments of just £16! Why wait, send for written details now!

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YELEU FT-747GX
HF all mode 100W transceiver, 0.1-30MHz, with the exclusive Raycom mod improving receiver dynamic range by 15-20 dB. Turns a good receiver into a great receiver. Ideal as a base and particularly suitable for mobile/marine use with its light weight and click-stop dial. Save money with the RAYCOM STARTER PACK - it's unbeatable value - just look!
Regular retail prices:
- FT-747GX ................................ £699.00
- Raycom RX mod ......................... £139.00
- 20 Amp PSU .............................. £129.99
- G5RV V2 -sized antenna ................. £14.95
- Fitt mic ................................... £21.00
- Total regular price ........................ £948.94
- Raycom package price .................... £913.94

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RAYCOM GIVE YOU MORE CREDIT ON CERTAIN ITEMS AT MRP. CALL TEL. 021-552-0073 FOR MORE INFO AND FOR CLEAR. MANY OTHER ITEMS IN STOCK.
PLEASE ALLOW TIME FOR CHEQUES TO CLEAR. MANY OTHER ITEMS IN STOCK. WE OFFER A RANGE OF CREDIT OPTIONS - SAE FOR INFORMATION SHEET.

PHONE BEFORE 4PM FOR NEXT DAY DELIVERY BY COURIER £5.00 (SAT/SUN £5.50) FOR DELIVERY BY POST PLEASE ALLOW 48 HOURS TO CLEAR. MANY OTHER ITEMS IN STOCK. PLEASE CALL FOR MORE INFO AND FOR EXTRA SPECIAL DEALS!

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THE WORLD FAMOUS RAYCOM FRG-9600 MARK II & MARK V

The Yaesu FRG-9600 has always been a desirable scanner since its' first introduction, offering the user continuous coverage between 60-905 MHz with all modes (SSB up to 460MHz) at a good price and with all the options you would expect to get with a well designed scanner (TV and computer interfaces, mobile bracket, etc.) Raycom offers exclusive upgrades to new or existing units.

FRG-9600 MARK II

We extend the frequency coverage to at least 950 MHz (this depends on individual units) and fit a low loss 'N' connector. By modifications to the front-end RF switching we retain the single connector and improve the sensitivity throughout the range, typically by 3 to 4 'S' points! Beware of imitations - nobody does it as well as we do!

FRG-9600 MARK V

Incorporating all of the Mark II mods above, the Mark V adds a short wave converter board to give continuous coverage from 150 KHz to 950 MHz, retaining all the modes of the standard unit. An elliptical filter in the input circuit, combined with a high dynamic range active mixer results in a unit which will copy Radio 4 or Stateside 10 metre SSB as easily as 900 MHz FM cellphones. Please send S.A.E for an information leaflet.

Grand opening offer, to Celebrate the Launch of our new Showroom.

Yupiteru MVT- 6000
25 to 550 Mhz and 800 to 1300 Mhz,
ONLY £349.00 inc accessory pack.

RAYCOM EXCLUSIVE POWER UNITS

R1320 - 13.8 VOLTS AT 20 AMPS
100 WATT TRANSCEIVER RATED

This sturdy unit is imported directly by ourselves and represents great value for money! Further modifications are made in the Raycom workshops to improve safety, add extra features and to give additional RF immunity. A hefty mains transformer drives up to 25 amps (surge) through no less than seven 2N3055 pass transistors driven themselves by a 2N3055.

- 13.8 volt fully regulated
- 20 AMP output (30 minutes)
- 25 AMP surge
- Over voltage protection
- High current connectors fitted
- Designed for RF service

Fitted in an attractive case with chrome grab handles, the R1320 makes a worthy addition to any shack!

R1320 13.8 v 20 amp PSU £129.99 inc. VAT

FRG-9600 standard 60-905MHz £479.00
FRG-9600 Mark II 60-950MHz £499.00
FRG-9600 Mark V 0.15-950MHz £625.00
FRG-9600 Mark II pack £545.00
FRG-9600 Mark V pack £699.00
Standard to Mark II upgrade £40.00
Standard to Mark V upgrade £149.00
Raycom Mark II to Mark V upgrade £129.00
All packs include a mains power unit and ROYAL 1300 discone (as below), worth £85! Great value!

RAYCOM EXCLUSIVE ANTENNAS

ROYAL 1300 DISCONE
STAINLESS STEEL CONSTRUCTION
A quality unit manufactured in Britain, the Royal 1300 is ideal for wideband scanners & scanning receivers.

Specifications:
Receive 25-1300 MHz
Transmit 50, 144, 430, 900, 1200 MHz
Power 200 watts
Connector type 'N'
Cable supplied
RA519
Type Discone 8+8
Length 1.7 metres
Weight 1 Kg

HR1300 discone £59.50

BB-145S
BROADBAND MAGMOUNT

Another exclusive Raycom import, the BB-145S is a broadband 1/4 wave mag mount antenna for mobile scanners and 2 metre transceivers. Supplied complete with 4 metres of quality co-ax and PL259 plug, this easily installed antenna is compact in size due to the integral loading coil and is specified for 138-172MHz, but often loads at 70 cms!

BB-145S magmount £14.95
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10, 12, 15, 17, 20 £55.15 + £3.00 p&p
FEATURES OF CAP LOOP ANTENNAS
- It has a very high Q
- A radiation resistance from 300 milliohms to never more than 0.8 of an ohm
- Has a bandwidth from 3kHz to 50kHz
- It has an SWR of 1.4 to 1 at the very least, 1.1 to 1 on most bands
- Will operate at virtually ground level
- The loop has a vertically polarised radiation pattern containing both very high and very low angle radiation (ideal as a DX antenna)
- Does not require an Antenna Tuning Unit
- Depending on the model used it only occupies from 60cm to 4m of space
- It is ultra compact, light and waterproof
- Planning permission is not necessary

YOU ONLY NEED TWO AERIALS FOR CONTINUOUS COVERAGE FROM 3.5 to 30 MHz.
COST OF THE TWO AERIALS—ONLY £655.50 + £30.00 p&p
THIS OFFER INCLUDES CONTROL BOX, CLAMPS AND CABLES.

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COME AND SEE US ON OUR STAND AT THE FORTHCOMING LONDON AMATEUR RADIO SHOW

Practical Wireless, March 1990
The PW Badger Cub

The PW Cub is a crystal controlled 144MHz f.m. transmitter which operates from a 12V supply and gives about 2W of r.f. output. It was originally designed to complement the PW Badger 144MHz receiver featured in the October 1988 PW. Because of this, a ‘netting’ facility has been incorporated in the circuit of the Cub to enable easy tuning of the receiver. Also on the board is an antenna change over relay which can also be used to supply both power and antenna connections for the Badger.

Block Diagram

Shown in Fig. 1.1 is the overall block diagram of the PW Cub. Use this in conjunction with the circuit diagram Fig. 1.2 and the following description. The crystal oscillator TR1 is a standard Colpitts oscillator running at just over 12MHz on standard fundamental frequencies. Trimming to exact frequency is achieved by adjustment of a series capacitor for each channel crystal. The output of this oscillator is phase modulated by the output of TR8, which follows a microphone amplifier and may also contain an audio tone burst for repeater access. The phase modulated signal is fed to a tuned buffer amplifier TR2, which is a BF244 f.e.t.

The following stages are frequency multipliers with TR3 being a tripler stage and TR4 and 5 are both doubler stages to the final frequency of 144MHz. The first two multiplier stages are f.e.t.s, to give less loading and so better Q of the tuned circuits. The second doubler, TR4 has a capacitive tap to reduce loading and to match the input impedance of the final bipolar doubler TR5. Capacitors C25 and 26 serve to both tune the doubler stage and match into the driver stage TR6, a BSX20 type transistor. This stage is fitted with a small heat sink as it dissipates some heat. Capacitors C28 and 29 tune this stage and match into the final p.a. transistor TR7, which is fitted with a substantial heat sink. This transistor is an r.f. power type MRF237 in a TO5 can.

The r.f. energy is tuned and filtered through a network comprising L7 through to C38 where it is applied to one set of contacts on relay RL1 and ultimately to the antenna. The other pair of contacts on RL1 are used to provide 12V power to either the Badger on receive, or the Cub on transmit. On receive, if the Net switch is pressed, then only the Cub’s oscillator and multiplier stages are energised which the Badger may then be tuned into. As the microphone is not ‘live’ at the time of pressing the netting switch, no ‘bowl-round’ shriek should occur even if the audio is turned to a high setting.

The audio stages are straight forward amplifiers with the microphone gain control (R17) feeding into TR10. Thus providing sufficient gain to give limiting action with diodes D2 and D3. Roll-off of the audio high frequencies is provided by C44 across the deviation control R23. Transistor TR9 provides post clipping gain to drive the phase modulator transistor and the network comprising of R28, 29. Capacitor C49 provides further low pass filtering. Overall maximum deviation is set by R23. In the prototype, over 5kHz of deviation was obtainable.

The tone burst amplifier uses a 4093 type c.m.o.s. NAND Schmitt trigger, with the first gate and associated components controlling the length of the toneburst. Refer now to the waveform and timing diagram, Fig. 1.3, along with the circuit.

On applying 12V to the circuitry, pin 2 of IC1a follows the charging curve of C54 via R32. At around half supply rail, the gate changes state and the output on pin 3 goes low once more. Gate IC1b has, during this period of a high level on pin 8, been oscillating with a frequency controlled by C55 and R33, and is set at 1750Hz later. These gated oscillations are allowed to reach R36 when the switch S2, connected to pin 13, is shown. If Pin 13 is taken to the negative line, then this gate is inhibited and no tone oscillations are produced. Integrated circuit IC1d is, at present, not used and so both inputs are tied to negative.

Starting in this issue Mike Rowe G8JVE describes this addition to the PW Badger, turning it into an ideal low-cost rig for 144MHz f.m.
Fig. 1.2: The full circuit diagram of the PW Cub. Showing the three separate areas of the design. The top portion is the r.f. strip above the modulator stage, with the tone burst circuit based on IC1 below.
Fig. 1.3. Waveforms to be found on some of the pins on IC1.

**Shopping List**

### Resistors
- 0.25W 5% Carbon film
- 4.7Ω 1 R12
- 12Ω 1 R16
- 33Ω 3 R3, 6, 9
- 270Ω 1 R27
- 470Ω 2 R7, 31
- 560Ω 1 R21
- 1.0kΩ 1 R28
- 2.2kΩ 2 R13, 29
- 3.3kΩ 2 R10, 15
- 4.7kΩ 2 R20, 26
- 6.8kΩ 2 R4, 19
- 10kΩ 2 R25, 35
- 27kΩ 1 R1
- 39kΩ 1 R2
- 47kΩ 3 R14, 18, 22
- 100kΩ 4 R5, 8, 24, 30
- 220kΩ 1 R11
- 270kΩ 2 R32, 34

Variable 5mm Cermet p.c.b. mounting
- 50kΩ 3 R17, 23, 33
- 1MΩ 1 R36

### Capacitors
- Miniature Ceramic plate
- 8.2pF 1 C50
- 22pF 3 C26, 36, 38
- 33pF 3 C1, 21, 37
- 68pF 1 C15
- 100pF 2 C5, 7
- 150pF 1 C20
- 220pF 1 C4
- 560pF 1 C11
- 1nF 6 C3, 12, 16, 35, 39, 52
- 10nF 17 C6, 8-10, 13, 14, 17-19, 22-24, 27, 30, 32, 49, 57

Miniature Polyester
- 22nF 2 C44, 55
- 0.1µF 1 C56

Min Electrolytic 16V radial leads
- 1µF 1 C31
- 4.7µF 6 C40, 41, 43, 46, 48, 54
- 10µF 4 C42, 45, 47, 51

Min Electrolytic 25V axial leads
- 100µF 1 C53

Trimmers film
- 2-22pF 3 C25, 28, 29
- 5-65pF 2 C33, 34

Trimmer ceramic
- 5-30pF 1-6 C2 and similar for additional channels

### Coil data
- Coil types are of the Toko S18 type available from Bonex

<table>
<thead>
<tr>
<th>Coil</th>
<th>Core</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Ferrite</td>
<td>White</td>
</tr>
<tr>
<td>L2</td>
<td>Ferrite</td>
<td>Violet</td>
</tr>
<tr>
<td>L3</td>
<td>Ferrite</td>
<td>Yellow</td>
</tr>
<tr>
<td>L4</td>
<td>None</td>
<td>Orange</td>
</tr>
<tr>
<td>L5</td>
<td>None</td>
<td>Yellow</td>
</tr>
<tr>
<td>L6</td>
<td>None</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Other coil details
- L7 3 turns 24s.w.g. 5mm i.d.
- L8 4 turns 24s.w.g. 3mm i.d.
- L9 4 turns 24s.w.g. 3mm i.d.
- L10 4 turns 24s.w.g. 3mm i.d.
- L11 1 turn 24s.w.g. 3mm i.d.

RFC1, 22 turns 26s.w.g. on FX1115 ferrite bead
- FB Thread an FX1115 ferrite bead on a 22s.w.g. wire link

### Semiconductors
- Transistors
  - BC237 3 C31
  - BF244 4 C36
  - BSX20 2 C37
  - MRF237 1 C38

- Integrated Circuits
  - 4093 1 IC1

- Diodes
  - 1N4001 1 D1
  - 1N4148 4 D2-4,6
  - 1N5401 1 D5

- Miscellaneous
  - Crystal 12MHz range, S18 single screening cans; Relay Bonex Part No. 610067; s.p.s.t. Min toggle switch; Push to make switch; Heat sink for TR7; Ferrite beads FX1115 5 off; Veropins; 1-pole 6-way rotary switch; Min coaxial cable; Multi-strand hook-up wire; Mounting pillars; p.c.b.

All components for the prototype were obtained from either Bonex or Maplin with the exception of the crystals which are available from Golledge Electronics at £5.50 per channel or £30 inclusive of VAT and P&P, for a set of 6 channels of your choice. Ask for the PW Cub crystals and the channels or frequencies required.
Beginner: A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently.

Intermediate: A fair degree of experience in building electronic or radio projects is assumed, but only basic test equipment is needed to complete any tests and adjustments.

Advanced: A project likely to appeal to an experience constructor and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Definitely not recommended for a beginner to tackle on their own.

Components for our projects are usually available from advertisers. For more difficult items a source will be suggested in the article. Kits for many of our recent projects are available from CPL Electronics and FJP Electronik. Kits, both of who advertise in the magazine.

Advanced: A project likely to appeal to an experience constructor and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Definitely not recommended for a beginner to tackle on their own.

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A precision laboratory 3 channel – 3 trace oscilloscope packed with features you’d expect to pay TWICE the price for:

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Practical Wireless, March 1990
Every once in a while, something comes along which marks a true turning point in amateur radio equipment. Such was the case when Trio-Kenwood introduced the TS-120 series; the first of the small solid state HF transceivers to appear.

Following the trends of the last few years towards more "sophisticated" equipment (really meaning more and more complicated), we have seen Kenwood engineering directed more towards better performance, particularly in HF transceivers; performance which has become a standard of excellence for others to try and match.

The culmination of Kenwood design thinking is a new transceiver which I think is another turning point in HF equipment. This is the TS-140S, and I can tell you that reading the enthusiastic comments coming from happy owners, I can confidently say that the TS-140S is the "HF transceiver of the year."

The culmination of Kenwood design thinking is a new transceiver which I think is another turning point in HF equipment. This is the TS-140S, and I can tell you that reading the enthusiastic comments coming from happy owners, I can confidently say that the TS-140S is the "HF transceiver of the year."

The TS-140S continues the successful "1" series, which began with the TS-120S, developed into the TS-130S and has now reached what I consider to be that new direction in amateur radio equipment. In the TS-140S, Kenwood designers have given the user a receiver section with real performance which matches today's expectations, and remember that Kenwood have consistently set the standards for many years.

It is almost impossible for any manufacturer to give every potential customer everything that the customer wants, but there is little doubt that many people have been asking for "simplicity". However, it is also possible to carry the "simplicity" concept too far, resulting in a transceiver which is certainly low priced but lacks facilities which many users see as essential. I happen to believe that Kenwood have achieved the right balance in the TS-140S.

In my opinion, the TS-140S in combining performance with simplicity at an attractive cost is giving real satisfaction to the radio amateur who wants to enjoy his hobby of communicating, rather than counting the buttons on the front panel.

73.
John Wilson
G3PCY/5N2AAC

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TS-790E – Just when you thought it was impossible

Impossible to design and produce a multi band VHF/UHF transceiver which would render all others obsolete? But this is what Kenwood have done with the TS-790E, in the same way that the TS-940S set new standards which have not yet been beaten, or the TR-751E 2 metre multimode, which is still without any serious competition. Kenwood have the magic touch which gives the customer what the customer wants, in a package which is easy to use, performs like a dream, and is simply a delight to own.

The TS-790E gives you all-mode operation on 2 metres, 70 centimetres, and with an optional internally fitted section adds 23 centimetres as well. Power output is 45 watts on 2, 40 watts on 70, and 10 watts on 23; and there is little doubt that the receiver performance will better any previous transceiver.

It is fashionable in some quarters to sneer at the microprocessor, but Kenwood write the software in their processors with the aim of giving the user complete control over a wide range of facilities and not confusing the issue. In this respect, the TS-790E adds a new dimension to VHF operating, with its dual (triple) band monitoring, cross band operation, full duplex facilities, and a wide range of features to make life easy for the operator.

John Wilson
G3PCY/5N2AAC

TS-790E £1,495.00 inc VAT

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- Low Battery indicator.
- Size: 124mm H x 55mm W x 31mm D.

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- Frequency range: 144-146MHz (with extended Rx capability).
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- Soft touch buttons & knobs.
- Rotary knob or pushbutton frequency selection.
- PTT and keyboard locks (rotary knob is left active).
- Low Battery indicator.
- Can be powered directly from a car's cigar lighter (5W output).
- Rotary Knob Selection.
- Dimensions: 124mm H x 55mm W x 31mm D.

**AX 700E**

- This new generation dual band mobile transceiver is virtually two radios in one box. 70cms and 2m each have their own displays showing frequency, S-meter and so on.
- The vertical line on the left hand side of the display is to show signal strength and the horizontal line along the bottom is the frequency range. This range can be set to 1W, 250 or 1000kHz. The frequency displayed at the top is the frequency at which the signal is being received.
- Each band has its own Volume and mute button. Each band can be tuned independently.
- Both bands simultaneously through the built-in speaker or through one or two external speakers. Each band can be tuned while transmitting (45Watts available).
- The height will show the signal strength and the position will indicate the frequency. By simply turning the tuning knob a cursor can be slid up with the new signal and its exact frequency will be displayed at the top of the screen. To receive the new signal but you only know the band that it is in and not the frequency can be tuned while transmitting. That's what a PanaDor can do.
- Each band has 4 different scan modes and 10 memories. Five step sizes are available and the spot frequency can be tuned while transmitting.
- As for the rest of the AX 700E, it covers 50 to 904.995MHz with AM and FM (wide 8 narrow), it is powered by 13.8V dc and it measures just 1110mm W x 180mm I x 75mm H.
- The supplied microphone gives remote control of some of these functions and Tone Squelch and ADS units are available as optional extras.

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A Collinear for 144MHz

Collinear antennas offer advantages over the normal quarter or half wave antenna, but good all-round coverage and increased gain over the smaller antennas are tempered by an increase in cost. With this in mind, I decided to develop a simple collinear that was also cheap to construct.

Loading coils and ground planes always seem to cause problems for the home constructor. To minimize these problems this antenna is based on the 'J' pole' which requires only one loading coil and no earth plane. The overall construction is shown in Fig. 1. The antenna is made up of three main parts, each of which is made from aluminium tubing. The lower and upper pieces are a sliding fit into the main stem tube. These pieces are constructed from 1/4in tube with a sidewall thickness of 20s.w.g., whilst the main stem is made from 3/8in tube also with a sidewall thickness of 20s.w.g. These are obtainable in 4m lengths from aluminium suppliers.

**Construction**

Starting with the loading coil, the assembly is constructed on a 75mm long piece of Type 66 nylon rod with a diameter of 16mm (Fig. 1 shows the cutting and drilling dimensions). If making your own pieces, then a 7mm drill normally gives a clearance hole suitable for the 1/4in required for the top section, and a 10mm drill should prove adequate for the other hole. The recommended self tapping screws will penetrate both walls of the tubing. Using a file, flatten an area which will give better clamping to the coil when the time comes to make connections.

The coil itself is formed by winding 6 close spaced turns of 1mm enamel covered copper wire on the rod, leaving sufficiently long tails to make the connections later on. When completed the wire 'tails' should be pulled through the 1.2mm cross holes. Then, scrape off the enamelling where the connections are to be made.

Cut the top element to the correct length as this requires no other work, but the main stem should be cut some 16-20mm longer as shown in the enlarged view diagram. A 1.7m length piece of the 1/4in tube is used to form the feed section of the antenna. If available, a hard former of 45mm diameter will allow the bend to be made with more accuracy and ease. A point 780mm from one end of this piece, is to become the centre point of the curve. Finally cut the short leg to the correct length of 737mm as shown in Fig. 1. This gives two legs of uneven length, the longer one will be inside the main stem giving more strength at the spacing bar support point. The shape is correct when this piece lays flat afterwards. Assemble the three pieces together using Fig. 1 as a guide, and check the continuity between the feed point and the top section of the antenna. Any reading greater than about 0.1Ω should be corrected. The loading coil must now be made weather-proof by several coats of a good marine polyurethane varnish.

**Setting-up**

Support the antenna as high up as possible and in the open, make temporary connections of the coaxial cable with crocodile clips and check the v.s.w.r. using a frequency of 145.300MHz. It should be possible to achieve a v.s.w.r. reading of 1.1:1 or lower at this frequency.
How do we know when the antenna and network are resonant and presenting the correct value of resistance to the transmitter? Directional wattmeters or reflectometers are an answer, Ray Fautley G3ASG explains.

Let's start with a couple of questions.
(i) Why are directional wattmeters so-called?
(ii) What are they used for?
Directional wattmeters are so-called because, when connected between a source of power and a load, they are able to differentiate between power flowing in one direction - from source to load - which is the direction it is supposed to go, and power flowing in the opposite direction - reflected from load to source - which is the direction it is not supposed to go. In other words, directional wattmeters can indicate power flowing in different directions. They are also called 'reflectometers' as they are able to indicate reflected power, another term for the power flowing the 'wrong way' from load to source. They can be used:
(i) To measure power into a resistive load (in watts) (ii) To measure standing wave ratio (s.w.r.) existing on an antenna feeder (iii) To indicate when the power reflected back to a source (such as a transmitter) has been reduced to a minimum. If they can be used to measure power into a resistive load, then they can also be used to measure power into an antenna, provided that the antenna and feeder together may be represented by a particular value of pure resistance.

To illustrate this, look at Fig. 23.1. Assume that the transmitter requires a load of 50Ω and that the directional wattmeter has been calibrated to measure power correctly when connected to a resistive load of 50Ω. If these assumptions are correct, the only measurement we need to make is that of the voltage appearing across the 50Ω resistor (after the transmitter has been switched on!) to determine the power dissipated in the resistor. From P = E²/R
If the measured voltage across the resistor is, say 50V r.m.s., the power in the resistor will be:

\[ P = \frac{50^2}{50} = \frac{50 \times 50}{50} = 50W \]

So, all we really need is an r.f. voltmeter! Well, that's all right as long as the load is a pure resistance of 50Ω. What happens if it isn't? Well, the wattmeter will still only read the voltage across the load and if the load is complex with a reactive component, the reading on the wattmeter scale will be very far from indicating the true power in the resistive part.

Remember only resistance dissipates power and the voltage measured by the meter would be that appearing across the whole complex load, not just the voltage appearing across the resistive part. So, what's inside one of these reflectometers? The main components are shown in Fig. 23.1. A brief description of operation in matched and un-matched conditions follows.

**Matched Condition**

When the output terminals are connected across a pure resistance, say 50Ω: (i) The r.f. voltage across C2 will be in phase with the line voltage at point X (ii) The r.f. current through T1 primary will be in phase with the line voltage. (iii) The r.f. voltage developed across R1 will be phase or exactly 180° out of phase with the r.f. voltage across C2, depending on which way round T1 secondary is wired.

It should be connected so that the R1 voltage is 180° out of phase with C2 voltage, thus the two r.f. voltages are made to be equal, the resultant reading on the r.f. voltmeter will be zero. That is, no reflected power.

**Un-matched Condition**

When the output terminals are connected to a complex impedance such as would appear if a random length of wire and an earth were to be connected to the output terminals. (i) The r.f. voltage across C2 would still be in phase with the line voltage at point X (ii) The r.f. current through T1 primary would not be in phase with the line voltage. (iii) The r.f. voltage across R1 would change, both in phase and amplitude (iv) The two voltages applied to the r.f. voltmeter, one from C2 and the other from R1, are neither exactly equal in amplitude nor exactly opposite in phase; the r.f. voltmeter will read, indicating a mis-match.

To enable the directional wattmeter to read forward power when connected to a pure 50Ω load, the connection to T1 secondary must be reversed by a switch, thus enabling the two voltages from C2...
there. There’s ample free parking. Talk-in on S22 and SU8.
stands, Morse tests and Bring & Buy, refreshments will all be
Course (1 mile North of Newcastle upon Tyne). The usual trade
at the North-Eastern Exhibition Centre at Gosforth Park Race
March 3: The Tyneside Amateur Radio Society Rally will be held
a Bring & Buy stall and refreshments. Talk-in GB4RRR on S22
for disabled visitors). The usual traders will be there along with
Gillingham, Kent. Doors are open from 10.15am to 4pm (10am
even if an impedance measuring bridge is available.

determining this antenna impedance either as a
series or a parallel network is quite a difficult task,
actual impedance of the antenna was at
22 of the series, so we have already got some clues
ratings than are required for use on the other bands.
smaller components with lower voltages and current
power level permitted on this band allows the use of
short length antenna. Another reason is that the low
requirements
The average amateur is not likely to have access to
such a bridge, so what can he do? The answer is to
design an a.t.u. which is capable of operation over as
wide a range of frequencies and impedances as
possible. Where do we start? What do we define as:
(i) a wide range of frequencies?
(ii) a wide range of impedances?
The range of frequencies is determined by the
amateur bands to be converted, say 3.5 to 29.7MHz
(80 to 10m bands). The range of impedances to be
covered is much more difficult to assess. A realistic
approach is to use variable components which have
low minimum reactances and high maximum
reactances. This is to enable the reactive part of
the antenna impedance to be tuned out, and as this
reactance may be either inductive or capacitive,
variable inductors and capacitors having low
minimum values and high maximum values are
necessary.
A further problem is that as the resistive
component of the antenna impedance may be higher
or lower than that required by the transmitter (which
is commonly 50Ω) and our a.t.u. must be capable of
converting upwards or downwards. From the
previous parts about impedance matching, it can be
seen that the way the matching components are
connected determines whether a step-up or step-
down or resistance results. The theoretical problem
of designing such an a.t.u. is very much greater than
the practical problem of actually using it to resonate
and match antenna systems to provide a 50Ω
resistive load for the transmitter. It is the directional
wattmeter which is the important piece of
equipment, for all that is necessary is to vary the
a.t.u. controls until the reflected power indicated is
zero, whilst the forward power is maximum.
All the complicated impedance matching is then
done for you without having to determine first the
actual reactance and resistance of the antenna
system for each different amateur band. To cover as
many practical cases as possible, one of the
requirements therefore is for the matching
compontents to be connected in different ways to
enable both upward and downward matching to be
achieved. Possible ways of doing this will appear at
some later date, as the design and operation of
a.t.u.s is quite another story!

A directional wattmeter is an important piece of
equipment in the shack. Most of the work is done for
you while you watch the dial as you adjust the
a.t.u. controls.

Radio Diary

February 24: The Rainham Radio Rally will be held in the
Parkwood Community Centre, Deanwood Drive, Rainham,
Gillingham, Kent. Doors are open from 10.15am to 4pm (10am
for disabled visitors). The usual traders will be there along with
a Bring & Buy stall and refreshments. Talk-in GB4RRR on S22
and SU22. Bob GOLKE. Tel: (0634) 362154.

March 3: The Tyneside Amateur Radio Society Rally will be held
at the North-Eastern Exhibition Centre at Gosforth Park Race
Course (1 mile North of Newcastle upon Tyne). The usual trade
stands, Morse tests and Bring & Buy, refreshments will all be
there. There’s ample free parking. Talk-in on S22 and SU8.
Terry G6VEG. Tel: 091-264 8196.

*March 9-10: There will be an amateur radio show at Picketts
Lock Centre, Picketts Lock Lane, Edgmonton, London N18. Details
from: London Amateur Radio Show, 126 Mount Pleasant
Lane, Brickett Wood, Herts AL2 3XD.

*March 18: The Norbreck Amateur Radio, Electronics and
Computing Exhibition organised by the Northern Amateur Radio
Societies Association (NARSA) at the Norbreck Castle Exhibition
Centre, Blackpool. Peter Denton G6CGF. Tel: 051-630 5790.

March 18: The Wythall Radio Club will be holding their 5th
annual radio rally at Wythall Park, Silver Street, Wythall,
Worcestershire. That’s on the A435 near junction 3 on the M42,

Continues over...
April 21-22: The RSGB are holding their Convention and Table Fair at the NEC, Birmingham. It's being held in three large exhibition halls and will include a trade stand, a bookstall, catering facilities, a licensed bar, a raffle and talk-in on S22. A licensed bar and cafe will be available for refreshments. The Knavesmire is well signposted and there will be additional RAC signs round the main approaches to York. Paul Whiting G4YOC. Tel: (0473) 642595.

April 28: The 1990 Bircotes Radio Rally will be held near Bawtry, Doncaster. Doors open at 11am (10.30am for the disabled). Talk-in on S22. Details and or booking forms from: Pat Smith, 23 Florence Avenue, Balby, Doncaster. Tel: (0302) 857526.

*June 10: The Royal Naval Amateur Radio Society Annual Rally & Radio Car Boot Sale will be held at the new venue of Stockwood Park, Luton. This is easier to get to (not far from junction 10 on the M1). Private sellers £7 in advance or £9 on the day, traders £20. Clive G4ENB. Tel: Luton 27907.

July 1: The York Radio Rally will be in the Tattersall Building, York Race Course, The Knavesmire, York. Doors open at 11am with an entrance fee of 50p (children admitted free). There is ample free parking. On show will be amateur radio, electronics and computing, arts and crafts, there's a grand Brings & Buy, Morse tests, lectures on various aspects of amateur radio, a raffle and talk-in on S22. A licensed bar and cafe will be available for refreshments. The Knavesmire is well signposted and there will be additional RAC signs round the main approaches to York. Frank Webb G3ZKS. Tel: (0904) 625798.

July 1: Newport ARS are holding their 3rd Grand Surplus Equipment and Junk Sale at the Brynglas Community Education Centre, Brynglas Road, Newport. The Sale is open from 10.30am to 4pm (10am for the disabled). Kevin GW7BSC. Tel: (0633) 262488.

* May 20: The 33rd Northern Mobile Rally will be held at the Oke Motor Park, Great Yorkshire Show Ground, Harrogate. Mike G0MKK. Tel: (0423) 564353/507653.

May 20: The 7th National Amateur Radio Car Boot Sale will be held at the new venue of Stockwood Park, Luton. This is easier to get to (not far from junction 10 on the M1). Private sellers £7 in advance or £9 on the day, traders £20. Clive G4ENB. Tel: Luton 27907.

* May 20: The Cambridge & District Amateur Radio Club are holding their 5th Annual Rally & Car Boot Sale at Coleridge Community Centre, Radegund Road, Cambridge. Doors open at 10.30pm. Brian G4TRO. Tel: (0223) 353664.

May 27: The 14th Annual East Suffolk Wireless Revival will be held at the Civil Service Sportsground, Straight Road, Bawtry, Doncaster. There will be a Bring & Buy, Car Boot Sale, a transceiver clinic, 50MHz demo station, all the usual traders and lots more including a children's play area. Paul Whiting G4YOC. Tel: (0473) 642595.

May 28: The 1990 Bircotes Radio Rally will be held near Bawtry, Doncaster. Doors open at 11am (10.30am for the disabled). Talk-in on S22. Details and or booking forms from: Pat Smith, 23 Florence Avenue, Balby, Doncaster. Tel: (0302) 857526.

* June 24: The Annual Longleat Mobile Rally will be, as usual, held at Longleat near Warminster, Wilts. Shaun O'Sullivan G8VPG. Tel: (0225) 873098.
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Available NOW this NEW Top of the range all band, all mode HF Transceiver from Yaesu. Again too many functions to list, so please send for leaflet!
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Compact HF transceiver with General coverage receiver, 26 memories, 100 watts output. All band, all mode, (FM optional).
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AR-1000 Handheld Scanner

Basic Specification:
Frequency Ranges: 15-600MHz and 905-1300MHz.
Frequency Selection: By direct keypad entry or by Tuning knob on top panel.
Memory Channels: 1000 arranged conveniently in 10 banks of 100, with direct keyboard access to any memory.
Search Bands: 15 Bands which come pre-loaded with the ten important UK bands of interest. Note these frequencies are pre-loaded in the factory and any search band can be easily re-programmed by the user.
Reception Modes: AM, FM (narrow) and FM (wide) which gives access for the first time to FM broadcast and TV sound in a handheld scanner.
Frequency Steps: User programmable from 5 to 995kHz, in any multiple of 5kHz or 12.5kHz.
Scan Speed: 20 channels per second.
Search Speed: 40 channels per second.
Power Source: 4.8v rechargeable Nicad.

Please note that the battery pack is four separate 500mAh AA size cells which are provided, but the user can easily replace them and replace them by four standard AA penclas. Also and most importantly, the AR-1000 can be powered from any external DC supply of 13.8V nominal, which not only powers the receiver but also charges the Nicad batteries.

All the performance and features which we wanted from AOR are here in a stylish handheld package, measuring only 70 x 36 x 170mm and weighing a mere 300g (excluding batteries). The AR-1000 comes complete with the following accessories:
- Set of 800mAh Nicad batteries
- 240V mains charger
- DC power cord with cigar lighter plug
- Soft carrying case
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- Carrying strap
- Earpiece
- High performance DA900 flexible gain antenna

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Practical Wireless, March 1990
As expected normal F2 contacts from the UK to Asia, Australia and the Pacific have been commonplace, with QRP achieving quite remarkable distances.

At G3YPZ, a list of 10 watts s.s.b. brought daily QSOs with Stateside, JA, USSR, etc., some interesting ones were HI8, A61, ZP5, CX2, V31, FH8, CO2, VU2, etc., all worked with a 5/8 groundplane at 6m from the flat Fenlands of North Cambridgeshire. ZL40D was also netted from the mobile installation on November 6. Whilst on the subject of ZL, it is worth checking the band for long path openings during our evening times - a freak c.w. QSO with ZL2GG occurred on November 8 at 2246 - he was the only signal on the band - so even if you think that the band is dead - it may not be.

The current mobile antenna used is the converted DV27 ex-CB whip. This is an efficient and cost-effective antenna. It is a shortened and helically loaded 1/4 wave with an adjustable screw in section at the top. With the section fully out, the antenna tunes with 1:1 v.s.w.r. on 144MHz. A power reduction from 100 watts to 10 watts workable. Graham managed to read my 4 watts and Graham's end with his signal could be heard reliably during which time VK6R0 was 20dB over S9. Incidentally, many of the European beacons were audible throughout the evening.

Fancy VK6 on FM?

Graham Rogers VK6RO at Perth, Western Australia is around and looking for Europe most mornings on 29.600 or 29.510MHz QRM permitting. I first worked Graham back in the last cycle when his signal could be heard reliability most days. I was delighted to renew the acquaintance again on October 26. Contact was established at 1250UTC and completed at 1309 during which time VK6RO was varying from 52 to 59 plus.

A power reduction from 100 watts to 1 watt was tried at Graham's end with 1 watt just detectable and 10 watts workable. Graham managed to work my 4 watts on 29MHz f.m. and many of the European beacons were audible throughout the evening. Were other PW readers active on the band on November? Let me know what you heard or worked.

Your comments and observations too:

G3YPZ, Rose Cottage, Hannath Road, Tydd Gote, Wisbech, Cambs PE13 5NA.

Fig. 1 Graham VK6RO's QSL card.

Fig. 2 Graham VK6RO
High Technology Test Equipment

30-Range Digital Multimeter
£69.95
Features front-panel socket for transistor and capacitor tests.
Low battery indicator, diode check function and continuity sounder.
Measures to 1000 VDC, 750 VAC, 10 amps AC/DC current, 20
megohms resistance.
20 µF capacitance and transistor gain. Requires 9V battery. 22-194

Probe Style Autoranging Multimeter
£29.95
Data hold function enables you to freeze the display and to remove it from the circuit
for more convenient reading.
Measures to 400 volts AC/DC and resistance in K-ohms up to 2 megohms.
Includes 2 button batteries. Overload protected. With carrying case 22-165

Regulated Power Supply
£59.95
13.8 VDC Regulated Supply.
Ideal for use with HAM transceivers. 5A continuous. 12A intermittent. 15A surge. 240 VAC, 50 Hz.
Fused 22-7001

For The Best In High Quality Electronics

Over 400 Tandy Stores And Dealerships Nationwide.
See Yellow Pages For Address Of Store Nearest You.

InterTAN U.K. Ltd., Tandy Centre, Leamore Lane,
Walsall, West Midlands, WS2 7PS. Tel: 0922 710000
"Thanks for the nice signal report, OM.

The station here is home-brew."

It's a great feeling to be able to say you built the equipment yourself, not to mention the enjoyment you gain from doing the construction. You can feel sorry for the guy, who spent over three grand on his new set, and isn't enjoying his radio as much as you are. Sure his set seems to have knobs for everything, but somewhere along the black box production line, they took the fun out. How many extra QSOs do you get with 1000 memories, and fifty less than essential functions?

May we suggest a rig that offers the challenge and pleasures of low power communication, combined with the fun of building it yourself?

**SINGLE BAND CW TRANSMITTERS**

These little rigs are simple to build, but offer a nice sounding CW note that you can be proud of. Key shaping and output filtering are provided, as is one crystal to get you on the air. RF output power is adjustable with an onboard control. Provision is made for connecting a VFO (HOWES CVF range) for full band coverage, and you can also add a DCrX Direct Conversion receiver for transceive operation if you wish.

<table>
<thead>
<tr>
<th>Part</th>
<th>Kit</th>
<th>Assembled PCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTX80 (80M 5W)</td>
<td>£13.80</td>
<td>£19.90</td>
</tr>
<tr>
<td>CTX40 (40M 3W)</td>
<td>£13.80</td>
<td>£19.90</td>
</tr>
<tr>
<td>CVF VFO</td>
<td>£22.90</td>
<td>£29.90</td>
</tr>
<tr>
<td>50pF Tuning capacitor to suit VFOs:</td>
<td>£1.50</td>
<td></td>
</tr>
</tbody>
</table>

**DUAL BAND AM/DSB/CW TRANSMITTER**

The HOWES AT160 transmitter is great for the 160M club net, local nattering on AM, and long distance working on CW. 10W PEP output is available on both 80 and 160M bands. Front panel controls are provided for output power and carrier level. Excellent modulation quality is provided by a low level balanced modulator, class A driver stages, and plenty of RF negative feedback. Full key shaping is provided. The transmitter is broadband with no tuned circuits to align. Harmonics are -40dB or better with relay switched output filters. One crystal (80M) is provided, as is PTT switching (including antenna relay).

Matching microphone amplifier and dual band VFO kits are available.

<table>
<thead>
<tr>
<th>Part</th>
<th>Kit</th>
<th>Assembled PCB</th>
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<tbody>
<tr>
<td>AT160 (Dual Band TX)</td>
<td>£34.90</td>
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<tr>
<td>VF160 (Dual Band VFO)</td>
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<tr>
<td>MA4 (Mic Amp for TX)</td>
<td>£5.60</td>
<td>£9.90</td>
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</table>

**DCrX DIRECT CONVERSION COMMUNICATIONS RECEIVERS**

These receivers make a great introduction to amateur radio for the novice, besides being widely used by experienced QRP (low power) operators as part of a transceive. Modes are SSB and CW, with up to 1W of audio output for 'speaker or 'phones. These are straightforward, single band receivers, and give amazingly good results. A "hardware" package to suit (case, dial, tuning caps, knobs, sockets etc) is available. There are versions for 20/30/40/70 MHz amateur bands.

<table>
<thead>
<tr>
<th>Part</th>
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<tr>
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<tr>
<td>DCrX Hardware:</td>
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<tr>
<td>DCRX10 10, 12 &amp; 15M COMMUNICATIONS RECEIVER</td>
<td></td>
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</tbody>
</table>

This three band receiver gives SSB and CW reception on the three highest frequency shortwave amateur bands. These are commonly known as “DX” bands, and you can hear stations from all over the World. You don't need a big antenna for these frequencies, and this set will give great results with a simple wire dipole (details in the kit instructions). Performance is excellent.

<table>
<thead>
<tr>
<th>Part</th>
<th>Kit</th>
<th>Assembled PCB</th>
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</thead>
<tbody>
<tr>
<td>DCRX10 Kit: £24.80</td>
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<tr>
<td>DCRX10 Hardware:</td>
<td>£14.00</td>
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</table>

**ACCESSORY KITS**

We have lots of add-on goodies to tempt you with. Could you fancy extra filters, or perhaps a digital frequency display? Need a good quality ATU?

<table>
<thead>
<tr>
<th>Part</th>
<th>Kit</th>
<th>Assembled PCB</th>
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<tr>
<td>CT150 (150W ATU 30W)</td>
<td>£27.90</td>
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<tr>
<td>CM2 Quality Mic with VOGAD</td>
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<tr>
<td>CSL4 SSB &amp; CW Dual B/W Filter</td>
<td>£9.90</td>
<td>£13.90</td>
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<tr>
<td>DCS2 &quot;S meter&quot; for receiver</td>
<td>£9.90</td>
<td>£13.90</td>
</tr>
<tr>
<td>DCF Digital Counter/Display</td>
<td>£19.90</td>
<td>£29.90</td>
</tr>
<tr>
<td>SWR30 SWR/Pwr Indicator</td>
<td>£12.50</td>
<td>£17.30</td>
</tr>
</tbody>
</table>

All HOWES kits come with a good quality Printed Circuit Board, full clear instructions, and all board mounted components. If you would like more information, please send an SAE for a free catalogue or information sheets on any specific products. Technical help and Sales are available by 'phone during office hours.

**PLEASE ADD £1.00 P&P to your order total.**

73 from Dave G4KQH, Technical Manager.
No Linear - No HF DX!

It is not possible these days to work DX on the h.f. bands unless you are using high power. The pile-ups are too big and only the 'big boys' will get through. Therefore, the h.f. bands are only for those with a fat cheque book and it is a waste of time going on the bands with 100W and a dipole, let alone trying just 2 or 3W from a home-brew rig.

This is certainly a view I hear expressed quite frequently and I wonder if this is your view of h.f. operating? Tuning around the bands, particularly when there is some rare DX about, it is very easy to take one listen to the melee of stations and decide that this aspect of the hobby is not for you.

I became interested in h.f. DXing around 1979, during the last sun spot peak, and at the time was running a commercial transceiver, a 400W linear and a 3-element tri-bander. Over a period of 3 or 4 years I had a lot of fun, using s.s.b. and c.w. to work about 300 DXCC countries. However, in 1983 I sold the rig and antenna because I had become despondent with the h.f. DX scene - it was becoming increasingly dominated by bigger and bigger linears, each attempting to 'outgun' the opposition. I decided that this was not much fun and hardly my idea of amateur radio.

I chose to move in the opposite direction and try some low power operation. With my old (but excellent) Drake receiver I listened around 3.560MHz - the 80m QRP c.w. frequency - and was amazed to discover that I could hear stations from around the UK who were running flea power and yet conducting solid QSOs. Some were using power levels of one watt or less, yet I was hearing them with little or no difficulty - I was hooked. In a lot of cases, but certainly not all, the equipment being used was home-brew and, of course, it's true to say that QRP equipment lends itself very readily to home construction. For me, this was an added attraction as I have always enjoyed building equipment - even if some of the end results have not always been quite what I would have hoped for - hi!

In contrast to what I had left behind on the h.f. bands, it seemed to me that I had 're-discovered' amateur radio.

I built a couple of 3.5MHz band QRP rigs and spent a year or two working (and meeting) fellow enthusiasts. In the process I discovered just how popular the QRP movement is in the UK and across the world.

After a while, I began to realise that the number of countries I had worked with QRP on 3.5MHz was slowly increasing - GW, GM, ON, PAO, F, etc., and entirely by accident here I was chasing DX again! On the face of it, I was now doing it the hard way though, because my 3.5MHz band antenna was only a low trap dipole and I was using a maximum of 3W output. Yet, to my amazement, my QRP c.w. started to give me contacts into Asia, USA and Africa as well as across Europe. Because these results were so unexpected, the additional challenge of making the DX QSOs with such low power and relatively simple and cheap rigs, gave me tremendous satisfaction and enjoyment. Working DX with a commercial transceiver and linear was never as much fun as this!

I set myself a 'target' of 50 confirmed countries on 3.5MHz QRP c.w., but wondered whether it would prove possible. The last two or three proved hard work (they always do) but eventually that elusive 50th QSL arrived!

Build a Rig

By this time, I was keen to build myself a rig for the h.f. bands - not to get into the rat race of h.f. DXing again, but to try some low power around the bands and hopefully have some enjoyable QSOs. I chose to build the G3OGQ multi-band transceiver (RadCom 1983 and 1985) which is a fairly time consuming project, but one which has proved very successful for me. Although it is capable of running about 50W of c.w. and s.s.b., it was my hope that QRP c.w. operation with it on the h.f. bands would prove as rewarding as had my earlier 3.5MHz activity. To replace the 3-element Yagi that I had
sold, I put up a 2-element tri-bander - a DX32 at about 10m - which I thought ought to provide some reasonable contacts.

Now I could venture onto the h.f. bands with my massive 3W signal, I wondered what would be in store for me. I was, of course, very pleased when stations around Europe came back to me with good reports. Any surprise I felt with some of those reports, was far outweighed by the surprises and amazement expressed by stations I worked when they discovered my power level! Sure enough, I was making plenty of QSOs and soon discovered that it was possible to work some of the more exotic countries.

It wasn’t long (surprise, surprise) before I began to enter one or two DX pile-ups. Of course, it was a bit ‘tongue in cheek’ as first - after all, how could I expect to compete with the competition, many of whom would undoubtedly be running anything up to a kilowatt. However, I soon discovered that I very often made the QSO despite the pile-up and realised that a respectable DXCC score could well be possible using QRP.

Even then, I don’t think I expected my efforts to be as successful as they have subsequently proved to be. At the moment, the DXCC score stands at 213, with over 200 confirmed. In fact, at times I think it harder to obtain the QSL card from stations than it is to work them!

Therefore, these results surely indicate that the statements in my opening paragraph cannot be correct - it is certainly not necessary to use expensive high power h.f. equipment in order to work DX. It can be very easy to work even some very rare DX on c.w. with a comparatively modest station. I will agree that not everybody is able to put up an h.f. beam, but most will run considerably more power than me, and that will balance things out somewhat.

As a rule, however, your chances of working the DX will be much enhanced if you try that ‘outdated’ mode - c.w. In fact, it seems to have just about everything going for it, not only is it such an effective mode for working DX, but the rig can be fairly simple, home-built (if that’s your cup of tea), and cheap.

**An Asset**

If you would like to fill your log with some juicy DX callsigns, there is one invaluable asset you can employ that is infinitely cheaper than a linear (and is probably more effective), and even cheaper than a c.w. rig. In fact, it is completely free!

That asset is simply the ability to listen. I believe that many operators miss out on DX more as a result of their apparent inability (or reluctance) to listen carefully, than any short-comings in the efficiency of their stations. The successful DXer spends more time listening than he does transmitting. He will winkle out the rare stations when they first appear on the band and make his QSO before the ‘pack’ descends, but if a pile-up has already developed then he will listen carefully to the DX station’s operating procedures. He will ascertain when to call, and whether to call ‘co-channel’, or to call slightly off frequency - ‘split frequency working’. This is the secret of success - particularly when trying to work c.w. DX. The received strength of your signal is of less importance than where and when you call, and this explains why QRP operators can and do enjoy so much success.

Of course, as with a lot of things in life, practice makes perfect. If c.w. is a mode you’re not too proficient in, then a c.w. pile-up will be a little daunting at first. But don’t despair because, apart from anything else, you will only need to exchange reports (usually 599) and won’t have to worry about name, QTH, etc. Again, time spent listening (to other peoples QSOs) will help you become accustomed to the usual procedures and abbreviations.

Get used to making normal ‘rag-chew’ QSOs before entering the fray of a pile-up, because they tend to be handled at a comparatively high speed and you will need a basically sound c.w. ability in order to understand what is going on. Your first task of course, when coming across a pile-up, is to find and identify the DX station. You may well find stations calling across a spread of up to 5kHz (sometimes even more), and the DX will normally be at, or just below, the bottom edge of the mass of calling stations. Listen for the signal that is giving a callsign followed by a report (599 is normally abbreviated to 5nn) and then perhaps a ‘QRZ’...
followed by another callsign and report. He may not announce his own callsign very often, and when he does he may add details of the QSL route before going on to take more calls.

Different DX stations adopt slightly different operating procedures, but they all fall into roughly the same pattern. For example, if I am calling in a pile-up, I will know I am being worked when I hear the DX send "G3XJS 59". In the interests of brevity, he may well not send a "K" or "BK" at the end of his transmission. In reply, I would send something like: "QLS 599 599 G3XJS TU". The abbreviation "TU" means thank you. I could perhaps send: "TU 599 599 73 de G3XJS" instead. His acknowledgement may simply consist of: "TU", or perhaps "QLS QRZ" and that will complete the QSO. The others who have been waiting will start to call. Unless there is a query, perhaps over your callsign, it will be all over in a trice!

**Before Calling**

Before even calling the DX though, you will need to know exactly where to call. If you are lucky, and have been doing some diligent listening, you may have found him calling CQ, in which case you will need to call him on (or very close to) his own frequency. If however, there are already a number of stations calling, then you should listen carefully, find the stations he is working and establish whether he is on his frequency or slightly to one side. Normally, stations tend to spread out by moving h.f. of the DX, perhaps only very slowly, or so that the size of the pile-up increases. The DX will probably give some indication of his tuning intentions by sending: "UP" or "UP2" at the conclusion of a QSO. In this case, UP2 is not a prefix, but means 'I am listening 2kHz up from my transmit frequency'. So be guided by the DX, but find for yourself the stations as he works them, and call around their frequency - but ONLY when the previous QSO finishes! You will not be very popular if you call while he is still trying to complete a QSO, or is looking for calls from another part of the world (e.g. "USA only!"). When you do transmit, send only your own callsign once or twice, do not send the DX callsign as part of your transmission - it is obvious who you are calling!

Bear in mind that the DX will be using a narrow c.w. filter and if you can put your transmission in the centre of its passband, then the chances are very high that he will work YOU if the other stations are calling in the wrong place. The worst place to call if the DX is working 'split' is right on his frequency. Not only will you not get through, but you will be causing a great deal of QRM to others who may then miss a QSO themselves if you have prevented them from hearing the DX giving them their report. Such operating leads to 'self-appointed policemen' telling you to "UP" - hi!

Clearly, life is easier if you are using a transceiver with a remote v.f.o., but it is by no means essential. A great deal can be achieved just by careful use of an r.i.t., or x.i.t., control. Indeed, I have yet to get round to building myself a separate v.f.o.

You may decide that c.w. pile-ups are not for you, but don't give up too quickly. They take a little getting used to, and can be very productive (even for a modest station) in the search for DX. I have frequently been amazed when I have worked some very rare and sought after stations against a great deal of high power competition in large pile-ups. DX can be found and worked without joining a pile-up of course, but these days it is unusual for a rare country or station not to attract a lot of attention very quickly. Whether you go in for pile-ups or not, there is a great deal of satisfaction and fun to be had from making contacts with low power and I know that some of my QRP colleagues work DX with power levels of one watt or less.

Even is you're not too worried about working some of the rarer DX and you simply wish to have some enjoyable QSOs around the world, give it a try. Particularly now the h.f. band conditions are approaching their optimum, you don't need to spend a fortune to work the VKs and ZLs, etc. Remember, provided you are prepared to use the key, you won't need a linear - all you need is a pair of ears! PW

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**Practically Yours**

To judge from the correspondence received it seems that there is good demand for constructional information and details on test equipment. Over the next few issues it is intended to provide constructional details for a wide range of such equipment such as simple signal generators, capacity bridges, power meters and so on.

**Function Generator**

Let us begin with the details for a wide range test oscillator. In the form described, the unit covers a range of 20 to 200000Hz, but this range could easily be extended to cover 0.001Hz to 1MHz. Over the design range the unit will provide simultaneous sine, square and triangular (or ramp) waveforms. An added bonus is that the duty cycle is variable over a large range, so providing a means of producing narrow pulse outputs.

This is achieved by using the square wave output and suitably adjusting the duty cycle. The waveforms produced are extremely clean and the third harmonic distortion (t.h.d.) on the sine wave output can be lower than 0.5%.

The full circuit diagram is shown in Fig. 1 where it may be seen that a dedicated chip type 8083b takes care of the generator functions. The frequency range is covered by the combination of C2 and R2. To extend the range of the basic circuit C2 could be replaced by a series of switched inveres values of C2, (larger capacity lowers frequency). Resistor R2 is mounted on the front panel and should ideally be equipped with a good quality epicyclic reduction drive to enable more accurate frequency setting. Alternatively a 10-turn potentiometer and turns counter could be used, as these may now be obtained at reasonable cost.

**Wave Shaping**

The duty cycle of the oscillator is controlled by R6 and this should also be front panel mounted. Only if the output is displayed on an oscilloscope will the full value of this control be appreciated. It is possible, by choosing a suitable waveform and adjusting this control, to generate practically any waveshape that
you could reasonably require. The preset resistors R8 and R13, which are p.c.b mounted, are used to minimise distortion on the sinusoidal output. If available a wave analyser should be used to set their optimum points, but more than adequate results may be obtained by observing the sinusoidal output on an oscilloscope while adjusting them. To do this simply, with the duty cycle set to 50%, adjust R8 and R13 for the most symmetrical output that can be obtained. Should an oscilloscope not be available, then dispensing with both of these presets all together may be the best idea. If this is the case then a fixed resistor of 82kΩ should be connected from pin 12 of IC1 to negative, and pin 1 should be left unconnected. Under these conditions the t.h.d. on the sinewave output will be around 2% or less, but still adequate for most purposes.

**Outputs**

The three outputs available at pins 2, 3 and 9 of IC1 have differing levels. The three combinations R9/10, R11 and R12 in conjunction with the input impedance of the buffer stage IC2 serve to give a similar output level for all three waveforms. Switch S1 selects the required waveform and the panel mounted R14 controls the output level available from pin 6 of IC2. This has been added to buffer the output of IC1 and ensure a constant output level into differing load impedances.

**Multi-outputs**

An alternative method is to make all three waveforms available simultaneously. If this is desired then S1 is dispensed with and each output is taken via its own level control to a buffer amplifier similar in all details to that of IC2 and the surrounding components. Adding this last option is highly recommended, considering the small cost of incorporating it. The unit has very modest power drain and will run on a power supply of between 10 and 30V, and a p.s.u. made up from components rescued from an old cassette recorder or radio would be adequate to power it.

**Construction**

There is nothing at all fussy about the construction of the unit which may be built on Veroboard. Should you intend extending the range covered towards the upper limits of 1MHz then a p.c.b. would be preferable and IC2 would require changing to a faster type. A diecast metal box could be used to contain the project and Fig. 3 shows a suggested layout for the front panel. Since the unit was originally built I had a requirement for a swept signal output to assist with the filter alignment. It was that this was easily achieved using the circuit of Fig. 2. The timebase output of an oscilloscope is connected to the terminals marked TB, allowing R2*, which should be panel mounted, to control the frequency swing available. In use this system works best with timebase speeds of between 2 and 20ms per centimetre.

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**Component Shopping List**

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<tr>
<th>Resistors</th>
<th>Capacitors</th>
<th>Semiconductors</th>
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<tbody>
<tr>
<td>0.125W 5% carbon film</td>
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<td>741 1 IC2</td>
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<td>820Ω 1</td>
<td>C1 1</td>
<td>8038b 1 IC1</td>
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<tr>
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<td>22kΩ 1</td>
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Practical Wireless, March 1990
You are cordially invited to the most colourful and prestigious Amateur Radio event in Britain. The new

LONDON
AMATEUR RADIO
SHOW

makes it's debut on Friday March 9th (10.00am to 6.00pm) and Saturday March 10th (10.00am to 5.00pm) at Picketts Lock Centre, Picketts Lock Lane, Edmonton, London, N9.

Talk-in on 2m and 70cm Facilities for the disabled Grand prize draw each day
Free parking for 3000 cars Special Interest Group section
Facilities for the disabled Bars and restaurants
Grand prize draw each day Easy access by road
Special Interest Group section Bring and Buy sale
On-site leisure and camping (not included in admission)

Admission £1.00
(75p for advance bookings of 10 or more tickets).

For advance ticket sales please send cheque and SAE to The Secretary, London Amateur Radio Show, 126 Mount Pleasant Lane, Bricket Wood, Herts, AL2 3XD.

Don't miss this superb event! Lee Valley Leisure Park

Presented in conjunction with Southgate Amateur Radio Club
It has been several years since London hosted a full size radio show but happily that is about to change with the arrival of the London Amateur Radio Show at Picketts Lock. As you can see from the floorplan and list of exhibitors, most of your favourite dealers will be there and there are rumours of some exciting new radios being announced at this show.

The venue, in the Lea Valley Leisure Park, should make an ideal day out for all the family and while you’re at the show we hope that you will stop by our stands (RA & RB) and tell us how you like the new look PW.

Don't miss this superb event!

Presented in conjunction with Southgate Amateur Radio Club
Don't miss this superb event!

Presented in conjunction with Southgate Amateur Radio Club
Index to Company names and Stand Locations for the

**LONDON**

**AMATEUR RADIO SHOW**

<table>
<thead>
<tr>
<th>COMPANY NAME</th>
<th>LOCATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.J.P.</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>A.R.E. Ltd.</td>
<td>South — MA &amp; MB</td>
</tr>
<tr>
<td>A1 Electronics</td>
<td>North — G</td>
</tr>
<tr>
<td>Air Training Corps</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>Arndal</td>
<td>South — W</td>
</tr>
<tr>
<td>Arnsat — UK</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>Andrews Computer Service</td>
<td>South — A</td>
</tr>
<tr>
<td>Arrow Electronics Ltd.</td>
<td>North — H</td>
</tr>
<tr>
<td>B.A.R.T.G.</td>
<td>North — LA</td>
</tr>
<tr>
<td>B.N.O.S. Electronics Ltd.</td>
<td>South — LA</td>
</tr>
<tr>
<td>Badger Boards</td>
<td>North — M</td>
</tr>
<tr>
<td>Birkett J.</td>
<td>South — D</td>
</tr>
<tr>
<td>Borex Ltd.</td>
<td>South — PA</td>
</tr>
<tr>
<td>Capco Electronics Ltd.</td>
<td>South — LA</td>
</tr>
<tr>
<td>Cheshunt &amp; District A.R.C.</td>
<td>North — K</td>
</tr>
<tr>
<td>Commonside Hardware Serv</td>
<td>South — LB</td>
</tr>
<tr>
<td>Compelec</td>
<td>North — C</td>
</tr>
<tr>
<td>Dataphone Electronics</td>
<td>North — F</td>
</tr>
<tr>
<td>Dee Comm</td>
<td>South — S</td>
</tr>
<tr>
<td>Dewsbury Electronics</td>
<td>South — G</td>
</tr>
<tr>
<td>Display Electronics</td>
<td>South — F</td>
</tr>
<tr>
<td>Dressler Communications Ltd.</td>
<td>South — JA</td>
</tr>
<tr>
<td>ECS Services</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>Radio Bygones Magazine</td>
<td>South — L</td>
</tr>
<tr>
<td>G4ZPY Paddle Keys</td>
<td>North — J</td>
</tr>
<tr>
<td>Garex (Startup Comms Ltd.)</td>
<td>North — O</td>
</tr>
<tr>
<td>Giacomelli</td>
<td>North — F</td>
</tr>
<tr>
<td>GQRPClub</td>
<td>North — I</td>
</tr>
<tr>
<td>Heatherlite Ltd.</td>
<td>South — U</td>
</tr>
<tr>
<td>Hilton Plant Ltd.</td>
<td>South — Q</td>
</tr>
<tr>
<td>I.C.S. Electronics Ltd.</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>I.S.W.L.</td>
<td>South — T</td>
</tr>
<tr>
<td>Icon (UK) Ltd.</td>
<td>South — K</td>
</tr>
<tr>
<td>K.W. Communications Ltd.</td>
<td>North — F</td>
</tr>
<tr>
<td>Kanga Products</td>
<td>North — M</td>
</tr>
<tr>
<td>Kent R.A.</td>
<td>South — JB</td>
</tr>
<tr>
<td>Keytronics</td>
<td>North — LB</td>
</tr>
<tr>
<td>Lee Electronics (Communique)</td>
<td>North — E</td>
</tr>
<tr>
<td>Loutronics</td>
<td>North — JB</td>
</tr>
<tr>
<td>Marco Trading</td>
<td>South — JB</td>
</tr>
<tr>
<td>Mechanelec Ltd./Comp Junk Shop</td>
<td>North — D</td>
</tr>
<tr>
<td>Merlin Systems</td>
<td>North — E</td>
</tr>
<tr>
<td>MFM Supplies (Rugeley)</td>
<td>North — K</td>
</tr>
<tr>
<td>Morgan Smith H.J.</td>
<td>North — G</td>
</tr>
<tr>
<td>Navico Ltd.</td>
<td>South — O</td>
</tr>
<tr>
<td>Nevada Communications (Nevada)</td>
<td>South — I</td>
</tr>
<tr>
<td>New Cross Radio</td>
<td>North — N</td>
</tr>
<tr>
<td>Newton Engraving</td>
<td>South — L</td>
</tr>
<tr>
<td>Nipco</td>
<td>South — U</td>
</tr>
<tr>
<td>Oasis Computer Services</td>
<td>South — N</td>
</tr>
<tr>
<td>Photo Acoustics Ltd.</td>
<td>North — A</td>
</tr>
<tr>
<td>Poole Logic</td>
<td>North — M</td>
</tr>
<tr>
<td>Practical Wireless /SW Mag.</td>
<td>South — RA &amp; RB</td>
</tr>
<tr>
<td>Procomm (UK)</td>
<td>South — JA</td>
</tr>
<tr>
<td>PTV Electrical Services</td>
<td>North — G</td>
</tr>
<tr>
<td>Quartzlab Marketing Ltd</td>
<td>North — Q</td>
</tr>
<tr>
<td>R &amp; D Electronics</td>
<td>North — G</td>
</tr>
<tr>
<td>R.A.O.T.A.</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>R.F. Engineering</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>R.N.A.R.S.</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>R.N. Electronics</td>
<td>South — U</td>
</tr>
<tr>
<td>R.S.G.B.</td>
<td>North — D</td>
</tr>
<tr>
<td>Radio Shack Ltd.</td>
<td>North — B</td>
</tr>
<tr>
<td>RAIBC</td>
<td>North — K</td>
</tr>
<tr>
<td>Rich Electronics</td>
<td>South — C</td>
</tr>
<tr>
<td>Royal Signals A.R.S.</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>S &amp; S Electronics</td>
<td>South — L</td>
</tr>
<tr>
<td>S.E.M. Ltd.</td>
<td>South — N</td>
</tr>
<tr>
<td>S.G.S. Electronics</td>
<td>North — I</td>
</tr>
<tr>
<td>Sandpiper Communications</td>
<td>South — PB</td>
</tr>
<tr>
<td>Siskin Electronics</td>
<td>North — P</td>
</tr>
<tr>
<td>Standing</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>Syon Trading/Bicomm</td>
<td>South — B</td>
</tr>
<tr>
<td>System Enclosures Ltd.</td>
<td>South — LB</td>
</tr>
<tr>
<td>T.A.R. Communications</td>
<td>South — H</td>
</tr>
<tr>
<td>Taurus Electrical Services</td>
<td>South — N</td>
</tr>
<tr>
<td>Technical Software</td>
<td>South — LA</td>
</tr>
<tr>
<td>Telford Electronics</td>
<td>North — K</td>
</tr>
<tr>
<td>Telstar Satellite TV Ltd.</td>
<td>South — LB</td>
</tr>
<tr>
<td>W.A.B. Awards</td>
<td>North — Balcony</td>
</tr>
<tr>
<td>W.H. Westlake Electronics</td>
<td>South — E</td>
</tr>
<tr>
<td>Waters &amp; Stanton</td>
<td>North — LC</td>
</tr>
<tr>
<td>Wilson Valves</td>
<td>North — N</td>
</tr>
<tr>
<td>Wrath T.</td>
<td>South — V</td>
</tr>
</tbody>
</table>
If we could amplify just the wanted signal, then we would be able to read even the weakest of signals merely by adding more r.f. gain to the front-end of our receivers! Unfortunately, when we add gain, not only do we increase the background noise of the signal itself but we also tend to introduce extra noise resulting from the process of the amplification.

Let's look at the sort of signal we might wish to amplify. In Fig. 1a you can see a signal comprising a number of discrete frequency components (e.g. a modulated signal), rising from a relatively low noise floor. The signal to noise ratio (S/N) can be regarded as the amplitude difference between the noise floor and the signal peak. This 'distance' along the amplitude axis is commonly expressed as a dB ratio. In Fig. 1b you can see the same signal, but this time relative to a higher noise floor and hence with a smaller S/N.

In many cases the readability of a signal is determined by the S/N. Thus, while signal (a) may represent R5, the higher noise floor of the signal (b) may impair the readability to R3 or R4 at best. What, then, can we do to make a signal such as (b) more readable? There are two primary things: one, of course, is to reduce the noise floor and the other to increase the signal amplitude.

All right, we may say, let's increase the r.f. gain by bringing in a pre-amplifier since this will increase the signal amplitude. Yes, certainly the amplitude will be lifted, but so also might the noise floor by the same amount. In that case the S/N will be unchanged - readability would not have improved despite the signal meter indicating S9 plus! We shall be seeing that there are times when a dedicated low-noise pre-amplifier can improve the S/N; but there are other times when the S/N might be further worsened by a pre-amp. We have undoubtedly encountered these effects when using the antenna pre-amp combined with some v.h.f. linears, where switching in the pre-amp dramatically steps up the S-reading yet does little to enhance the readability of a weak signal.

If we want to increase the signal amplitude, then one of the best bets is to improve the antenna at the operating frequency or by using a beam array directed for maximum signal response consistent with the best discrimination against QRM.

Noise Power Bandwidth

It is possible to reduce the noise floor at the expense of signal bandwidth and in this respect a couple of interesting diagrams are given in Fig. 2. At (a) a very high noise floor is shown which almost buries the wanted signal, yielding a very poor signal to noise ratio. The same signal is also present at (b), but this time it is passed through a narrow band-pass filter. Now, because the noise power falls as the bandwidth of a given signal spectrum is decreased, so the noise floor falls and the wanted signal, within the reduced operating bandwidth, rises above the noise and a very much enhanced S/N occurs, as shown.

From the first principles, the improvement in S/N corresponds to the ratio of the full bandwidth to the reduced bandwidth. By way of an elementary illustration, let's suppose that the full bandwidth is 5kHz and the filter bandwidth 100Hz (both to the -3dB or half-power points), then the ratio is 50:1. Hence the improvement in S/N is 50 times, or 17dB (power). This can certainly make the difference between a non-readable signal and a perfectly readable one!

Such a small bandwidth, of course, is only realisable with Morse code or data signals. Speech calls for significantly wider bandwidths; but, although the very narrow Morse-type of filtering cannot be used for s.s.b. signals, somewhat wider band-pass filters can be desirable, though the S/N improvement is less than with c.w. signals. With f.m. signals, of course, the requirement is for even wider bandwidths; but even with this mode it seems possible to reduce the channel width to something less than 25kHz, anyway. We shall possibly be hearing more about this at a later date.

What About Sensitivity?

Now having set the stage so to speak, let's see what is meant about sensitivity. The basic expression for sensitivity is merely the antenna signal level required for a stated S/N. Instead of an antenna, a modulated signal generator is correctly coupled to the receiver and the receiver tuned to the signal produced by the generator. It is usual to set the modulation somewhat below the maximum appropriate to the particular mode under test. The modulation level should be stated in the spec.

Of course, a meter is required at the output of the receiver, instead of the speaker or 'phones, to set a 0dB datum at the modulation level and volume control setting used. An audio millivoltmeter is highly suitable, and this is connected across a suitable value resistor which is replacing the speaker.

If it were possible to increase the amplification of a weak signal in total isolation we would have no problems. Unfortunately, as Gordon J. King IEng, AMIREE G4VFV points out, life isn't that simple.

---

Fig. 1: A signal spectrum rising from a relatively low noise floor (a) and a similar signal rising from a higher noise floor (b), showing the signal-to-noise ratios (S/N)
Practical Wireless, March 1990

Improved by passing the signal almost buried in noise over a relatively wide spectrum (a) resulting in a very poor S/N. Part (b) shows how the S/N can be greatly improved by passing the signal through a narrow band-pass filter.

Fig. 2: A wanted signal almost buried by noise over a relatively wide spectrum (a) resulting in a very poor S/N. Part (b) shows how the S/N can be greatly improved by passing the signal through a narrow band-pass filter.

at the output of the receiver. To achieve the 0dB datum, the r.f. output from the signal generator is set fairly high to start with. After setting 0dB on the meter by adjusting its sensitivity and/or receiver's volume control, the modulation is switched off and the meter's sensitivity stepped up allowing the meter to read noise only down to about -10dB or so, as required.

Sensitivity at any appropriate S/N can be determined by adjusting the r.f. level and making sure that the 0dB reference is correct at each r.f. input. The diagram in Fig. 3 shows that we are not really measuring the true S/N because when the 0dB datum is set, especially at low r.f. inputs, the meter must be reading the noise as well as the signal. The ratio is thus S+N/N. It would not be valid to make a sensitivity measurement by switching off the r.f. completely because, then, the receiver's a.g.c. system might increase the r.f. and i.f. gain at zero signal level. The effects of the a.g.c. should, in any case, be considered. It is sometimes best to switch it off if possible. Ratios of S+N/N of 10dB sensitivity are often given in the specifications.

**The RF Level**

The way that the signal is coupled from the signal generator to the receiver can yield a conflict between measured performance figures and specifications. It is, of course, very important always to ensure that the generator is terminated accurately to match the antenna input impedance of the receiver. In addition, the performance data should state whether the signal level corresponds to potential difference (p.d.) across the matched input or e.m.f. (electromotive force) from the generator directly. As p.d. corresponds to half e.m.f., the difference between e.m.f. (e.g. open circuit voltage from generator) and p.d. is shown in Fig. 4. Probably most reviewers of amateur radio equipment indicate sensitivity in terms of p.d., but unless the load coupling is accurately matched there will be errors. Many signal generators have their attenuators related to e.m.f., so if the generator indicates, say, 2µV (e.m.f.) for the required S/N, the sensitivity in terms of p.d. will be 4µV. The frequency spectrum over which the measurement is made will influence the results. Some engineers use 'weighting' circuits or low pass filtering so that the S/N performance relates more to the subjective (how we judge it by our ears) effect.

**Signal Noise & Distortion (SINAD)**

Rather than actually switching off the modulation to measure the noise content at the given r.f. input, an alternative method uses a distortion factor meter to 'notch out' the modulated audio signal at the output of the receiver, so that the meter then indicates the ratio between the signal plus noise plus distortion to the noise plus distortion (S+N+D/N+D), which is often called the SINAD ratio.

Dedicated meters are available for this sort of measurement, combining the readout proper, bandpass filtering and weighting and an automatically nulling notch filter. This tunes accurately onto the modulated tone and thus puts a 'notch' at that audio frequency, so that at the output (e.g. input to the readout) there remains the noise and harmonics (e.g. distortion), which are then read on an r.m.s. basis as a dB value below the datum value originally established by the instrument. The scheme is shown in Fig. 5.

It is possible, of course, to employ an ordinary audio distortion factor meter which some engineers, including me, regard as more convenient. The sensitivity is commonly referred to as a SINAD ratio of 12dB, which corresponds to a distortion factor meter reading of 25 per cent. The generator, of course, must produce modulation suitable for the mode under test, however, for s.s.b. it is feasible to apply an unmodulated carrier and adjust the receiver's tuning for a suitable (1kHz) beat note. This, then, represents the modulation which can be notched out in the usual way to achieve the SINAD ratio.

A similar thing can be done for c.w. measurements. However, where the S/N of very narrow band c.w. is being attempted, account should be taken of the noise power which is being removed by the notch filter. Notch filters for SINAD tests are very narrow, but so also are some c.w. filters! To avoid noise-power error, therefore, it may be desirable to quote mere S/N (not SINAD) for c.w. sensitivity measurements. With f.m. the generator should provide a deviation some two-thirds of the full deviation of the system (for example, around ±3.3kHz for narrow band f.m. (n.b.f.m.).

The output of the receiver under test should be properly loaded (with a suitable resistor to match the speaker’s impedance) and the volume control kept fairly low to avoid overload distortion. An output of about 50mW is a good level. This corresponds to 632mV across 8Ω or 447mV across 4Ω. It sometimes helps to monitor the modulation on a pair of phones or the receiver's speaker if this can be switched off when the actual measurement is made. The receiver must always be very accurately tuned to the generator signal.

**Noise Signal**

Noise signal is born of the random movement of electrons in electronic circuits. It is the bane of all electronic engineers - not to mention radio amateurs! Over the years many things have been done and techniques evolved to try to minimise its effect; but it is still with us. From our ‘phones or speakers it manifests as a hiss like the sound of car tyres on a wet road. When made up of components...
covering a wide frequency spectrum it is called white noise, by analogy with white light which contains all the colours of the rainbow. Owing to the filters and response characteristics of our receivers, the noise we hear is more 'pink' than white. It is weighted noise. Even so, over the air we often hear it referred to as 'white noise'.

**Noise Power**

Power in the noise signal is equal to the product kTB where \( k \) is Boltzmann's constant (1.38 x 10^-23 joules/K), \( T \) is temperature kelvin (K) and \( B \) is bandwidth in hertz. \( K \) is referred to absolute zero (-273.16 degrees C), so at an ambient of 17°C, \( T \) calculates to a shade over 290K, which is the noise temperature 'standard'.

As an example, the noise power in a resistor at 17°C works out close to 4 x 10^-21W per unit bandwidth (e.g. per Hz). Thus at 10Hz bandwidth it would be 4 x 10^-20W, at 20Hz 8 x 10^-20W, at 40Hz 1.6 x 10^-19W and so forth. In other words, the noise power increases by 3dB (it doubles) each time the bandwidth is doubled and decreases by 3dB (it halves) each time the bandwidth is halved. This, of course, directly relates to the noise power bandwidth discussed earlier.

**Equivalent Noise Voltage**

It is interesting to consider what sort of noise voltage power produces across a given resistor value over a stated bandwidth. Let's suppose that the noise power is acting in, say, a 50Ω load resistor over a bandwidth of 2000Hz (2kHz) at an ambient temperature of 17°C. Then, to work out the equivalent noise voltage we can use the simple expression of voltage equals the square-root of the product of the power is watts and the resistance in ohms.

We thus derive (KTB)0.5, where KTB is the noise power part and \( R \) the resistance. It should be noted that the noise power is that occurring in a matched load of the same value as \( R \) and is independent of the value of \( R \). Substituting the figures, the noise voltage across the matched load resolves to 2 x 10^-4 or 0.02µV. With \( R \) at 1kΩ and \( B \) at 5kHz, the noise voltage is around 0.14µV. The open-circuit e.m.f., of course, is double these values, given by (4KTB)0.5, which is regarded as an r.m.s. voltage in series with the conductor resistance \( R \). The noise voltage, of course, is amplified along with the antenna signal, and the effective S/N is further impaired by the noise contribution of the r.f. amplifier itself.

**Noise Factor & Noise Figure**

Noise factor is the input S/N to the output S/N, both direct ratios, while noise figure is the dB difference between the two when themselves expressed as dB ratios. For example, a 5:1 noise factor is 7dB noise figure (e.g. 10log5 = 7).

If an amplifier produced zero noise (not possible!) the noise at the output would be the direct contribution of the input noise (e.g. from the antenna and load). In practice the output noise is bound to be greater. The noise figure is a measure of the 'noisiness' of the amplifier.

As an example, an output S/N of, say, 2dB resulting from an input S/N of 9dB would indicate a noise figure of 7dB, this stemming essentially from the nature of the transistor and r.f. amplifier design.

Clearly, then, for the most effective operational S/N we need a receiver with a low noise figure, along with a reasonably strong antenna signal. However, if at. h.f., especially on the l.f. bands, a low noise figure is of very minimal consequence owing to the noises arriving from the antenna system itself. These tend virtually completely to mask the receiver noise. Just consider, for instance, the 3.5MHz band after dark and not only QRN, QRN, atmospheric noises in general, but also the multiplicity of intermodulation products stemming from many strong signals, which not only produce a dramatic rise in overall noise level but also diminish the effective dynamic range! The noise level on this band can be greater than 40dB (10 000 times) more powerful than the noise generated by the receiver.

**Noise Above 28MHz**

The noise figure plays a more important role at frequencies above about 28MHz, where the antenna noise is essentially cosmic and hence more sanitary. At v.h.f. and above, therefore, we should strive for receivers with the lowest possible noise figures. Modern 144 and 430MHz band rigs are, in fact, designed with a low noise figure in mind. This is aided by the use of low-noise r.f. amplifier transistors, and the design focusing on low noise performance rather than maximum possible gain.

It is not particularly easy to improve on the noise figure achieved by the manufacturer of a v.h.f. or u.h.f. rig without, perhaps, a minor redesign of the r.f. amplifier stage, for it is the first stage of a rig which is generally more important from the aspect of S/N ratio improvement than subsequent stages.

Sometimes a change of r.f. transistor can help and/or careful realignment of the front-end for the lowest noise figure (e.g. best S/N). After purchasing some years ago a Yaesu FT-840R 144MHz rig, I was able to attain a very worthwhile improvement in noise figure merely by 'optimising' the drain current of the 3SK9Y r.f. transistor and realigning!

If one has a "deaf" 144MHz band rig, there's always the temptation to hook in an external antenna pre-amplifier. Working 144MHz band s.s.b. on a not-very-strong signal without the pre-amp, one can be fooled into concluding that the pre-amp is a
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Practical Wireless, March 1990
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Thank you John and Adrian the Sorcerers Apprentice!
worthwhile device by the way the S-meter reading shoots up when it is switched in! Any pre-amp will give higher S-meter readings and make s.s.b. signals louder; but is the S/N improved? Try tuning an R3/R4 s.s.b. signal without the pre-amp, and then switch in the pre-amp. After resetting the volume control to get the audio level the same as before, determine whether the signal is now R4/R5. If it isn’t, then there’s not much point in having the pre-amp in circuit. In fact, it could be doing more harm than good merely by amplifying all the signals - weak and strong ones - and hence dramatically reducing the overload margin of the receiver, and possibly inciting spurious responses and intermodulation products in the r.f. amplifier and mixer stages! In other words, the dynamic range of the receiver could be impaired by as much as the gain of the pre-amp. The craft, then, is not particularly for high gain, but for the best noise figure!

**Improving the Overall Noise Figure**

Nevertheless, a well designed pre-amp, such as those produced by the small, specialised British firms can certainly enhance the S/N performance of a v.h.f. front-end if the rig itself isn’t endowed with a particularly exciting noise figure. As already mentioned, it is the first r.f. amplifier which is the critical one from the noise performance aspect. Total noise of a system takes account of the input circuits, r.f. amplifier, mixer, etc., according to the expression:

\[
N_{f1} + \frac{N_{f2} - 1}{G_1} + \frac{N_{f3} - 1}{G_1 \times G_2} + \ldots
\]

where \(N_{f1}, N_{f2}, N_{f3}, \ldots\) are the noise factors of the first, second, third, etc., stages and \(G1, G2, \ldots\) are the direct ratio power gains of the first, second, etc., stages. Let’s suppose that our 144MHz band rig has a noise figure of 4dB (2.5 noise factor) and we hook in a pre-amp with 2dB noise figure (1.58 noise factor) and 14dB gain (25:1 power ratio), then by using the first part of the foregoing expression we obtain:

\[
1.58 + \frac{2.5 - 1}{25} = 1.64 \text{ noise factor}
\]

or 2.15dB noise figure

Thus, by using this low noise pre-amp we have achieved a 1.85dB improvement in noise figure over the rig without a pre-amp. Quite a worthwhile improvement which would undoubtedly be noticeable on a weak s.s.b. signal, possible making an R3/R4 signal into an R5 one!

We can do even better than this by putting the pre-amp at the top end of the feeder, near the antenna. If, for example, the feeder at 144MHz has a loss of 3dB, the signal at the input of the pre-amp will be twice the power, thereby improving the S/N by 3dB. However, the total noise figure will worsen since in effect 3dB will be knocked off the pre-amp gain, leading to a total noise figure of 2.3dB, which is still very good.

If the feeder is fairly long and hence lossy, it certainly pays to site the pre-amp close to the antenna; but with an ordinary antenna system the pre-amp at the rig end of the feeder will do a good job if its noise figure is less than that of the rig. A relay, r.f. or ‘hard-switched’ operated, by-passes the pre-amp in the transmit mode.

In summary then, the noise factor of an ideal receiver can be defined as the number of times by which the signal power from the antenna must exceed kTB to provide unity S/N! In terms of practical performance, a receiver with 10dB S+N/N with an input of 1µV to 3µV is very good. At v.h.f. and above, higher sensitivities are being achieved; but at h.f. the ‘usable sensitivity’ is invariably established by atmospherics and other noises below 12MHz, as already noted.

Because of the reduced noise-power bandwidth required for reading Morse code, receiver sensitivity is commonly higher in this mode. In fact, with a narrow-band c.w. filter a S/N advantage up to 20dB becomes possible in with with respect to s.s.b. This means that a signal just bordering on R5 c.w. would need to be raised by more that three S-points to provide similar readability on s.s.b. Or, put another way, a c.w. transmitter with 100 times less power would provide a similar readability. Hence the popularity of c.w. QRP.

**Dynamic Range**

The noise floor is also caused to rise by spuri and intermodulation effects generated in-band by the large-signal limitations of all receivers. Viewed from the large-signal side of the dynamic range sandwich, the ‘usable dynamic range’ can be regarded as that dB range over which the multiplicity of signals can increase such that the intermodulation products (essentially third and odd-order) do not result in a significant rise in noise floor. In other words, a receiver with a good dynamic range performance is not only adequately sensitive for the band in use, but also one whose spurii and intermodulation products are well tamed.

We have seen, therefore, that receiver sensitivity is certainly not the ‘be all and end all’ of receiver performance. A more important consideration, in fact, can be how well a receiver can handle strong signals.

**Fig. 5: Showing the signals and instrumentation for a SINAD sensitivity test. The receiver r.f. input is adjusted for a SINAD ratio of 12dB (corresponding to a distortion factor meter reading of 25%), making sure that the 0dB datum is correctly set for each r.f. level change. The SINAD sensitivity is given by the signal generator, usually expressed as µV (p.d.)**
This Morse training program, written by GITEX, takes advantage of the availability and convenience of a portable computer to provide random Morse characters on the move or at unusual times.

Although I have held my Class ‘B’ licence since early 1986, it is only recently that I have made any determined efforts to learn Morse. The days that separated the Morse classes, run by Phil G0KKL, meant that any advances in ability made during the sessions were eroded by not listening to Morse inbetween times. I had tried commercial tapes, but these proved unsuitable in my case. The sounds of chairs scraping and intestinal activity of the person generating the Morse were distracting on one tape and I found myself listening less and less. Finally Phil said “You have a computer, why don’t you write a program to train yourself”? The listing reproduced here is the result of being unable to answer that question.

Starting Point

I have several computers, but the one I chose for the program is a Tandy Model 100. This small portable computer has 32KBytes of memory, runs from batteries and has various utility programs built into it. Not only that, but it also has a good, if not fast, version of BASIC. I had an Olivetti M10 version of this computer previously and the program will run on that, also I believe NEC make a copy of this machine although I do not know the model number of their machine.

Basically, the program will turn characters, saved previously in a text file, or a pseudo-random series of characters into the equivalent Morse tones. Either numbers or letters or mixed letters and numbers may be produced, with the possibility of limiting the characters to those that cause problems.

When typing the listing in, each BASIC line should have no spaces between the words, except where they have a textual meaning. So there should be no attempt to make the listing on your machine look tidy. The spaces within the program line will only slow the maximum speed down, which might eventually make the Morse less useful.

Definitions

Only lines 1 and 2 produce Morse sounds, all the others are there for support and organisation. Sound is produced by the BASIC command SOUND tone, duration. Where tone is an inverse number, i.e. high number-low note, and duration is in fiftieths of a second.

Practical Wireless, March 1990

0 GOTO 1000
1 SOUND TN,DI:FOR Y=0 TO WC:NEXT
:RETURN
2 SOUND TN,DA:FOR Y=0 TO WC
:NEXT:RETURN
3 PRINT CS,:FOR Y=1 TO WW:NEXT:RETURN
4 FOR X=1 TO LEN(MCS):IF MID$(MCS,X,1)=":":THEN GOSUB 1:NEXT:RETURN
ELSE GOSUB 2:NEXT:RETURN
5 X=(INSTR(MAS,C$)-1)*2+1:MCS=MCS(X)
6 FOR X=1 TO 2:WW:NEXT:PRINT ";":RETURN
10 CLOSE:CLS:PRINT " Produce MORSE tones from ";:PRINT "[P]re-recorded message":PRINT "[K]eyboard text input":PRINT "[R]andom characters":PRINT "[E]change parameters":PRINT "[ESC] to quit"
11 INS=INKEYS:IF INS="":THEN GOTO 11
12 IF INS="P" OR INS="p":THEN GOSUB 200
:GOSUB 100:GOTO 10
13 IF INS="K" OR INS="k":THEN GOSUB 300
:GOSUB 100:GOTO 10
14 IF INS="R" OR INS="r":THEN GOSUB 400
:GOSUB 100:GOTO 10
15 IF INS="C" OR INS="c":THEN GOSUB 500
:GOTO 10"
16 IF INS=CHR$(27):THEN CLS:END ELSE
17 RETURN
100 IF LEN(MS$)> 0 THEN MCS="":
:GOSUB 4:GOSUB 6:CLS:FOR N=1 TO LEN(MS$):MCS=MID$(MS$,N,1):IF CS="":THEN GOSUB 6:NEXT ELSE GOSUB 5:NEXT
120 RETURN
200 CLS:FILES:PRINT " Please use only a file name":INPUT "with 'DO' in it":FLS
:OPEN FL$ FOR INPUT AS 1:CLS
210 IF NOT EOF(1)THEN INPUT#1,MS$:
:GOSUB 100:GOTO 210
220 IF NOT EOF(1):THEN INPUT#1,MS$:
:GOSUB 100:GOTO 210
300 CLS:PRINT "Please input your text up to 4 lines">:MS$ :CLS:GOSUB 100:GOTO 10
400 CLS:PRINT "[L]etters":PRINT "[N]umbers":
:PRINT "[ESC] TO RETURN"
:PRINT "[E]xit":RETURN
401 INS=INKEYS:IF INS="":THEN GOTO 401
402 IF INS="L" OR INS="l":THEN GOTO 410
403 IF INS="N" OR INS="n":THEN GOTO 420
404 IF INS=CHR$(27):THEN RETURN
405 GOTO 400
410 CLS:PRINT "[L]etters":PRINT "[N]umbers":
:PRINT "[ESC] TO RETURN"
411 INS=INKEYS:IF INS="":THEN GOTO 411
412 IF INS="L" OR INS="l":THEN GOTO 410
413 IF INS="N" OR INS="n":THEN GOTO 420
414 IF INS=CHR$(27):THEN RETURN
415 GOTO 400
420 RNS="0123456789"
450 RL=LEN(RNS):CLS:PRINT " Please wait generating the characters":FOR X=1 TO VAL(RIGHTS(TIMES,2)):RN=RND(X)
:NEXT:MS$="":NEXT:RETURN
451 FOR GP=1 TO 30:FOR CH=1 TO 5
:RN=RND(9)*RL+1
:MS$=MS$+MID$(RNS,RN,1)
:NEXT:MS$="":NEXT
452 CLS:PRINT "[ESC] to quit:" PRINT " any other key to continue"
455 INS=INKEYS:IF INS="" THEN GOTO 455
456 IF INS=CHR$(27) THEN GOTO 10 ELSE RETURN
500 UP=0:CLS:PRINT "Change which parameter?": PRINT " [T]one of character": PRINT " [S]peed of character": PRINT " [W]ait periods": PRINT " [ESC] to quit"
501 INS=INKEYS:IF INS="" THEN GOTO 501 ELSE IF INS=CHR$(27) THEN RETURN ELSE
502 IF INS="T" OR INS="t" THEN GOTO 520 ELSE IF INS="s" OR INS="s" THEN GOTO 530 ELSE IF INS="w" OR INS="w" THEN GOTO 540 ELSE GOTO 500
505 GOTO 500
520 UP=0:CLS:PRINT "press": PRINT "[0] to go lower": PRINT "[ESC] to return"
521 INS=INKEY$:IF INS=" " THEN GOTO 521 ELSE IF INS=CHR$(27) THEN RETURN ELSE IF INS="o" THEN UP=0.1*TN ELSE IF INS="0" THEN UP=0.1*TN END IF
523 MSS="k":TN=TN+UP:GOSUB 100:GOTO 500
530 CLS:PRINT "press": PRINT "[1] for faster": PRINT "[0] for slower": PRINT "[ESC] to return"
531 INS=INKEY$:IF INS=" " THEN GOTO 531 ELSE IF INS=CHR$(27) THEN RETURN ELSE IF INS="o" THEN DI=DI-1:DA=3*DI ELSE IF INS="0" THEN DI=DI+1:DA=3*DI END IF
532 IF INS="I" THEN WW=W*.75:GOTO 590 ELSE IF INS="O" THEN WW=W*1.5:GOTO 590 ELSE GOTO 530
540 CLS:PRINT "Press": PRINT "[1] for shorter pauses": PRINT "[0] for longer pause": PRINT "[ESC] to return"
541 INS=INKEY$:IF INS="" THEN GOTO 541 ELSE IF INS=CHR$(27) THEN RETURN ELSE IF INS="w" THEN WW=W*1.5:GOTO 590 ELSE IF INS="O" THEN WW=W*1.5:GOTO 590 ELSE GOTO 540
590 TN=TN+UP:GOSUB 100:GOTO 500
1000 CLEAR 5000:DI=3:DA=3*DI:WC=2.5*DA:GOTO 590
1001 DIM MCS$(36):FOR X=1 TO 36:READ MCS$(X):NEXT
1025 GOTO 10
1030 DATA ",",",",",",",",",",",",",",",",",","",","",","",","",","",","",",",",",","",","",","",","",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",",","
in line 451. The latter half of line 450 is an attempt to create a differing series of characters each time the program is run. (Other computers may use the RANDOMIZE command to achieve this).

**Minus points**

The Morse characters become more staccato and less ideal as the dot time is shortened and is too mechanical to be the only training used. It should augment the periods of listening to Morse created by hand, either in a club or by listening to the radio. Finally the volume of the Tandy is not in the ear-splitting range, so a method of making more sound was sought. Sound is produced using a ceramic sounder behind the badge on the upper right hand side of the front panel. An audio frequency signal is sent to this sounder to produce the 'tinny' tone. On my model there was an unused plastic panel onto which a 3.5mm jack socket could be fixed, to allow the inbuilt sounder to be bypassed and an amplifier to be used.

This has not made learning Morse any easier, in fact I have spent less time learning, but I now have no excuse for not being able to practice. Five minutes listening may be achieved at any time of the day or, much to my long suffering XYL's disgust, the night.

Dah-Di-Dah.

PW

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Construction

In this final part of the PW Irwell, The Reverend George Dobbs G3RJV describes how to case the project and interconnect the modules to complete the QRP transmitter.

The prototype Irwell was built into a Minffordd Engineering Equipment Case Type J9 because the J9 case is both attractive and easy to drill. I drill the holes for controls slightly undersized and then enlarge them with a hand reamer to the correct size. The placement of the boards and controls is shown in Fig. 3.1. Mark and drill the holes for the various sockets and i.e.d.s then using standoffs, mount the boards in their respective positions. The case allows plenty of room for the boards, with the v.f.o. in its own box, placed in the centre. The signal leads must be wired with screened leads, and these are shown as the bold lines in Fig. 3.1. Ideally miniature 50Ω coaxial cable should be used. The commonest small coaxial cable available is type RG174, but often it is stiff and difficult to use for small interboard connections. In practice small screened cable, sold as microphone cable, may be used for the interconnections without too many problems.

Front and Back

The front panel on the prototype was finished off with a false front made of thin white card, with legends produced using dry rub-down lettering. This card is protected by a layer of sticky-backed transparent plastic of the type used for covering books. The main connections into the Irwell are all on the back panel and consist of: 12V in, key, antenna and receiver. I have used phono sockets for all these terminations because they are cheap and standard in my shack, but any type of connector may be used. If phono sockets are used throughout it is essential to clearly mark and remember which socket is carrying the 12V input.

It is easy to overlook interconnections between the various boards, so work in a logical order. I would suggest beginning with the 12V input from the back of the case. Add all the power leads...
beginning with the 12V via S2, then adding +12,
+TX and +RX interconnections leads. The v.f.o.
cut-off control, R9, is mounted on the back panel of
the outer case behind the the v.f.o box. The signal
connections starting from the v.f.o. may then be
added.

Putting It To Use

The Irwell requires a nominal 12V stablised
supply at a load of around 1A. One of the cheaper
p.s.u.s available from radio shops should easily
supply enough power. Bear in mind though, that a
poorly regulated supply could result in a poor
transmitter tone so please try to make sure that the
smoothing is adequate.
The Irwell is actually very simple to use. The
receiver is connected to the receiver socket SK3
which, on receive or with the unit switched off,
connects to the antenna. When the key is pressed,
relay RLA connects the antenna to the output of the
p.a. board.
The transmitter does not have a built in sidetone
monitor, as I prefer merely to back off the receiver
gain control and listen to the actual signal. Most
receiver front-ends will cope with the few watts of
r.f. passing close to the input, but being cautious I
have added a little more receiver protection. The
diodes D13 and 14 shown in Fig. 2.3 of PW Feb.
'90, show how a pair of diodes may be mounted
back-to-back across the receiver socket to limit the
amount of r.f. voltage that can enter the receiver.

Hints & Tips

Operating QRP is good fun, ask any of the
several thousand members of the G-QRP Club and
they will confirm this.

There are, though, a few simple rules which help
to reduce possible frustration. Avoid just simply
going on the band and calling “CQ”. Listen for and
call other stations after carefully netting onto their
frequency. Using the tail-ending technique is a good
method of QRP working, that is calling one of the
stations at the end of an existing QSO. Wait for the
final exchange and call the required station by using
a “two by two”, that is his callsign twice then your
own twice. Call just a little slower than the previous
QSO speed. Avoid giving your power level until
after a report has been given, this can be worth up to
2 extra S-points! Try listening on or near 7.030MHz
for other QRP stations. Above all, expect to make
QSOs and you will. Have fun!

Errors & Up-Dates
March 1990

An extra V crept into the headline of the review. The transceiver is of course, for the h.f. bands. We apologise
for increasing the versatility of this excellent transceiver.

Readers wishing to build the PW 49'er In-Car Short Wave converter which appeared in the January issue (the
p.c.b., layout, reference WR267, was reprinted in the February issue for the benefit of those readers wishing to
make their own boards) can now obtain the ready-made board from the PW p.c.b. service @ £6 inclusive of
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Signed

Practical Wireless, March 1990
Ron Ham has had a very long career in radio which started with the construction of a 1-valve radio when he was 10 years old. Ron quickly caught the radio bug and was soon to be found working on Saturdays in a cycle and wireless shop. At 14 he left school and worked in the radio retail trade from 1945 and was much involved with the increasingly popular television service - busily installing receivers for customers. It was while watching a Philips TV receiver he’d installed that he saw Sporadic-E long-distance reception of TV signals for the first time and it was that incident that triggered his life long interest in the study of propagation.

From 1950 to 1953 he worked for the South Eastern Electricity Board and married Joan, who he had met in 1948, during 1953. Since then the two of them have been inseparable and work together on virtually every project undertaken, although Ron freely admits that he can’t cook!

During 1953 Ron was busy installing TV sets at the time of the mad rush to see the Coronation via the fascinating new service and during this time gained a great deal of practical engineering experience working with low-band v.h.f. television.

At Home

Since 1954 the couple have lived in the heart of the West Sussex countryside in the picturesque downland village of Storrington where Ron became a half-partner in a long established radio and electrical retail business - which is, he’s glad to report, still thriving - until he took early retirement so as to concentrate on his writing and many other activities.

Living as they do in the beautiful West Sussex countryside, it comes as no surprise to find that both Ron and Joan are very keen gardeners. Along with their very large garden they have three greenhouses to look after and guests can always look forward to a good selection of home-grown vegetables at mealtimes. They are of course, also keen members of the active local horticultural Society.

Their cottage - ‘Faraday’ - is tucked almost under the slopes of the South Downs and it is hard to imagine that the outside world has ever intervened in the tranquil life of Storrington. However, as Ron delights in telling the visitor, the last war did come to Storrington and if it had come any closer they might have lost their home before they had even found it, because of a badly damaged German aircraft that had crashed almost opposite the house. This aircraft had been successfully attacked after it had raided Portsmouth and had not been able to gain enough height to fly over the South Downs. It crashed, narrowly missing what is now ‘Faraday’, in the field opposite the house. All the crew were killed and Ron recalls the story as it was told to him by a villager who was at the scene at the time and had witnessed the souvenir hunters amongst the wreckage.

Ron’s own interest in aircraft, flying and radio led him to be an instructor for the Air Training Corps for many years. He encouraged many young people to take up radio as a hobby through this disciplined form of training and it was through his connection with the ATC that Ron and Joan first became involved in rifle-shooting. Although they are the last people to boast about their skills - they are both excellent shots and have enjoyed target match shooting for many years and are both qualified RAF marksmen.

This month we offer a double value personality page as we profile the very well known and respected husband and wife team of Ron and Joan Ham. It’s not often that such teams go together and it can be honestly claimed that Ron and Joan are unique and only come as a pair and to profile them separately wouldn’t work!

Amateur equipment of the 1950s - one of the many exhibits at Chalk Pits Museum.
Performance. Yours and your radio's. They go hand in hand. To be a truly world-class competitor, you've got to have a truly world-class rig. And it's here, now. The versatile new FT-1000 from Yaesu.

Designed for the elite global contest and DX operators. With state-of-the-art design including direct digital synthesis (DDS) for low noise and fast lock-up time. The FT-1000 will blow away your competition with a spectacular combination of power and operating flexibility. This HF transceiver boasts a list of

UK Sole Distributor South Midlands Communications Ltd S.M. House, School Close, Chandlers Ford Industrial Estate, Eastleigh, Hants SO.
features and options that other manufacturers still have on their drawing boards: Like 200 watts RF power output; Built-in TCXO, for superior frequency stability; Independent filter selection; Dual receive with balance control and two tuning knobs for simultaneous reception in tough pile-up situations. Using BPF-1 allows cross-band dual receive.

And the FT-1000 options such as digital voice-recording system (DVS-2) for storing and playback “CQ Contest” messages. On RX the DVS-2 has a 16-second running memory for playing back garbled calls. There’s also a CW spot control, so you can align your frequency to that of an incoming signal without having to transmit; Plus direct keyboard frequency entry; Front panel RX antenna selector; Built-in cascaded filters;

Dual-mode noise blanker. And the receiver front-end uses a four JFET up-conversion mixer, for high dynamic range.

This HF rig is the product of three years of intensive research and design. These efforts show in Yaesu’s scrupulous attention to detail with features and options ergonomically designed to allow you to achieve a position of competitive dominance. To hear and be heard ... Like never before.

See the exciting new FT-1000 at your Yaesu dealer today. It’s the best of the best.

BY Tel: (0703) 255111

"These items and some filters are optional"
Propagation Interest

Propagation and astronomy has always been a great interest, especially the problems of Sporadic-E and tropospheric 'openings' and the resultant interference to television reception. In 1968 Ron designed and built a solar radio-telescope which worked almost daily until 1984 when it was honourably retired after many thousands of hours of observations. The building of an instrument of this type by a radio engineer who was not involved in professional astronomy attracted a lot of attention and Ron soon found himself appearing on the Tomorrow's World programme with James Burke, BBC South Today with Andrew Harvey and a science film entitled All For Love made by Yorkshire TV.

Between 1970-73 this enthusiastic and dedicated observer designed, built and ran an instrument for the radio observation of meteors as the entered the earth's atmosphere. The instrument ran for 15 hours a day and it gathered an enormous amount of information and statistics on radio signals reflected from the ionised trails left by the many meteors that burn up in the atmosphere every day. Several other models of Ron's instrument were built by other observers after they witnessed the original working at Storrington but Ron still has Mk 1, although it has now been retired. Between 1970 and 1975 Ron took part in over 50 of the BBC World Service World Radio Club programmes and its successor Waveguide. During this period he also presented a programme on BBC Radio Brighton dealing with amateur radio activity.

Many of Ron's broadcasts on radio and TV were associated with the late Frank Hennig, who for so many years contributed to the national radio network and the BBC World Service programmes. It was the sudden death of Frank Hennig, at 53, that made Ron decide that he should retire - if that is the right word - from business to concentrate on everything else.

Broadcasting work and mutual interests have also brought Ron into contact with another specialist, Patrick Moore. Ron and Patrick have worked and co-operated together closely for many years. Patrick contributes on a regular basis to the propagation pages in the 'Backscatter' section in PW. Despite being an extremely busy man himself, the famous astronomer finds time to assist Ron Ham in his own specialist field from his own home in nearby Selsey.

Despite being an incredibly busy man, Ron finds time to be involved in the British Astronomical Association and has written for many technical journals including PW and our sister publication Short Wave Magazine. Since 1979 he has been immersed in the running of the vintage wireless collection at Chalk Pits Museum nearby in Amberley. This section of the museum is based on Ron's own collection and now is an ever-growing part of the proceedings. As Honorary Curator of the Museum - a title which is misleading as it cannot do justice to the amount of work involved! - Ron has appeared on TV and radio many times showing special guests around the unique displays of vintage German military radio equipment and the many other special exhibits, while Joan (amongst her many other activities at the huge 36 acre museum site) is the specialist librarian in charge of the historic wireless library.

Team Work

Both Ron and Joan insist that they are not individuals but are part of a team! The couple complement each other in an extraordinary way and this can be illustrated by the fact that when Ron gives a talk on any one of a multitude of subjects, Joan operates the projector during the slide-show. When Joan gives a talk it's Ron's turn to be the projectionist!

Joan has made her own mark in West Sussex as a local historian, journalist, publisher and bookbinder! Along with her work as a freelance journalist for PW, Short Wave Magazine, etc., she writes for local papers and also researches, publishes and binds her specialist books with help from Ron.

Joan Ham's interests are also very wide and she is active in many local activities including the Horticultural Society of which she was Chairman and Secretary for many years. Along with the interests in science, physics and local history which she shares with her husband, Joan has a particular interest in Genealogy and has discovered much about the family name and history. This interest led her to become a member of the West Sussex Archives Society which provides her with another outlet for her skills and also helps her with the research for the various book projects which are planned or under way.

Publishing Skills

As an author Joan has produced some interesting titles which are still proving to be popular. The first book was published in 1979 and featured Storrington in Pictures. Following the success of that book Storrington In Living Memory appeared in 1982 to be followed closely by Storrington in Georgian and Victorian Times and The History of Storrington and District Horticultural Society in 1987.

Another particular speciality that Joan has is the restoration of ancient books and manuscripts which can entail many hundreds of hours of painstaking work. Her published book titles on local history have proved so popular that the couple are kept very busy in their bookbinding factory which has to double as a dining table at mealtimes!

No personality profile can ever do justice to this amazing couple. They really do come as a matched pair and as many past visitors (over 80 000 last year!) to the museum - which is set in old chalk-pit workings only a stone's throw from the mainline Amberley railway station - can verify, Ron and Joan Ham are very special pair of personalities!
**Packet Update 9**

The launch of the new series of Microsats is due in early January. It was to have been early November but there has been a delay due to a technical problem with a previous launch. It will make a nice New Year present for us. Six are being launched, three of which will be of interest to the packet operator, Pacsat, Lusat and UoSat D from the University of Surrey team. The amateurs involved with these projects have put in an enormous amount of work, in design, construction and organisation of the satellites and are to be congratulated for their efforts. Most of the AMSAT and TAPR teams were involved in the Microsat project, whilst the University of Surrey team were responsible for the UoSat D and E satellites.

Pacsat and Lusat are digital store and forward satellites. They will allow open access to a packet radio bulletin board to any amateur who has the correct equipment. They will use AX25, HDLC, NRZI as produced by any standard TNC. However, because these are operated from orbit, they will use mode JD. Mode JD, as defined by the Japanese, is 'Manchestered' FSK on the uplink and BPSK on the downlink. The hardware requirements are described in the Satellite column by Pat Gowen G3IOR. UoSat D will be carrying a packet radio experiment that will be operating a polling protocol with the satellite the master on top of AX25. This protocol will run in your computer and you will use a TNC running AX25 with a special modem. This satellite will operate 9600 baud FSK. The modem needed is K9NG compatible. These are available from TAPR and James Miller G3RUI.

The Pacsats will be used as flying BBS's in the usual way, using the satellites as a transmit device or a stored data device, enabling the 'human' to use it as he would a terrestrial BBS. It will also have real-time and stored telemetry files. However, the most interesting and innovative possibility is the introduction of a Broadcast Protocol. This will enable the reception of bulletins by a large number of terrestrial stations simultaneously. Assuming a 20K file on board the Pacsat BBS being read by 200 people. How long would that take? We only have a ten minute window every orbit, so the satellite will be tied up for a long time! However, with a broadcast protocol, all 200 stations would receive that file at one time. Another advantage of a broadcast protocol is that it does not require a transponder. The satellite will do all of the work and the radio station need only receive the packet. Also, the transmit and receive frequencies are on different bands. Pacsat will be the only transmitter on the downlink, thus removing the possibility of collisions, data-loss and QRM. This system, if it is successful, will be an ideal way of transferring large files around the globe. At present, all h.f. stations are available. With his comments on the International scene as he sees it. And if you think the v.h.f. networks are jammed, you should just see once what is happening on the h.f. international forwarding network.

**Bandplans - Again!**

Two concerned comments on the bandplans for h.f. packet as they stand at the moment. The first comes from John TOWT.

According to the h.f. bandplan for IARU region 1 (Africa, Europe, The Middle East, Mongolia and the USSR) the following sub-bands are recommended for packet radio.

- 3.590 - 3.600 MHz
- 14.089 - 14.100 MHz
- 21.100 - 21.150 MHz
- 28.120 - 28.150 MHz
- 29.200 - 29.300 MHz

If this is true, it is feared that the allocation end up with 9kHz of 14MHz allocation for RTTY - just enough for a few mailboxers and goodbye to rag-chewing or DX on 14MHz. Packet has been intruding on 14.055 and below and there is a net on 21.095 MHz and at times the ARRL bulletin cannot be heard due to packet. Another comment comes from Tom ODSNG, who is also concerned. Tom operates an AMTOR link, also operates packet and his comments are given verbatim.

"We do badly need a better bandplan, but not one arbitrary arrived at by a small selection of users."

Practical Wireless, March 1990

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**Feature**

Roger Cooke G3LDI reports on the ever growing popularity of satellite-packet radio.
“My forwarding partners for both bulletins and mail are:
SV11W, J1NHU, L6G6X, EA4DXY and SB4TX.
My forwarding partners for mail only are:
GB7LDI, PAOSCH, HB9AC, HB9GLD, F6ABJ and DK1OQ.

Russia is a special matter since at various times I was forwarding to RA3APR, R55 and HK43XQI, at 200 km. At the present time, there is no one left with a license to operate packet radio other than possibly RA6APR in Armenia. With this group and their extensions into other forwarding groups on either h.f. or v.h.f., mail and bulletins reach every BBS within a few days.

In addition, there is now a v.h.f. link to Cyprus, SB4TX. Costis now reads all bulletins that I receive and he is able to feed other stations that would otherwise not be able to receive them. The problem is that stations in the Mediterranean have been getting the traffic through the ARPANET and lead to two BBS’s being passed traffic on HF that another packet station has been able to get. The critical parameters we use are:

ACKNOWLEDGED BEFORE QSB and severe multi-path can occur but packets can be accepted and acknowledged before QSB and severe multi-path can distort the signals. The critical parameters we use are:

MAXFRAME = 1
FRACK = 1
PACLENGTH = 32
RESPONSE = 0
DWAIT = 0
MAXFRAME = 1
ACK = OFF (Level 1)
RETRIES = 15

There seems to be some misconception that when two BBS’s are passing traffic on HF that another packet station can be tolerated simultaneously. This just results in a severe slow down of channel through-put and leads to ‘everybody going nowhere, fast’.

We are continually plagued by other packet stations calling CQ on top of us. RTTY stations calling CQ or just sending strings of ‘dits’ and other clever individuals sending strings of ‘dits’, trying, and often succeeding, to dump the link. But with all this we are able to clear all traffic both ways every 24 hours 5 days out of 7. And the problems are associated with QRM and the other half due to the lack of propagation.

HF band conditions have been truly fantastic this SunSpot Cycle, but it won’t continue forever. In a few years we will have to abandon 15m for 20m and the QRM there is horrendous. Hopefully, the PACSATs will be operational and the truly long haul circuits can be handled by satellite.

I guess the most frustrating experience that has occurred is the failure to use packet radio to handle third party traffic during the earthquake in Armenia. Several months before this disaster struck, I had been in regular contact with Leo UA3CR on packet. He had been using his BBS as his ‘HOME’ BBS for several months and we had worked together spending many interesting hours getting our link to work. Leo had then gone to the States and managed to acquire an IBM-PC some kind and MBL software. Within a few weeks he had the first Russian BBS operating under his son’s, Evengi’s, callsign, RA3APR. We were handling traffic several times a week between Moscow and Washington but there was not much traffic. Then the earthquake in Armenia struck. For several days I did not hear from Leo and then when we finally got together he told me that Evengi went to Yerevan to set up some kind of packet station with the call sign RA6APR. Leo was desperate for equipment. He was in contact with many amateurs in Europe and the United States to enlist their help. Many stations all over the world were ready and willing to assist. And help was sent. But then the political and bureaucratic in nature and not technical. Equipment that arrived was held up in customs. Those individuals who came physically to help set up the amateur communications links were turned away. And the worst of all, even though within a few days after the earthquake, we had a good operational link on packet between Yerevan, Moscow, Israel and Washington, the United States and Russia never came to an agreement on third party traffic.

There have been several months that followed I could tell from Leo’s comments, which I was surprised to see, that he was terribly frustrated in his efforts to get things moving in Moscow. We all did the most we could but there are some things that remain beyond our influence.

The primary justification for amateur radio is to give assistance during emergency situations. The international packet network is the ideal mode for handling traffic during such emergencies and this network is operational. It’s daily used by countless stations all over the world proving that it is a dependable mode of operation for error free transmission of messages literally to any place in the world.”

**HF Forwarding**

The h.f. mail has increased just lately, most of it personal mail, with one American in London writing about three or four letters per day to his family, all of whom seem to be licensed. Nice way to keep in touch with home! As I am writing this, the personal mail in the last two days has reached 90. This is not including all the normal bulletins that are shipped over from N4QQ. It’s daily used by countless stations all over the world proving that it is a dependable mode of operation for error free transmission of messages literally to any place in the world.”

**Odds and Ends**

Please keep packet away from the beacon frequencies. There have been several complaints about QRM on 14.100MHz.

Please exclude packet from contests! A personal view, but wonder what you think?

That’s about it for another month, comments please to G3LDI @ GB7LDI, QTHR or Tel: (0508) 70278.

73 and happy packeting.

Practical Wireless, March 1990
### Dressler Antennas

**NOW NEW ARA 1500**
50MHz-2000MHz
Phone for details

- **ARA 900**
  - £139 (N-Type £159)
- **ARA 30**
  - £129

**ARA 900 ACTIVE ANTENNA**
50MHz to 1300MHz
Gain 17dB Typical

**TECHNICAL SPECIFICATIONS**
- Noise figure: 1.5dB at 50%RF
- Insertion loss: 1.5dB at 50%RF
- Isolation: 30dB below 100MHz
- 2.7dB below 400MHz
- 3.0dB below 500MHz
- 3.8dB below 650MHz

**ARA 30 ACTIVE ANTENNA**
50kHz ... 40MHz WITH LIMITED PERFORMANCE UP TO 100MHz

- Professional electronic circuitry with very wide dynamic range.
- Meets professional demands both in electronics and mechanical ruggedness.
- 1.2m long glass fibre rod.
- Circuit is built into waterproof 2.5mm thick aluminium tube. Ideal for commercial and swi-receiving systems. £129. See Review in August 1985 issue p.35
- Both antennas come complete with 7 metres of cable, interface, power supply and brackets.
- Also a wide range of masthead pre-amplifiers available for most V.H.F. and U.H.F. frequencies, including scanner pre-amps from £99.

**Special Offers**

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<td>IC-R9000</td>
<td>ARA 30 + ARA 1500(N) £3,999</td>
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<tr>
<td>IC-R7000</td>
<td>ARA 30 + ARA 1500(N) £999</td>
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<tr>
<td>IC-R71</td>
<td>ARA 30 + ARA 1500(N) £855</td>
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**Kenwood**

- **NEW TS850**
  - H.F. TRANSCEIVER
  - EP.O.A.

- **Kenwood R1000 + ARA 30**
  - £899
- **Kenwood R5000**
  - £169

**ICOM**

- **IC-781**
  - H.F. TRANSCEIVER
  - EP.O.A.

- **IC25E**
  - £349.00
- **IC25B**
  - £399.00

**Yaesu**

- **FRG8800**
  - H.F. RECEIVER
  - EP.O.A.

**Scanners**

- **AOR 2525**
  - £774
- **AOR 2502**
  - £499

**Sony**

- **ICF 7600DS**
  - FM/AM/SSB 76-108MHz
  - £159

**Standard**

- **C500**
  - Dual Band
  - £230
- **C528**
  - Dual Band
  - £237

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<td>TS850</td>
<td>EP.O.A.</td>
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<td>Yaesu</td>
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<tr>
<td>Sony</td>
<td>ICF 7600DS</td>
<td>£159</td>
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**Note:** Prices correct at time of going to press. Please phone for latest quote.
**ALINCO DR 110 2M 45 Watts!**

**£299**

**2m/70cms**

Optional Receive range

140-470/870-900MHz

* 10, 12.5, 25kHz steps
* 2.5 Watts output
* 144-146/430-440MHz Tx
* Programme Shifts
* Full duplex
* Battery Save
* 20 Memories
* Reverse Repeat

**NO EXTRAS!**

Includes:

- Rubber Aerial, Ni-cads
- Charger, Hand Strap,
- Belt Clip.

FREE CATALOGUE & PRICE LIST! We now have an illustrated catalogue of some interesting products for the radio amateur that we have never had the space to advertise. Also details of new items coming along. Just drop us a first class stamp and we will send you this plus our price list of over 700 items!

**“STILL THE MOST SENSITIVE” SCANNERS!**

**25-1300 MHz**

**£299**

Handheld JUPITER II

- AM/FM
- Direct up/down tuning
- 5, 10, 12.5, 25 kHz steps
- 100 memories
- 10 programmeable bands
- Sleep change frequency correction
- High speed scan 20 per sec.
- Carrier or audio peak
- Battery Saver
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- Fast scan load feature
- Individual memory unload
- Uses 4 x AA cells (Jupiter II)
- 30 km/mph or 1.5 km/mph
- 700 MHz first IF
- Proper English Manual
- Battery save
- Full duplex

Best Buy!

The Jupiter scanners are now recognized as the best on the market. Incomparables reverse compparetve models have understood this fact.

Sensitivity.

The Jupiter is more sensitive than the competition. Our own tests and an independent review have shown this to be the case even at UHF. And when it comes to UHF, the Jupiter wins hands down.

Battery Saver.

How often have you had batteries go down on you? With the Jupiter you can relax. It has a built-in battery saver that will dramatically reduce battery drain.

Channel Steps.

It's easy to be able to change channel steps. Most scanners have this essential feature. But with the Jupiter when you change steps the frequency is corrected to the nearest channel multiple. Some models don't offer this which means that you will run up with some horrific muddles on the display and lots of missed stations.

**FREE CATALOGUE & PRICE LIST!** We now have an illustrated catalogue of some interesting products for the radio amateur that we have never had the space to advertise. Also details of new items coming along. Just drop us a first class stamp and we will send you this plus our price list of over 700 items!

**SECONDHAND BARGAINS!**

**ALL FULLY CHECKED 3 MONTHS’ WARRANTY**

**E & O.E.**

**ALINCO DIAMOND JAYBEAM TONNA**

Send for our catalogue and price list

For years we have been operating a mail order service. Now it is even better! Here are the facts:

We have the widest range of ham products in the South. Nearly all products advertised in this magazine are stocked by us. All the famous names and a few lesser ones as well. Our price list contains nearly 800 items. We accept major credit cards and can arrange budget finance deals if needed.

Each order is entered on a computer and can be traced in seconds. Despatch labels and invoices are automatically generated and most orders received in the morning leave the same day. Each one is carefully packed and fully insured at our own expense. 24 hour Securicor and Datapost is available on request. And if you have any quibbles with your order we are here to put it right quickly and professionally! We take the risk out of mail order buying and our customers keep coming back. That's why we are bigger than most!
The AEA PK-88 Packet Radio TNC

Many beginners to packet radio are overwhelmed by the complicated all-mode terminal units on the market, offering I.e.d.s galore together with manuals stretching to over 100 pages long. It must be said that the PK-88 is similar in many respects, however the multiple I.e.d.s are there only as indicators to tell you what is happening. The long manual goes into detail about the many facilities available, rather than needing you to fully understand every line. As such, once connected to your computer and radio, you can be on the air within minutes. Most of the standard commands have sensible 'default' values already programmed in for you, so there is no need to worry about things such as what to set the Paclen to, and whether you need the AX25L2V2 'On' or 'Off' before you start!

The PK-88 will basically give the average amateur every facility needed to get going on packet, to link to other amateurs or 'Bulletin Board' stations and, if required, to automatically receive messages from other amateurs and even to act as an automatic 'digipeater' when the radio and TNC are left switched on but the station is unattended.

The PK-88 provides all the decoding, encoding and receiver control routines needed to send and receive packet radio. You will need a 144MHz f.m. transceiver capable of operation on 144.650 and/or 144.675MHz to link it to. This does not necessarily need to be a sophisticated all-mode affair, many amateurs use a low-cost ex-professional radio crystallised onto 144.650MHz for this. Other frequencies are used to a much lesser extent on packet, such as 430MHz and h.f., but you will normally find the 145MHz band to have the greatest activity. The PK-88 comes fitted with internal headers for v.h.f./u.h.f., spare headers are also provided in case you wish to use the unit on h.f. While you're in the shack, you'll need to connect a simple terminal or a computer operating in 'terminal mode' with a suitable program to allow you to see what is happening and to have QSOs.

The unit is quite small, measuring 35 (H) x 150 (W) x 190mm (D), and operates from a 13.8V power supply requiring a supply current of 550mA.

Computer Connections

The usual RS232 port connection is provided on the rear of the PK-88 to interface with your terminal or computer, as well as this a pair of headers are provided to give a t.t.l. level interface to some computers that do not have an RS232 connector fitted, the Commodore 64 for example. This interface requirement is worthwhile noting if you are considering purchasing a computer 'just for packet', make sure it can communicate through a serial port to the outside world! Unless you are using a dedicated terminal, you will also need some form of terminal program for the computer of your choice. Again make sure something suitable is available unless you have one of the popular computers such as a BBC or a PC clone for which an abundance of software is available. A straightforward pin-for-pin connecting lead is used between the TNC and your computer, if the thought of making one puts you off then several TNC suppliers and computer shops stock stock ready-made leads. Screened multi-way cable is advised to prevent any r.f. problems.

Radio Interfacing

An 8-pin connector on the PK-88 links to your radio, this needs to be connected to the transceiver p.t.t., transmit audio, receive audio, and ground connections, an optional squelch line may also be connected if available at the radio end, to prevent the TNC transmitting when a carrier is present. The PK-88 may incidentally, be internally linked to allow either positive or negative polarity p.t.t. keying, many Japanese sets and early UK transceivers employ negative keying, whilst later UK sets such as the Europa and Olympic use positive keying.

Powering Up

When first switched on, the PK-88 upon command goes through an 'Auto-Baud' routine, where it sends data to your terminal or computer at 300, 1200, 2400, 4800 and 9600 baud rates. Until the baud rate matches that set at your terminal, meaningless data appears on your screen, however when you have typed a few '*' characters the PK-88 matches your terminal baud rate, digital word length and parity automatically, what could be simpler? The default values are 1200 baud, 7 bits and even parity, but these may be altered at will. An internal lithium back-up battery is used to store these and other pre-set command functions when power to the TNC is removed.

After the PK-88 has recognised your terminal parameters, the following message appears on the screen:

AEA PK-88 Packet Controller
AX.25 Level 2 Version 2.0
Release 29.APR.88
Checksum 3D9

The final 'cmd:' prompt indicates the unit is in 'Command' mode, i.e. awaiting any instructions, with the front 'CMD' I.e.d. being lit to indicate the unit's state.

Commands

The numerous commands which you may enter are common to those used by most other TNCs, the descriptions of all of these are beyond the scope of this review, indeed over 70 pages of the instruction manual are devoted purely to them! However the most commonly used are the simple commands such as 'Monitor' ON/OFF which allows you to monitor other traffic on the channel, 'MHeard' which gives a listing of the last 16 callsigns heard, and 'Connect' to attempt a 'Connection' to another named packet station. Other commands such as 'MYCall' to set your callsign, 'DIGipeat' ON/OFF, 'DAYTime' to set the internal clock, 'CText' to set the automatic text sent to another station on connection and so on are used to a lesser extent, with the vast majority of other commands either being set once only or just left at their default values.

The front panel I.e.d. indicators show whether the TNC is in 'Command', 'Converse' or 'Transparent' mode, as an indication of the current control status. Further LEDs show the 'STA' which indicates if...
any of your packets are awaiting acknowledgement, ‘SEND’ showing p.t.t. status, ‘DCD’ indicating data is present on air, ‘Connected’ and ‘Multiple Connect’ modes, and Power On.

**Maildrop**

A useful feature of the PK-88 is an internal ‘Maildrop’ programmed internally to the TNC EPROM software. This allows stations to connect to your station in your absence provided your radio and TNC are left on, and to leave you a message to read upon your return. It uses a sub-set of the standard national bulletin board station commands such as ‘Send’, ‘Read’, ‘Bye’ and so on, to ensure familiarity. This also means that, with prior arrangement with your local BBS operator, your PK-88 has the facility to automatically receive auto-forwarded messages addressed to you from distant stations through the national BBS network.

The PK-88’s internal message memory capacity is 8000 bytes, i.e. a few A4 size pages of text. In compliance with the UK licence regulations 3rd party messages are not allowed by the maildrop software, this means all stored messages are either from you or to you.

**Technicalities**

The TNC uses the AMD7910 demodulator i.c. to ensure a reasonable rate of detection under noisy conditions, it has an input sensitivity of 5mV r.m.s. with a dynamic signal input range of 5mV to 770mV r.m.s.. An external modem may be connected if required, for 9600 baud usage on 23cm or store-and-forward packet satellites for example, HDLC rates of 45 to 19,200 baud are available from the TNC. A Z80 processor with a 32K battery backed RAM is used for operation, with 32K ROM. The unit is compatible with TCP/IP protocol, and a software ‘Host’ mode may also be used to allow dedicated programmers to write support software to communicate using shorter commands, hence speeding things up by communicating directly with the computer.

Note that although many of the user commands are TNC-2 compatible, the PK-88 is not a TNC-2 clone, hence it will not operate with TheNet EPROMS for individuals or groups wishing to set up this type of network node.

**On Air**

After connecting the TNC up and setting the data rate accordingly on the Auto-baud routine, I commenced entering the preliminaries such as ‘MYCALL G4HCL’ and so on. It’s often amusing to see the odd ‘NOCALL’ (the TNC default callsign) floating around on air, with their owner wondering why they’re not having any luck until some kind amateur connects and tells them! Within two minutes of powering up I had ‘connected’ to my local BBS, and commenced listing the latest news and gossip message titles available for me to read.

After a period of successful operation from home, due to the TNC’s compact dimensions I decided to become adventurous and take the unit out mobile, as a passenger in my car commuting between Cambridgeshire and Hampshire. My Z88 computer served as a terminal, a converted synthesised PMR rig purchased for £15 as the radio. On my journeys more than one amateur was astounded to see my periodic beacon ‘Mobile CQ’ message, with several QSOs resulting. It also certainly makes a change to be able to download the weekly RSGB news whilst travelling along, storing rally details and contest dates in computer memory rather than relying on frantic jottings on scraps of paper!

Throughout the review period the TNC operated perfectly when used with an Amstrad PCW9512, a BBC, and a Z88 lap-top, all operating in ‘Dumb Terminal’ mode to ensure I was testing the TNC itself rather than how clever any add-on computer software was. Further computer refinements are of course available, such as specialised programs for split screen operation, file downloading and uploading and the like. AEA for example have the PK-88 ‘Pakrate’ program available for both PC Clones and the Commodore 64, this uses Host mode and offers more features than a simple terminal emulator.

**Conclusions**

The PK-88 appears to be an excellent starter TNC at a budget price of £129.95 inc. VAT plus £5 P&P, yet still has facilities such as Host mode and external modem expansion capability to provide for many future interests. The internal ‘maildrop’ is very useful to enable other stations to leave you messages in your absence, to be read locally on your return without the need for both amateurs to connect in to a remote BBS station.

My thanks go to ICS Electronics Ltd., Unit V, Rudford Industrial Estate, Ford, Arundel, West Sussex BN18 0BD for the loan of the review sample.

Practical Wireless, March 1990
THE NEW IC-2SE,
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The IC-2SE measures only 49(W) x 103.5(H) x 33(D)* mm with the BP-82 Battery Pack. Hold the IC-2SE in your hand to truly appreciate its miniature size.

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Even with its tremendous versatility and a wide variety of functions, the IC-2SE is easy to use. All functions are performed by a total of just six switches and three controls. The IC2SE includes both simple and multi-function modes. The result is two transceivers in one: both an easy-operation and multi-function transceiver. Simple mode ensures totally error-free operations. Multi-function mode allows you a variety of function settings depending on your operating requirements.

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Reduced size doesn't have to mean reduced quality. The IC-2SE proves this with a wide variety of advanced functions.
- Tuning control on the top panel for quick QSYing.
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Options
- BA-11, Bottom Cap, Protective cap for terminals on the base of the IC-2SE.
- Battery packs and case.
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  BP-82 .......... 7.2V, 300mAh
  BP-83 .......... 7.2V, 600mAh
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  BP-85 .......... 12V, 340mAh
  BP-86 .......... Case for six R6 (AA) size batteries
- BC-72E, AC Battery Charger, Desk top charger for the BP-81- BP-85
- CP-12, Cigarette lighter cable with noise filter. Allows you to use the IC-2SE through a 12V cigarette lighter socket. Also charges the BP-81- BP-85.
- FA-140BB, 144MHz flexible antenna. Flexible antenna for 144MHz band operation. Some type supplied with the IC-2SE.
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- HS-51, Headset. Headset with VOX function that allows hands-free operation.
- Carrying Cases,
  Carrying Case Battery Packs, Battery Case
  LC-53 .......... BP-81
  LC-55 .......... BP-81, BP-83 or BP-86
  LC-56 .......... BP-84 or BP-85
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* At 13.8V DC

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The IC-2SE has 48 fully-programmable memory channels and one call channel. Each memory and call channel stores an operating frequency and other information required for repeater operations.

Convenient Repeater Functions.
The IC-2SE is equipped with programmable offset frequencies for accessing repeaters. All memory channels and a call channel store repeater information for your convenience. The IC-2SE includes a newly designed 1750 Hz tone call transmit function. A 1750 Hz tone call transmits when the PTT switch is pushed twice quickly.

Power Saver for longer operating time.
The power saver ensures lower current flow during standby conditions. Operating times are much longer than with older, more conventional transceivers.

Built-in Clock with timer functions.
The IC-2SE is equipped with an advanced 24-hour system clock with timer function. The transceiver automatically turns on when real time matches a pre-programmed time. This is perfect for scheduling QSO's. Auto power-off timers and other settings can be made in clock mode.

Convenient Scan Functions.
The IC-2SE is equipped with VFO and memory scan.

• VFO Scan. VFO Scan repeatedly scans all VFO frequencies. In addition, unnecessary frequencies can be skipped.

• Memory Scan. Memory scan repeatedly scans memory channels.

Auto Power Off Timer Function.
If you ever forget to turn the IC-25E off, don’t worry. It will turn itself off. Power-off time can be selected or deactivated using multi-function mode. Preserve battery pack power for the times when you need it most.

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Why interrupt calls to check other stations? Priority watch monitors a specified station every five seconds while you operate on a VFO frequency. Continue with your communications and let priority watch do the checking for you.

Helpline: Telephone us free of charge on 0800 521145 Mon-Fri 0900-13.00 and 14.00-17.30. This service is strictly for obtaining information about or ordering Icom equipment. We regret this cannot be used by dealers or for repair enquiries and parts orders, thank you.

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A new, shorter regulations booklet, DOC71, has now been published though another, DOC72 *Amateur Service - Operating Procedures* is only now entering the printing phase before being released. Because of this, the regulations examinations are still being conducted on the old collectors item regulations book which was last modified in December 1978. This has caused confusion among candidates in this transition period and will continue until several months have elapsed from the release of DOC72 to allow the information in that booklet to filter through to all examiners and candidates.

The main changes to regulation, apart from deleting obsolete requirements, are the introduction of WARC '79 emission designations and a major change to novice licences.

**Novice Licences**

The Australian novice licence from its introduction has restricted holders to transmit at limited power on three segments of the h.f. bands. There were two problems with this. One was that Australia’s v.h.f.-and-above-limited licence holders could not communicate on air with h.f. only novices. The other was the problem of reciprocal licensing arrangements with Japan. With increasing tourism between VK and JA, anomalies became apparent, in that JA telephony only operators were able to receive v.h.f. privileges in Australia and Australia’s novices, who are better grounded in radio theory, could not.

To solve these problems DoTC has permitted novices 10 watts f.m. voice on the 146-148MHz segment of the 2m band. Novices and most other amateurs are pleased with the change, though some die-hards in VK7 are reported to have moved their net into the 144-146MHz segment to avoid novice contacts.

**Callsigns**

Because of a DoTC computer limitation and the difficulties involved in a manual system, VK9 calls are now issued randomly rather than as previously with the fourth character signifying location. This VK9L calls will not now necessarily come from Lord Howe Island.

The fourth character of VK callsigns are currently A to G inclusive, S and W for full calls; L, M, N, P and V for novices; J and K for combined limited and novice calls and, though UK amateurs would be surprised to hear them, R for repeaters and T, U, V, X, Y and Z for limited calls. DoTC is not keen to issue I, O or Q but H will no doubt appear in due course.

**Loss of the 576MHz Band**

The 576-585MHz (50cm) band, uniquely though temporarily, allocated to Australian amateurs until needed be broadcast services, has now been largely withdrawn. Operational ATV repeaters which use the 587-585MHz segment will be permitted to continue until these frequencies are needed in the coverage area for Band IV u.h.f. television. The pressure has come from the installation of large numbers of u.h.f. translator stations in Band IV and V, to give television coverage to hundreds of country towns across Australia. The WIA is looking to an ATV segment around 614-620 or 902-928MHz. Though the DoTC Spectrum Planning Section is examining the proposal, success is not likely.

**Ionospheric Prediction Service**

Australia’s propagation forecasts come from the Ionospheric Prediction Service (IPS) now renamed IPS Radio and Space Services. The IPS is based around the joint US-Australian solar observatory at Learmonth on North West Cape in Western Australia. This facility uses both a radio telescope and an optical telescope to constantly monitor the sun when it is above the horizon. Reports are compiled using this information and information for IPS’s other solar observatory at Culgoora near Narrabri in New South Wales.

The IPS has become very active in recent times. In the past, their main output as far as the amateur service was concerned, was the standard GRAFEX charts of predicted propagation conditions from east and west coasts to a dozen or so target areas. These charts show for all h.f. bands, and across the twenty-four hour period, the sorts of propagation conditions to be expected. These continue in Amateur Radio Action magazine but have died in the WIA’s Amateur Radio which now only runs a brief ionospheric summary.

In addition, though, IPS now offers more services to amateurs and to the general community. First is a
series of IPS user training courses. Each course costs $A75 (£4) per person for an all-day session of 3 two-hour lecture and demonstration sessions. The first session covers the scientific principles involved in ionospheric prediction, the second covers propagation and prediction formats and the third examines solar activity and the effects of short term solar disturbances. Participants receive an IPS User Training Manual. The courses are held on rotation in state capital cities and large country towns. Those wanting the course either at different times or other places can get their own presentation at $A500 (£225) per day plus the lecturer's travelling expenses and $A25 (£11) per participant for manuals.

Second is the availability for a cost of $A16 (£7) per year predictions for a user nominated eighteen circuits. Predictions are posted twelve times per year to subscribers.

Third is the IPS Frequency Prediction Calculator. This laminated card calculator shows upper and lower frequency limits plus recommended frequency for paths of up to 1000 kilometres in the Australian region any time of day for any month, season or year. The cost is $A14.50 (£6.50) per year which includes the laminated card body plus a new slide posted at three monthly intervals to subscribers. It is ideal for mobile operators wanting to choose the most appropriate frequency for their h.f. communications.

The fourth is the Sydney IPS Solar and Geophysical Report recorded telephone message service, which gives a rundown on solar disturbance warnings, solar activity, the geomagnetic field and provides predictions of flux number and indices.

The fifth is SAPS - the Stand Alone Prediction System computer program and data files. It is suitable for predictions across any circuit in the world and outputs a myriad of ionospheric prediction information to 40MHz. User information files of such data as antennas available and their characteristics and operating schedules can be included for SAPS to use in its predictions and recommendations. As a bonus, the system calculates beam heading and distance. The system is on seven disks and includes an historical data set from 1938 to the present and with predictions to 1990. Data updates, latest predictions and other useful solar information are provided in the Solar Geophysical Summary sent monthly to all SAPS purchasers. Users input this data to their existing database. Cost for SAPS is $A250 (£110). Advanced SAPS, ASAPS, will soon be available to SAPS users for an additional $A100 (£45) and will provide more advanced features.

Finally, the sixth IPS service is a propagation report five times a day Mondays to Saturdays from Radio Australia. First daily report is at 0425UTC.

Other News

My horror story of the decade comes from VK5. As part of South Australia's Jubilee 150 year celebration, a group of amateurs took VVISJA aeronautical mobile in a Cessna 172. That sounds normal enough, but the antenna arrangements have alarmed all pilots who have come across the details. The antenna was an 11m length of wire, wait for it, weighed at the trailing end with a house brick! All the arrangement needed was a brief period of negative G-forces for the brick to smash through the fuel tanks, control surfaces or whatever. I shudder to think of it.

Australia's volunteers for the International Travel Host Exchange Scheme now exceed an astounding score. Any G amateurs interested in contacting these VK amateurs with a view to meetings and accommodation in Australia can contact the ITHE via the WIA at PO Box 300 Caulfield South, Victoria 3162, Australia, or the federal co-ordinator Ash VK3CIT at PO Box 539, Werribee, Victoria 3030, Australia.

Amateur Radio magazine has published a very useful list of current prices for a vast range of second-hand equipment in Australia. Covering about 250 transceivers, linear amplifiers, microphones, receivers, antennas and rotators, the list could be useful for any G amateur wanting to pick up gear on holiday here. I've sent a copy to a Hampshire PW reader interested in just that. For 4 IRCs, I'm happy to send the list to other interested PW readers as well. The compiler Jim Linton VK3PC at 4 Ansett Crescent, Forest Hill, Victoria 3131, Australia will no doubt do the same.

I reported some while ago that Australian Telecom was proposing to close the precise time and frequency station VNG. The station closed on 1 October 1987 leaving users to find alternative time and frequency standards. A VNG Users Consortium was formed in December 1987 to consider reintroduction of VNG services. It was estimated that $A40 000 (£18 000) was needed yearly to maintain services plus another $A10 000 (£4500) to relocate the VNG transmitters.

The $A10 000 was raised from 55 users and sympathisers and the transmitters moved to Llandilo near Sydney. Test transmissions began on 4.5MHz late in 1988 but have now moved to 5MHz.

The Australian Government has announced that subject to normal rules and regulations, broadcast licences will in future be allocated to the highest bidder. The idea is to ensure windfall profits from the use of frequency spectrum accrue to the government rather than to private interests. While I support the idea in principle, I hope it's not the thin end of the wedge as far as services like the amateur service are concerned. Imagine how much spectrum amateurs could afford if money was the sole criterion for frequency allocations!

And so I don't finish two columns in a row on a low note, there's a little gem from Chris VK3SR and published in Amateur Radio Action.

In the 1920s the Melbourne Cup results were sent by telegram to Perth. Because this took at least an hour, Perth bookmakers took bets up to half an hour after the race was run. Some enterprising amateurs used the opportunity to send the results to fellow amateurs in the form of a code based on radio terms. For three years they raked in a tidy profit until short wave broadcasters relaying 3L0 from Melbourne put an end to it!

VK amateurs or s.w.l.s with the news of interest to PW readers can send it to me at PO Box 93, Braidwood, NSW 2622, Australia.

PW readers who write and would like a reply PLEASE send a couple of IRCs for return postage.
Back-Scatter

I started writing this piece in the run-up to the Christmas break, with the thought that there will be little activity on the bands, if only because mouths (and fists!) will be employed in more fundamental activities such as eating and drinking! To all those who sent Season’s Greetings, my sincere thanks.

And, of course, I have a problem, in that the first issue in the new format omitted to indicate the deadline dates, so there was reduced input of data from which to construct this offering. So, please note they are: March 12, April 9 and May 14.

Conditions

Not bad, at that, of course, there are band

...and the lads was slated to continue at least to

Goings-on

First, I hear that Conway Reef 3D and Banaba (Ocean) is T33 will be added to the DXCC list on March 1. Cards may be offered after that date.

If some kind soul would - with appropriate gestures of course - find the person concerned and fit him with a supressor, relations between G and OY will be improved. Come to think of it, amplification of the head is usually successful in such cases!

Another maggoty-headed individual is the one who persists in using the callsign GW6WD - he says he is 'Don' from Bristol, then you hooked a Bristol Slim; the real one and John has tried the band using a 20m wire and some 10m to act as a counterpoise. At the time of Angie’s letter this had yielded contacts with G4TNI, G2AGC and G3JUT, although the latter dipped deep. Very heavy QSB immediately after they had completed the essence of a QSO.

The 3.5MHz Band

This again is a band where many people are inhibited from activity by the length of a half-wave dipole, and the fact that even if they have one, it won’t cover all the band at reasonable output. The 3.5MHz Band activity, in favour of 50MHz. In addition, John has eschewed the early-morning stuff, and the late-night activity, but his occasional managed c.w. QSOs with RL7PAJ, U9AK8A, CT1UP, CT1NK, YO3APJ, VE1IZZ, W1ZE, W8BA3 and AX5D.

Finally to G0HGA (Stevenage) who has used the band using a 20m wire and G3MCK, GENT, 3.5MHz as Top Band; on this band it yielded contacts with G4TNI, GW1AH, G2AGC and G3JUT, although the latter dipped deep. Very heavy QSB immediately after they had completed the essence of a QSO.

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The next stop is to G0JBA who offers H78PV, JE8NZE, J1HLBR, J1HQB, RA9ST, VE2BBD, W6LXK, and, on f.m., V6EVS.

G0HGA used 30 watts c.w. and a half-wave vertical, which netted a fifty-minute highest level with N1FEN, NAAR, N3EP and K2SWZ.

Just a single foray on the band for G0HKA yielded a c.w. GSO with W6DU. G3BDG was one of those who worked into England, plus Iris Colvin, plus H8FHD, UV9FM, VK6HO, ZD7CW. All were on s.s.b.

Turning to the all-c.w. offerings of ON7PQ, Pat mentions X74T, VA3BSG, PK1DF/PP6F, DA4BC, CM0A, SM0R, SU1RR, KH0AM, KHC0, TUB4, J6DX, ZP0YD, BP1H, OK2XR, TL8CM, VP5F, XT2KJ, CE6FDD (Easter Island) and 3DML.

The 21MHz Band

For many people this is the favourite; ON7PQ went the bundle on to the tune of GCQD, XF4T, W8INU/ JBL, KU8F, JJ2SKV, KH0AM, J79DX, KCB9X, DC0ML, VP5F, XT2KJ, CE6FDD.

On the other hand, G3BDQ seems to have continued himself to knocking off EC8ASD and 8P3EM.

As for G0HGA Angie uses the 28MHz vertical and managed K02HE.

G0JBA offers a new prefix for him but of ZM2I (a special from ZL), plus EC4VCA, VK2AMD, VK2AN, VK2KGY, VK2PEJ and VK3JAY.

Opening on the long path at 0800Z, to HLJ4/KZ/VZ3L, the band changed to 20MHz, then 17MHz, when contacts were made with G3NOF heard from little from the Pacific area, but S. America was noted around 1000 and Africans around 1800-1900Z.

As for the Yanks, they were about from around 1100Z until the band closed. Don booked in Y0C2R, CX8PD, H1C1G, HL3UJ, IO1A, JJ8BS, J5A, JT1BV, JT1KAI, KG4DD, NP4WR, GH5SC (Santa Claus Landl), OY9A, RASGAD/ JT, UF2FEK, UWAS0/W5UJ, UH3AA, UL7G, UB8MO, UW9L (Zone 19), VZ2GA, V31BB, VE7DGI, XK2XG, VP2VE, VQ9F, XT2PS, XW8DX, XW8KV, Y11BGD, ZB2I2Z, ZC4NC, ZL3R, ZK2DD and 5N1IN.

The 14MHz Band

G2KHU mentions that he used c.w. and 80m but worked US0I, US0C, US0I1, UIQG, W6LW, W10RN who was running 4W to a crystal-controlled rig, 8N6BL, K4L and HX3R.

G3NOF notes that he hasn't been too active on this band but was happy to make contacts, on s.s.b., with K7XLD, TASC, UL7GBW, UW1ZC/UA10, X9JG, XT2KJ, X2A, XW8D0, XW8KPV, 5HT1W, JU1RI and 505XX.

"Never really liked this band," says G0JBA, but he did manage to force himself to work EA7GOJ and WITT.

Angela at G0HGA had a play in the CW WW with 28w, and added lots of USA, W1-2-3-4-5-7-9-0 plus VE7ZZZ and CT3SM.

The only one for G3BDQ, namely FX5YE, worked on the key.

For the very latest in what's happening on the h.f. bands, call Wireless Line on (0898) 654632.

See page 68 for full details.

The 50MHz Band

As to be expected, activity waned a little during December, although those fanatics with time to monitor the band 24 hours a day still managed to work the real DX. The latest forecast for sunset maximum is that it will take place in March 1990. Operators of the 50MHz band should be aware that the maximum is that it will take place in March 1990. Operators of the 50MHz band should be aware that the DX heard and worked during the latter part of 1989. A new continent, country and island appeared on his list.

Unfortunately, I have to finish this month with some sad news. Frank Anzalone W1WW passed away on December 30 at the grand old age of 97. He was a true DX men and has produced over the last 30 years.

Paul continued working the DX during December. In the period between December 7/14, the US was worked every day. More interesting contacts included EA9/50KPV (LB18) and PE2AP on December 13, and HHT7P (KF28) on the following day. Other DX stations heard but not worked were ZU3MA on the 2nd, QAR8T on the 3rd and the Ascension Island beacon ZD8VHF on 1058UTC on December 6.

John Hilton GM1YU/ZL1JH/ has been on the band since June 1988 and has yet to work into England. John runs 2.5W from an FT-680 transceiver into a 1/4 wave whip antenna. I trust John operates with the set on its side so that the antenna is horizontal! During an Auroral-Es opening on December 2, at 0139UTC, contact was made with OH1ZAA (KPD1) for a new country.

Moving down country to South Wales, Paul Baker G6WVZ/GW1 reports on the DX heard and worked during the latter part of 1989. A new continent, country and island was being worked into, such as HC5K at 1223UTC on November 21. AFT1 (FN43) was worked the next day, giving Paul another new square.

On November 26, Richard EL2B was heard but not worked, however ZD8VHF was worked but not heard later in the day. A number of other stations in North America were heard, including YV2ZZ (FN86) on Prince Edward Island.

This latter station incidentally, confusing some of the inexperienced operators into thinking he was in the Yukon Territories (NV1) and not in the Maritime Provinces.

Solar Data for December 1989

For the last few days of November, continuing through to December 3, there was an increase in solar activity, with, on November 28 and 29, a number of flares and ionospheric disturbances. On December 1, at 1340UTC, a sequence of proton events started, continuing through to December 3. During the afternoon and evening of December 1, there was an auroral disturbance. As to be expected, the geomagnetic A index was very unsettled during this period, with a sub-storm level of 30 units being reached on the 1st. Solar activity considerably lessened during the period between December 4 and 10, with an unexpected decline in solar flux levels every day. These levels continued to fall for the next few days, reaching a minimum of 166 flux units on December 14. The geomagnetic levels generally remained quiet until December 16 when Boulder recorded the A index at 15.

The radio quality indices remained below normal during all of the period, although there was a good 50MHz opening to North America on December 11. From December 15, the solar activity steadily increased, reaching 285 flux units on December 27, the highest level since last September.

During the period between December 22 and 26, there were no new levels of flares and by consequence, solar alert and magnetic alert were in force for most of this period. This activity caused a number of reasonable auroras to take place on the 14MHz band.
Jim worked V55VW (Hong Kong) at 1152 UTC, whilst beaming Southeast. Guantamano Bay was worked on November 11, when KJ4SM was contacted at 1201UTC. A good opening on the 15th, put another 25 WVE calls in the log book. An aurora, 2 days later, had Jim rattling the key, best DX in this event being F1C1AN (LNO9) S5A 59A. It was a pleasure to work the F2 DX in November, with P8E, P8B, WJ and many stations in W1, W2, W3 and W8, being worked from 1200UTC. A similar opening, on November 26, boosted the scores totals dramatically when numerous US stations were worked. It was a pleasure to break the monotony of the US openings by working, on November 30, at 0935UTC, C6FZ (FZ7Q) and later in the day from 1152UTC, H7P7, K2PA and KPE2K. New call areas, K6VE (ES2) and W80V (EN35) were contacted, between 1500 to 1700UTC on December 6. W5 was also heard but not worked. Jim mentions that by the middle of December he had made up to 132 US state contacts. 171 squares and 43 countries.

The 144MHz Band

Propagation during December was pretty uninspiring, although some stations situated in northern England reported good tropo conditions during the weekend of the 144MHz fixed station contest, giving contacts with stations in Scotland, Scandinavia and Poland. A few US stations reported contacts with Latvia and Lithuania. Propagation was very localised, reducing being caused by a subsidence inversion. Towards the end of the month there were a number of reasonable auroras. On December 29, some stations in eastern Europe, the Midlands and Central Wales worked SK3L (FP3Q). Andy Stephens GW4MPF (Shetland) reported an Auroral-Contact with UA1ZL, the Russian station being heard for almost an hour.

Noel Moore GM4UCM reports that on hearing an aurora on November 17, he opened the December Practical Wireless to re-read the article on auroral operation. Following my advice, Noel went on to work six stations plus PE1CIO, O9NAD and ON4KST, the latter being S9A in both directions. Noel mentions that his site in Belfast has a poor take-off and that he was very pleased to work these stations with a nominal 10W into a 16-ohm element.

John GM2UV running 100W into a 16-ohm element, worked G1DFM (DHM) and G8SUM (LW) in the aurora on December 1 and GM1SEF (HLD) in a similar event on December 4. In an aurora on December 27, John Lenay G4TR (ESX) worked GM1GPX (GTP4) and GM4UX (FES). Another aurora, on December 30, produced a solitary contact with GM3JUL (HLD).

Ian Wright G1WMLV (CWO) caught both tropo and auroral propagation in early December. On December 1, tropo was noted for ON2ABR and ON4AUC (L011) and FC1AMZ (LNO9), whilst the aurora on the same day gave contacts with G4KKS and GM4MPF. By the next day the tropo

Back-Scatter

| 144MHz QRB Table |
|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Station | 310MHz | 281MHz | 255MHz | 237MHz | 219MHz | 201MHz | 183MHz | 165MHz | 144MHz |
| G4ZM | 124 | 128 | 132 | 136 | 140 | 144 | 148 | 152 | 156 | 160 |
| G4DR | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 | 256 | 260 |
| G4CL | 192 | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 |
| G4AT | 216 | 220 | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 |
| G4AG | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AF | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 | 256 | 260 |
| G4AD | 192 | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 |
| G4AC | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AB | 216 | 220 | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 |
| G4AG | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AF | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 | 256 | 260 |
| G4AD | 192 | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 |
| G4AC | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AB | 216 | 220 | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 |
| G4AG | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AF | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 | 256 | 260 |
| G4AD | 192 | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 |
| G4AC | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AB | 216 | 220 | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 |
| G4AG | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AF | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 | 256 | 260 |
| G4AD | 192 | 196 | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 |
| G4AC | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AB | 216 | 220 | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 |
| G4AG | 200 | 204 | 208 | 212 | 216 | 220 | 224 | 228 | 232 | 236 |
| G4AF | 224 | 228 | 232 | 236 | 240 | 244 | 248 | 252 | 256 | 260 |
front had swung around to Scandinavia, giving Ian contacts with G1ZBUR and G7LJX (both in J046), G7LYL and SM4KBY (both in J057), SM4MNS (J057), SM4NET (J057) and SM4RTM (J038). The band was still in good shape on December 4 and several GB s.s.b. QSOs were made with ON1CDQ (J020) and DB9JK (J030). The Scandinavians opening on December 3 was a big hit with everyone. Ela Martyn G6KHK (ESX) reckons the signals were going straight over her head with only SM3NET, SM3RTN and LAbD1 (J059) making it into Chemsford.

David Law G0LKX (YSS) thought that the Gemind meteor shower was poor compared to other years, the peak appearing at about 0500UTC on December 14. The longest reflection heard was about 6 seconds. Stations worked on c.w. included EA3BEW, HG7KPL, HG7UL/P, IONLJ, IKOFEF and IK1LGV. Dave asks if meteor showers are getting worse or is he getting complacent! I’ll have to make a few assumptions about when David was playing the meteors, probably 0000 to 0800UTC. Most of the contacts made were on a south-easterly beam-heading from Rotterdam which, according to my calculations, would produce best results between 0200 and 0600UTC, the times when David was active. It is sometimes the case that operators can get poor results after upgrading the antenna system. Confused? Well, let me explain. A single long Yagi may have a typical vertical beamwidth of between 30 to 40 degrees. Noting that the ideal m.s. geometry is where the meteor trail is mid-way between both stations, and at an elevation angle of 45 degrees, a single Yagi, mounted high above the ground generally gives very good results, up to 2000km or so. In David’s case, the antenna system consists of two 14-element NBS Yagis. The vertical beamwidth of this stacked array may possibly be as low as 15 to 20 degrees. Further calculations show that the ideal vertical angle for communication into Hungary and Italy should have been around 50 to 60 degrees. Perhaps this is the reason why the shower and reflections seemed poor. Each shower has different characteristics. The Gemind shower, for example, is noted for its long duration character Com and setting up. Perhaps everyone has gone onto Packet Communications.

The 430MHz and Microwave Bands

Not very much was reported regarding the u.h.f. and s.h.f. bands although trop conditions were particularly good during the period December 2/3, enabling many contacts to be made from the UK into central Europe.

Geoff Pike G1GODE (ATM) made the most of prevailing conditions on both the 430MHz and 1296MHz bands. Running a home-brew MRFS46 430MHz amplifier at 40W output into a 19-element Yagi, a large number of qso’s were made on December 3. Contacts to G6KHK from GB stations were mainly restricted to stations in locator squares J013, J106 and J080. Continental all including FILE, ON4ZQ, PA5FRE, PA5JDF, PA5OJ in J022. Most of these contacts were around a distance of 80km and Geoff comments that it was very difficult to decide on which band to operate. When he did make it to 1296MHz, the conditions were found to be just as good if not better than 430MHz. The beacon GB3MHL was first copied at 0700UTC at 32W output into a 19 -element Yagi, a level of activity of former years. Contest activity has recommended that 50.185MHz be included EA3BEW, HG7KPL, HG7UL/P, ION, IK0FEF and IK1LGV. David asks if meteor showers are getting worse or is he getting complacent! I’ll have to make a few assumptions about when David was playing the meteors, probably 0000 to 0800UTC. Most of the contacts made were on a south-easterly beam-heading from Rotterdam which, according to my calculations, would produce best results between 0200 and 0600UTC, the times when David was active.

As of January 1, another European country, Denmark, has obtained permission to operate on 50MHz. More details as and when I get them.

The RSGB VHF Committee would be interested in finding out if there are any stations using f.m. above 1296MHz, or stations using f.m. above 51.1MHz. Geoff comments that the move from 25kHz to 12.5kHz f.m. aerialing will now not be implemented purely because activity, even on f.m. has reduced. Statistics from the RSGB Repeaters Management Group back this up. Perhaps everyone has gone onto Packet Radio. Who knows? What will happen to this band? Does it matter at all? I would be interested to hear your views.

Assuming of course that you can make the effort to write a letter!

Des Carne G6HRR (CML) passes on the news that there are now two more stations active on 70MHz from Cornwall. Des, located in Par and Clyde G6XNH, in Newquay, both have Microwave Modules transverters and listen most days, beaming to the north-west. They also have an f.m. sked each evening on 70425Hz using horizontal polarisation. Whilst on the subject of 70MHz f.m. it should be noted that the Chiltern DX Club Packet Cluster system officially started on January 1 using the callsign G7BDXT. Access is on 70325Hz, the packet working frequency, or via VDXO2 on 144675MHz. Operators may care to note that 50475MHz is also used for packet radio.

Wet Squares

The Royal Research Ship Challenger will soon be carrying out a scientific cruise, between March 1 to 31, in the Atlantic Ocean, west and north of the UK. The ship
The Microreader is a small compact unit that allows anyone equipped with a suitable SW receiver, to read Morse & RTTY signals simply and without fuss. No computers, interfaces or program tapes are needed, just connect the Microreader to the ear or speaker socket & switch on. The decoded words appear on the built-in 16 character LCD display screen.

The Microreader contains all the filtering & noise blanking needed to allow reception even under bad conditions. A three colors bargraph tuning indicator makes precise tuning simple, while shift indicators take some of the guess work out of RTTY. Despite the fact the Microreader contains two fast processors (12 MHz), it is extremely quiet generating virtually no RFI. The Microreader can also if you wish, transfer the decoded messages to any printer, computer or terminal unit equipped with an RS232 port.

In the tutor mode, the Microreader will send random groups of characters with variable speed & spacing, or plug in your own morse key to check your sending. In both cases the characters are shown on the display.

To order or for more information on any of our products, ring or write. All Products unconditionally guaranteed for 12 months.
will sail from Barry, South Wales, on March 1, via locator squares I081, 71, 61, 51, 42, 33, arriving in I034 on or about March 4. The area covered by locator squares I035, 36, 45, 46, 55, 56 will be visited between March 8 to 11. Challenger will then sail to Torsvaa in the Faroe Islands via locator squares I035, 65, 66, 57, 48, 58, 59, I050, 51 and 61, arriving overnight on March 19. It will then continue via I072 to an area covered by locator squares I081, 82, 83, 91, 92, being in this area between March 22 to 27. Moving southwards she will sail via I081, 80, I089, arriving in I086 on March 29. Challenger will, or direct to Mr A Adams, 2nd Engineer, RRS Challenger, c/o Natural Environment Research Council, Research Vessel Services, No.1 Dock, Great Yarmouth, on April 1.

Andy Adams GW0KZG/MM. 2nd Engineer aboard R.S. Challenger will again be operating on 144MHz using a Trio TR-930 and Microwave Modules 100W amplifier into either an 8-element Yagi, or an 8 over 8 slot-fed Yagi by Jaybeam. A 5/4 vertical collinear can also be used if necessary. Andy hopes to be active during any auroras and maybe try meteor scatter, although during this period there will be no meteor showers to aid communication. The dates are approximate and are subject to weather and operational delays. Operating times, to fit in with work schedules, will be 1200 to 1300UTC, and 1700UTC onwards. Some operation will be possible on Saturday afternoons, again depending on work loads. Operation will not take place during port calls, or whilst in Foreign Countries territorial waters. QSL cards can be sent either to Mr A Adams, 2nd Engineer, RRS Challenger, c/o Natural Environment Research Council, Research Vessel Services, No.1 Dock, Barry, South Glamorgan CF6 8UZ.

I can supply, on receipt of a stamped addressed envelope, a locator map giving a plot of the proposed cruise track. In addition you will also get a mapped plot of the cruise commencing April 4, lasting 30 days covering most of the wet squares in the North Sea. Details of this trip will be in the April issue of PW.

Just a reminder that the final table placings will appear in the April issue of PW. The new 5 band locator squares table will commence from the May issue. In the meantime please keep those reports rolling in. Letters in to me by March 26 at the very latest. In my role as RSGB VHF Manager I will be attending the IARU Region 1 Conference in Torremolinos, Spain, during the first week of April, and by consequence, time to write the column will be very limited.

VHF Tables

Just a reminder that the final table placings will appear in the April issue of PW. The new 5 band locator squares table will commence from the May issue. In the meantime please keep those reports rolling in. Letters in to me by March 26 at the very latest. In my role as RSGB VHF Manager I will be attending the IARU Region 1 Conference in Torremolinos, Spain, during the first week of April, and by consequence, time to write the column will be very limited.

RF Software for IBM Compatible

I don't really want to turn this column into a computer buff's corner but there are times when it is worth mentioning specific software of use to the v.h.f. enthusiast. For a number of years I have been handling the release of material based on articles by Ian White G3SEK on front end optimisation (TCAL) and long Yagi design (GW0WU). Additionally, I also distribute the US/UK RF library of BASIC programs. These programs cover r.f. design, Antenna design, Propagation and other areas.
RTTY Filter

BARTG (British Amateur Radio Teledata Group) have recently announced that they can now supply p.c.b.s for the G3ISD filter which they featured in the Autumn and Winter '89 issues of their magazine Datacom. This versatile filter technology, which greatly simplifies the tuning of audio filters, is at sorting out these audio signals. These signals are rarely noise free and are usually buried in all manner of unwanted whistles, whines, clicks and whirrs! This is where the filter can help, because it can take away all of these unwanted signals and so give your decoding equipment a far better chance of decoding the RTTY signals accurately.

Of course, as well as being very useful for RTTY and general data operation, the wide tuning range of the BARTG filter means that it can be equally effective on s.s.b. The p.c.b. from BARTG costs £5.25 inclusive of post and packing and comes complete with instructions. The address for your orders is: Mr E.J. Hatch G3ISD, 147 Borden Lane, Sittingbourne, Kent ME10 1YV. Incidentally, if you would like to take up membership of BARTG, the 1990 UK subscription rate is £10 and the membership secretary is: Miss Ann Reynolds G3GCF, 169 Bell Green Road, Coventry CV6 7DW.

BARTG Spring HF RTTY Contest

Yes it's contest time again! This popular contest takes place on the weekend of March 17-19 and is always well worth having a go at. The period of operation is actually 0200UTC on March 17 - 0200UTC on March 18. Although this is a 48 hour period, only 30 hours of operation (that includes listening) is permitted. The 18 “rest” hours can be taken at any time, but must not be less than 3 hours and all times of operation must be recorded on the contest summary sheet.

Categories:


Points:

Bands: 3.5MHz, 7.0MHz, 14MHz, 21MHz and 28MHz amateur bands.

Stations:

May not be contacted more than once on any band, but additional contacts with the same station may be made on other bands. Transmission on two or more bands at the same time is not permitted. The 18 “rest” hours are used by amateurs and a good range of commercial signals. Drum speeds are 60 r.p.m., 120 r.p.m. and 240 r.p.m. whilst the picture length is determined in lines at 400, 900 or 1200. Each received line is displayed as 1024 pixels, with each pixel set to one of sixteen grey levels. These images can be printed using the standard Amiga printer device and can be stored as standard Amiga FIT (Interchange File Format). This is a great advantage, as it allows the images to be manipulated and enhanced using a wide range of Amiga software packages.

FAX and SSTV System

The latest press release from ICS Electronics reveals details of a brand new FAX and SSTV system from AEA Inc. which is designed to run on the Commodore Amiga computer and is called ATV Master. The FAX capability covers all the modes used by amateurs and a good range of commercial signals. Drum speeds are 60 r.p.m., 120 r.p.m. and 240 r.p.m. whilst the picture length is determined in lines at 400, 900 or 1200. Each received line is displayed as 1024 pixels, with each pixel set to one of sixteen grey levels. These images can be printed using the standard Amiga printer device and can be stored as standard Amiga FIT (Interchange File Format). This is a great advantage, as it allows the images to be manipulated and enhanced using a wide range of Amiga software packages.

Log Sheets:

Entries and check logs must be received by May 26 at the following address: John Barber G4SKA,32 Wellbrook Street, Twerton, Devoret EX16 5LG.

AEA FAX/SSTV System

The latest press release from ICS Electronics reveals details of a brand new FAX and SSTV system from AEA Inc. which is designed to run on the Commodore Amiga computer and is called ATV Master. The FAX capability covers all the modes used by amateurs and a good range of commercial signals. Drum speeds are 60 r.p.m., 120 r.p.m. and 240 r.p.m. whilst the picture length is determined in lines at 400, 900 or 1200. Each received line is displayed as 1024 pixels, with each pixel set to one of sixteen grey levels. These images can be printed using the standard Amiga printer device and can be stored as standard Amiga FIT (Interchange File Format). This is a great advantage, as it allows the images to be manipulated and enhanced using a wide range of Amiga software packages.

Please set to one of sixteen grey levels. These images can be printed using the standard Amiga printer device and can be stored as standard Amiga FIT (Interchange File Format). This is a great advantage, as it allows the images to be manipulated and enhanced using a wide range of Amiga software packages.

There are excpected options for starting the reception process, including fully automatic where the program detects the start tone and synchronising pulses. This mode ends when the end of message tone is received. An unusual but very handy feature is the timed auto-start which puts the program into auto start mode at a particular time and then stops on successful receipt of a picture. I can see this being particularly useful for the reception of some of those very interesting pictures which are often sent from weather stations in the early hours. One very powerful facility is the ability to select a number of message groups, including - linear, log, anitlog, etc. This has great value when receiving photographs rather than charts and can be very useful for enhancing the visible detail in dark areas such as the land masses on Meteosat images. This facility is made even more powerful by the fact that you can make up custom demodulation curves, e.g. you could specify a log curve for the bottom quarter and leave the rest of the curve untouched. This gives immense potential for obtaining the best image quality for a given signal quality.

In addition to this, the image can be flipped horizontally and vertically and even rotated through 90 degrees. If the image has been received on the wrong sideband and is negative, it can be corrected by inverting the image. This feature is particularly useful for the reception of some of those very interesting pictures which are often sent from weather stations in the early hours. One very powerful facility is the ability to select a number of message groups, including - linear, log, anitlog, etc. This has great value when receiving photographs rather than charts and can be very useful for enhancing the visible detail in dark areas such as the land masses on Meteosat images. This facility is made even more powerful by the fact that you can make up custom demodulation curves, e.g. you could specify a log curve for the bottom quarter and leave the rest of the curve untouched. This gives immense potential for obtaining the best image quality for a given signal quality.

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Amateur Satellites

Reports to
Pat Gowen G3IOR
17 Heath Crescent
Hellesdon, Norwich, Norfolk NR6 6DX

Satellite
Micro-Satellite Cluster.
Epoch Year
1989
Epoch Day
313308075483
Inclination
98.13 degrees
Right Asc. of Ascending Node
24367560

Mean Motion
16731
Eccentricity
0.001362
Argument of Perigee
Mean Anomaly
1249.63

Delay rate or Drag factor
1.86-66
Epoch Day Number
RS-10/11

Many users think that RS-10/11 is being switched off from time to time, as the signal has been noticeable by its absence at known passes well within range. This commanding off as assumed is not the case. The scarcity of signals are due to daylight path attenuation of the 25MHz downlink by the dense E layer ionisation, this is brought about by the high solar flux. Only too often, particularly when the satellite pass is at low elevation angles, daytime passes produce extremely low signal strengths deep in the noise, and when it is audible, the incoming tone is frequently very auroral, sounding like a rough hiss. The night-time dark path passes are clean, clear, invariably very strong, and free from the daytime multipath variables. Signals have been heard from RS-10 by many users when the satellite is well below horizon on the far side of earth, over the Pacific, above Japan, Alaska and California.

Of course, the re-annotation of the 145MHz uplink is insufficient to permit accessing the satellite at such times, but some degree of sub-horizon access is possible to assist the optimum range limits. One such 'out of range' QSO was made by Dave Rowan G4CUD, who succeeded in working N5TAK in Arkansas for a new one, getting a RST 33A report to boot!

RS3A operator Andy Minion has been asked to reconsider putting the 21MHz uplink/29MHz downlink "KA" mode on, as this would enable many round the world and indeed antipodal QSOs to be made by RS-10/11. He has so far declined to do so, as it is felt that the QRM produced by those using the 21MHz uplink satellite band section without adequately first listening could be embarrassing and counter productive. Similarly, most RS operators feel that abandoning the 3kHz sections of the passband each with individual computer a/c command levels is a retrograde step, as it means that high powered stations seize most of the available power, so eliminating the modestly powered users. The fact that they still only produce a solar flux high attenuated weak downlink means they try to make up for it by using even more power, despite the fact that the 145MHz uplink attenuation is rarely more than 6dB.

Presumably, it is thought that it is better to have one or two strong signals produced over the noise rather than a large number of lesser readable signals under such conditions, but this practice does not do much to encourage the problem users to improve their downlink antennas rather than their linear outputs!

Finally, the users in USA say that they are unable to copy stations on s.s.b. between 25.930 and 29.400MHz, e.g. the top 10kHz of the current space band. The ROBOT is also very difficult to work, all due to an f.m. repeater output now being on 29.400MHz. As if simplex f.m. is not enough to contend with!
GX-2 FAX SSTV TRANSCEIVE FOR THE BBC COMPUTER

Fantastic system supporting all modes of FAX and mono and colour SSTV. All facilities. Send for brochure. Complete system of EPROM, interface, leads, instructions only £99 or £119 with direct FAX printing option.

TX-3

RTTY / CW / ASCII TRANSCEIVE

Split-screen, type-ahead operation. Clock, review store, 24 large memories, callsign capture and much more. Needs TIF1 interface or T.U.

BBC-B/Master and CBM64 tape £20, disc £22
SPECTRUM tape £35, +3 disc £37 inc. adapter board (needs interface or T.U. also).
Also VIC20 RTTY/CW transceive program £20.

RX-4

RTTY / CW / SSTV / AMTOR RECEIVE

This is still a best-selling program and it's easy to see why. Superb performance on 4 modes, switch modes at a keypress to catch all the action. Text and picture store with dump to screen, printer or tape/disc. Needs TIF1 interface. BBC-B/Master, CBM64 tape £25, disc £27. VIC20 tape £25. SPECTRUM tape £40, +3 disc £42 inc. adapter board (needs interface also). Spectrum software-only version (input to EAR socket) tape £25, +3 disc £27.

TIF1 INTERFACE Designed for TX-3 and RX-4 software only available with them. Kit 20 (assembled PCB + cables, connectors) or ready-made £40, boxed with all connections.

RX-8 FOR THE BBC COMPUTER

FAX, HF and VHF PACKET, COLOUR SSTV, RTTY, CW, AMTOR, UoSAT, ASCII RECEIVE

Every possible feature and superb performance. Full printer and disc support. Send for our brochure or see review in Oct 89 Ham Radio Today. Complete system of EPROM, interface, instructions, all leads and demo cassette £259.

BBC LOCATOR with UK, Europe, World maps £10, MORSE TUTOR £6, LOGBOOK £8, LOCATOR £7, RAE MATHS £9 for BBC, Spectrum, CBM64, VIC20, Electron. BBC, CBM64 programs available on DISC at £2 extra.

Prices include VAT and p&p by return.

technical software (P.W.)

Antex (Electronics) Limited, 2 Westbridge Industrial Estate, Tavistock, Devon PL19 8OE. Tel: 0822 613565. Fax: 0822 617998. Telex: 931210595 AE G.
Further to last month’s input on the launch time possibilities, we now have provided from source the latest probabilities, plus the test findings on the coming pair of RS-12 and 13 transponders, which were integrated with the COSMOS NAVSAT at the end of 1988.

Leonid Lubatkin UA3CR, on his recent visit to Britain supporting the British North Atlantic Space Conference, described the forthcoming compound satellite. The very earliest launch date, he thinks, will be in April this year. May or June is thought to be more likely, but it could possibly be held over until the end of 1989. It will fly as a single unit with a COSMOS Maritime Navigational Satellite, the demand for which will determine the launch time. It will be placed into a 1000km (621 mile) orbit, at an inclination of 85 degrees, giving a 103 minute period.

The transponders will give modes ‘A’ (2m to 10m), ‘K’ (15m to 10m), ‘T’ (15m to 2m) and any combination of these, e.g. ‘KA’ etc.

The ROBOT system will be flown, and will also operate on modes ‘A’, ‘K’, ‘T’, etc.

The measured mean power provision to RS-12 was 25 watts, and with RS-13, 25 watts. The 2m downlink transmitters were found to be 12 watts for RS-12, and 8 watts for RS-13.

RS-14

Whilst RS-12/13 is still awaited, probably not for long now, RS-14 is not far behind. Some six different USSR AMSAT groups are now busily working on this satellite, and are making good progress. The RUDAK-II intended to fly with RS-14 has now been handed over from AMSAT-DL to UAA3CR for incorporation and integration. If the descriptive handbook for the planned digital communications system is required, a s.a.s.e. to Ron Broadbent G3AAJ QTHR, Secretary of AMSAT UK, will result in the availability and price. No further information has evolved on the condition of the original RUDAK aboard OSCAR-13, but hope still exists.

OSCAR-13

A further memory wipe-out was suffered by this satellite just as soon as the ‘hot’ side of the highly active sun came round to face earth again. It was soon overcome by the command stations, who had the satellite up and running again within 24 hours. All users report that it is performing very well indeed, up to all expectations. Lots of new stations are appearing on this satellite, as the last section headed ‘Satellite DXCC Listings’ will show.

The current transponder operational schedule reads:

- Mode ‘B’ MA 000 to MA 110.
- Mode ‘UL’ MA 110 to MA 145.

All transponders off from MA 145 to MA 150.

Mode ‘S’ (beacon only) off from MA 146 to MA 147.

Mode ‘S’ transponder off from MA 147 to MA 160.

Mode ‘B’ transponder off from MA 150 to MA 255.

The two directional antennas (as distinct from the beams) will be used from MA 225, through perigee, to MA 405.

The current power position is as follows. There are +3.6 degrees. A.LON.+179.4 degrees (i.e. 0.6 degrees).

Phase III-a

Dr. Karl Meine, D4J2C, head of AMSAT-DL points out that despite the generous BBS 00000/30D grant of the German Federal Government to the next elliptical orbit satellite project, an immediate capital exists. Additional funding is still required, and needs to be sought from the world amateur radio community.

Hams in Space

Information from Chris Van der Berg PA9DO and TASS prove that the present MIR cosmonauts have had little time to come out of their. 000/30s at 145 MHz, f.m., so the 26 November launch of the 9.5 meter tonne Kvant-II module gave them a very busy schedule. The solar panels of the addition were initially jammed, right over the three 12’s and were suddenly unfurled on December 1. Two attempts were made to dock, but when the module was only 20 metres away, the navigational computer failed, and the docking was abandoned. AMSAT and the Alex par to reactivate the computer also failed, so the manual skills were brought in, remanoeuvring the spacecraft on December 3 to give a good docking at 1222 UTC that day. On December 5, Kvant-II was removed from the main docking port and was fully coupled to the main side port on 8 December, now giving the 60 meter tonne combined spacecraft an L’ configuration. All this was performed by the cosmonauts working in space suits from Soyuz-T M-1B, no easy task!

On December 10 the electrical system was coupled, and TM-1B was moved to the free docking port to permit taking another Progress docking on December 17. The large T’ module is now due for launch on March 6, and after a week free flight will be docked to the already busy Mir/RF system, thus giving a symmetrical and stable space station again capable of easy manoeuvring and boosting.

From Bill Tyrant W2XO, QST/VHF/AMW columnist for Manned Space Programmes, comes the latest news on the Shuttle amateur radio activity scene.

The bad news is that the T/S-25 mission is half way through and a lift on April 28 is to be extended to 10 days, additional storage capacity is needed for food, water, etc. This means that Ron Parise WA4SIR, will no longer be able to take aloft the FTV7 and the FTV8. The good news is that the 145MHz voice f.m. and the packet TNC system will still go, the letter now using the on-board back-up computer of the Shuttle itself. Even better news is evidenced by the fact that Ken Cameron, scheduled to fly on Shuttle Mission STS-37 has just passed his Amateur Radio Examination and has the callign KASEWC. Plans are now in progress that both the Fast and Slow Scan TV experiment now abhorred on STS-35 may fly on this STS-37 mission, soon after WA4SIR’s activity.

Quicker Keplerian Elements

Here are sets of ‘smoothed’ Keplerian element sets for our two elliptical orbiters provided by Ham Radio World, so called A1ULS respectively. They are devoid of long runs of many decimal places, having been abbreviated to a mean value giving more than a sufficient of accuracy to keep in your computer sets for at least a year without change. The passes times given will be well within the limits of your timepiece

Practical Wireless, March 1990
and your beam elevation and azimuth accuracy.

Satellite

<table>
<thead>
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<th>OSCAR-10</th>
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The point was noted last month by John Branegan GM4HJH, when he noticed that the element sets for MIR, KWANT and SOYUZ-TM-8 indicated mean motions of 15.556072, 15.556276 and 15.556628 respectively, which would indicate that MIR is separating from these three spacecraft, one by one, at a mean of about 8km per day. He now points out that a similar elasticity is shown for SALYUT-7 and the attached COSMOS module, which, after a few weeks of absence, will now be moving again on 18.955555MHz. At first it was thought that the beacon had been separated as a first stage to bringing SALYUT-7 back to earth this year, hence the parameters were closely scrutinised. Whilst the separate sunspot elements showed a distinct separation between the spacecraft, visual observation proved them still to be connected. As we have pointed out many times, the elements are not intended to be used for precise scientific tracking, but merely to enable us to locate the various spacecraft to within reasonable limits. Even if we published the precise additional values that would permit accurate tracking for several passes ahead only, the average home computer tends to round off decimal places and produces an incremental error. If you tire of typing in all those long numbers every two months, then it will please you to know that you will not see a significant departure from good tracking if you round up most of the elements supplied to the nearest first decimal place. On the proviso that you are sure to place in the full figures given for the Epoch, the Mean Motion and the Decay or Drag factor (and this alone is subject to dramatic changes day by day in present solar conditions) you will not go far wrong.

I leave some of mine in the computer for months at a time, only bothering to change them to the latest set when the AOA, TCA and LOS are noticeably out of true due to the incrementing error. I then try the latest set and check them against a pass or two. If they do not fit, I sublimate the drag factor on the lower orbiters, or the mean motion on the higher ones, until a good fit results.

For those active on the packet radio network who feel the urge to regularly update their element sets, G1LYI is putting them out on this media the moment he has them ready. I subtley change the drag factor on the lower orbiters, or the mean motion on the higher ones, until a good fit results.

Phase-IV

Amateurs in North America are keen to pioneer the ‘Phase IV’ era, a phrase coined by Joe Kasser G3ZCJ in the January 1981 issue of Orbit magazine. The idea is to provide a pair of geostationary satellites, one to the east of the USA, and one to the west, which, requiring no tracking, means that high gain fixed antennas can be used by ground stations, providing continuous 24 hours per day coverage to the majority of the world amateurs.

Such a concept is not without its critics, who are concerned at the high relative cost of such a venture, the limitations of use to those not in ‘view’, and the sheer simplicity of access and use without the need for the skills required otherwise developed by those plotting and tracking the existing Phase 2 and 3 satellites. The debate is not unlike that of the ‘commercial or home-brew’ argument, the c.w. test or code free or even the full examination or novice licence’ controversies, but with satellites comes the additional concern as to whether the limited finance available is being well spent, and whether satellites should be a simple to use chat-box for the masses or a means of training and education, or even both of that is possible.

Additionally comes the point that whilst the earlier satellites could be used and enjoyed by the whole world community of radio amateurs without recourse to expensive equipment and difficult technology, latter day satellites have appeared to be quite difficult to the newcomer and those without the needed supply of money and resources, both of which are short of availability in the majority of the world.

A similar debate is ongoing today due to the equipment costs and technology demands of both the packet satellites and the high elliptical orbiters, or this is reflected in the sources of activity, or rather the lack of it, on the more recent satellites compared with the early OSCAR and RS spacecraft.

Whilst mass use may provide the wide interest, the enlarged user numbers, and hence the finance needed to build and launch such AMSAT GEOSATs, the numbers actually able to use them may be limited more by income and frequency allocations than by the availability over their horizons.

Notwithstanding, AMSAT has already built a model of the projected Phase-IV spacecraft, seen in our Fig. 2 this month, during it’s unveilng at the Webster State College in Utah. Designer Dick Jansson W6FAF is on the left, and the College President Stephen Naudauld on the right, the comparison of people to model giving an idea of the size of the structure. AMSAT have set a goal of $30 000 US for funding, the first $30 000 to be used for completion of the current microsats, the remaining $50 000 for Phase-IV. Already donations excided $23 000 and are steadily growing.

Satellite DXCC Listings

Ed Steebe W2AR2DE of Buffalo, New York has provided Fig. 3, an updated list of stations active, current and past, on OSCAR-10 and 13. Ed suffices the DXCC country and callsign with an indicator to show the status. "F" indicates that the station is on OSCAR-13, "A" shows he/she is currently active, "VA" is very active, "NA" not currently active, "EX" indicates a special DXpedition visit, "VAC" is vacation, whilst "V" means current position unsure or unknown.

Ed points out that the "DF" following SM5STA means that he was active on a day one operation only. He asks that amateurs provide input to him either via the mail (QTHR) via this column, or via the satellites themselves, providing the actual call or calls worked that are not on this latest list of countries, so that assistive updating is possible. His address is: Ed Steebe, W2AR2DE, 15 Greveiland Street, Buffalo, NY 14214, USA.

Already a number of OSCAR-13 user stations have worked over 100 different countries, among them being G4CUU, KL76RF and W6GVU. We suspect that many more exist out there who are too modest to stake their claims! Any contributor may claim anonymity if desired!

Dial Wireless Line for the latest news, see page 76
Auroral

Ron Livesey, the auroral coordinator for the British Astronomical Association received reports described as "glow, patch" from observers in Scotland for the overnight period of November 3, 5, 23, 24, 25, 26 and 28, "quiet arc or band" on the 7th and 8th, "rayed arc or rayed band" on the 6th and 28th, "Active forms, flame, flickering" on nights 2, 3, 4, 5, 17 and 28 and "all sky aurora", from Denmark and Scotland on the 17th. "Ray bundles", were also reported from Eire, England and France on the 17th. The storm of 17/18 was the 27 day repeat of the 21/22 October storm and was more intense," said Ron and added, "Aurora was visible in N.Scotland 1800-2300, S.Scotland 1830-2000, England 2000-2100, S.England 2120-2140, Denmark 1630-2250, Eire 1730-2200, Nova Scotia 0430-0520 and France 2200." Doug Smillie (Wishaw) noted the auroral effect on 144MHz radio signals on days 11, 13, and 17 and Tony Hopwood (Worcester) heard such signals on the 17th and 26th.

Em Warwick noticed a small echo on the signals from The Rutherford Appleton Laboratory beacon (GSSR - 28.216MHz) on November 29 and 30 and on the American beacon (KH609 - 14.100MHz) on December 1. He also reports weak...
auroral effects on signals at 1900 on November 21, 1747 on the 22nd and on the 10MHz German beacon (DK0WCV) during the early evenings of December 27 and 28. In Storrington, Fred Pallant G3RNM suspected aurora when he heard a "good echo effect" on several Scottish stations at 1000 and 1010 and 1045 UTC on December 27 while parked in East Sussex, using his Punston TVR9D with its own 3rd antenna.

Magnetic

Although the Ap index up to November 19 was generally unsettled there were storm peaks on days 13, 16 and 19 which can be seen on the graph sent by Neil Clarke, Fig 9, and the beginning of a rise at the end. "From the 16th to the end of the month the field became quiet with just the odd unsettled day," said Neil and the various magnetometers used by Tony Hopwood, Karl Lewis (Saltash), Ron Liggat, Gordon Livesey, David Pettitt (Carlisle) and Doug Smillie, between them, recorded magnetic storm conditions on November 5, 8, 9, 13, 14, 15, 17, 18, 19, 28, 27 and 29 with a note of "severe" on the 17th and 18th.

Sporadic-E and "F2"

Smeary and unlockable domestic television pictures were received on Ch. R1 (45.75MHz) during an "F2" opening early on December 1 and a test card from Sweden, via Sporadic-E, on Ch. E2 (42.5MHz) between 1000 and 1115 and on the 7th. In Meitil, India, Lt. Col. Rani Roy saw adverts and cartoons from India on Ch. R2 (55.25MHz), via "F2" on Ch. C1 (57.5MHz) between 1000 and 1115 on December 1, 2 and 3 to work some u.h.f. DX and, in addition to contacts with stations ranging from the Isle of Wight to Harris, he hit the jackpot of 4881m working UK-S13 in Darlington, Co. Durham. "The longest distance GEO I have enjoyed on the frequency," said Terry. John Livesey received signals from the Channel islands on December 1, 2, 9, 10, 23, 24, 25 and 26.

Back-Scatter

Back-Scatter Round-up

Reports to

Peter Shaw

It has been a dramatic few months in international broadcasting, with stations in West Europe and the revolutions - both peaceful and bloody - which have occurred during the end of 1989. In particular Romania's external service provided dramatic details of events there.

On December 22, Radio Bucharest's scheduled external programme at 1130 in French was replaced by the station's internal signal, which changed at around 1153 to tone and shortly after 1200 UTC all transmitters went off the air. Nothing more was heard until 1830, when announcements in English and Romanian asked listeners to stand by for more information. At 1900, an announcement about the current situation in the country was heard on four frequencies in Romanian, English and three other languages. Broadcasts from Radio Bucharest were somewhat erratic during the following two days, but on Christmas Day, normal programmes resumed, but on less frequencies than scheduled. Meanwhile, regional broadcasting in Romania has restarted. Radio Free Timisoara-Romania has restarted broadcasts in December/January and February/March also. Several years after the station was closed, replaced by Radio Bucharest's three programmes.

Czechoslovakia's radio has also made some changes recently. The long wave programme on 270kHz has a new signature tune and is no longer known as Vheda, but Radio Station Czechoslovakia, or in Czech, Rozhlasová Stanice Ceskoslovenska.

Back in the west, Radio Canada's fears of cuts were less severe than had been anticipated. The station's output will remain at the present level and the station is investigating the possibility of starting a live daily two-hour programme exchange with Radio Korea's international service. It is hoped that RCI will use South Korean transmitters for its new Mandarin service before the end of 1990, although the h.f. station will take at least 18 months to complete. The Voice of America will start Tibetan language broadcasts during 1990, for two hours a day, although the station anticipates some problems in finding Tibetan-speaking broadcasters in the United States. Radio
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102

Part 1, 1990
Portugal started using a new 300kW transmitter in early December which should benefit reception particularly in Africa, but may also aid reception here in the UK.

**European Stations**

All times UTC (w/GMT)

In Nice, the Cyprus Broadcasting Corporation sends Greek to the UK on Friday, Saturday and Sunday for thirty minutes at 2215 on 9.535, 7.18 and 6.195MHz. Radio Berlin International in East Germany has made some changes to its programme lineup following suggestions from listeners. A new programme called Viewpoint is heard on Wednesday, whilst Berlin in Focus is a new Friday broadcast. There is also a new programme called Radio Budapest's English schedule for November which should benefit some of the Soviet Republics have some of the new ideas are intended to provide a potential catch here in Europe. English from Radio Pyongyang, North Korea, broadcast to Europe:

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<td>2180-2190</td>
<td>7.945MHz</td>
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<td>2190-2200</td>
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<td>2200-2210</td>
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<td>2210-2220</td>
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<td>2230-2240</td>
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<td>2370-2380</td>
<td>7.565MHz</td>
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<tr>
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<td>7.545MHz</td>
</tr>
<tr>
<td>2390-2400</td>
<td>7.525MHz</td>
</tr>
</tbody>
</table>

**Back-Scatter**

**New Techniques**

All of these new technologies may be important one day, but unlikely that they will all be adopted, but some of the techniques to which they relate are bound to filter down to domestic reception and surplus equipment one day. For this reason alone, and because you like to keep abreast of what's happening in the world of TV, you may care to note what the abbreviations stand for.

All of these new ideas are intended to change the way we think about television, but not all are memorable.
make TV better, generally by improving the definition of the picture. That’s all
though, and there are some fundamental differences in what you do and how you
do it which may not be obvious at first sight.

There is a distinction, for instance, between extended definition and improved
definition. Some improvements can be
made entirely at the receiver end, but
most involve changes to the transmitted
signal as well. Some of the new
transmission systems are compatible
with existing receivers and some are not.
Some use digital techniques, others are still
analogue. Some of the improvements can
be implemented straightforwardly and some
cannot. Some can be applied to terrestrial
TV, others only to satellite or cable
transmissions.

**IDTV and EDTV**

The most basic split is between IDTV
and EDTV. The term IDTV means improved
definition TV and that means adding extra
lines to the structure of the signal which
implies a fundamental change from
existing TV standards. EDTV is extended
definition TV, which is taken to
mean anything with do in making improvements to
the existing PAL, SECAM or NTSC
picture.

IDTV will retain the existing 4:3 aspect
ratio of the picture (4 units wide by 3 units
tall); other systems are likely to use a 16:9
'letterbox' or motion picture-style
format.

Further technical details are given below.

IDTV is generally taken to mean that
the picture definition is greater than twice
the existing resolution: anything less than
this is only EDTV. EDTV schemes include
1050 line and 1125 line systems for NTSC
countries and a 1250-line one for Europe.

These schemes have a wide (‘letterbox’)
aspect-ratio picture.

**Dessier**

Here is a summary of the main
expressions which you may come across and
what they stand for.

**ACTV** - advanced compatible television.

An American 1050-line, 59.94Hz
HDTV system compatible with existing
broadcasts.

**ATSC** - Advanced Television Systems
Committee. A USA body investigating TV
systems.

**AVT** - advanced television, i.e. anything
more advanced than what we have at
present.

**DIGIT 2000** - a chip set made by ITT
Semiconductors and intended to be
incorporated in new generation TV
receivers. The chips are capable of
processing PAL, SECAM, NTSC, C-MAC,
D-MAC, D2-MAC and NIMAC
transmissions.

**EDTV** - extended definition television.

**EDTV-WIDE** involves changing the aspect
ratio and adapted TVs will change picture
format automatically. The extra picture
information will, of course, only be seen
on sets equipped to display this.

**EPAL** - extended PAL. A system devised
by the BBC some while ago for sending
PAL signals with additional picture
information in the frequencies above the
6MHz sound carrier. Suitably equipped
receivers would use this to display
improved pictures.

**EUREKA Project** - a 1250-line, 50Hz
system widely backed in Europe.
Conversion to/from 625 line systems is
easy but 24 F.P.S. film transfer is still a
problem because of the 1:1 flicker.

**EUREKA EDTV** - a European 625-line,
50Hz system with 16:9 picture. Much
cheaper than 1250 lines and may become
a European standard.

**HD-MAC** - high definition multiplexed
analogue component. European proposal
for HDTV by upgrading the existing MAC
system. A high definition analogue video
signal of about 25MHz bandwidth is reduced
so that it can fit within a transmission channel
of 12 MHz bandwidth.

**HDTV** - high definition television. Back
in 1938 this meant 405 lines monochrome
tv (with absolutely no colour compatibility
problems). Nowadays, it means anything
better than your existing system, be it 525
or 625 lines.

**HDVS** - a 1125-line, 60Hz HDTV system
already in use for some television
production. Most support comes from
Japan. Not directly compatible with any
existing system.

**HIGH-SCAN** - a proprietary design of
multi-standard TV receiver made by
Thomson which takes normal 625 line
transmissions and electronically enhances
the picture. It can display both 4:3 and 16:9
format pictures and can take a HDTV
adapter.

**Hi-Vision** - (see HDVS).

**IDTV** - improved definition television.

At the transmitter end improvements can
be made in encoding and filtering, but
most of the improvements will be in the
receiver. For instance a frame store will
allow the picture refresh rate to be
increased to 100Hz, totally eliminating the
flicker effect.

**MAC** - multiplexed analogue component.
Extended bandwidth transmission system intended for use on
satellite and cable systems, having a high
immunity to interference.

**MUSE** - multiple sub-Nyquist sample
encoding. Japanese signal encoding
 technique that reduces the amount of
signal needed to send a HDTV picture.

**NTSC** - (National Television Standards
Committee) or ‘never twice the same
colour’. The existing 525-line colour
system used in the Americas, Japan and
elsewhere.

**PAL** - (Phase Alternating Line or
‘perfection at last’). The 625-line colour
system used in Britain, most of Europe,
Australia and New Zealand and elsewhere.

**SECAM** - (Sequence a Memoire or
‘system essentially contrary to anything
American’). An ingenious and much under-
rated 625-line colour system used in French
countries and the Soviet bloc.

**SUPER NTSC** - an American 1050-line,
29.97Hz system which is cheap to
implement and completely compatible with
existing NTSC channels and receivers.

NB: this list is not claimed to be
exhaustive, since so many new techniques
(see acronyms) are appearing now. It is
hoped, however, that all the explanations
are accurate and meaningful.

**Sign-off**

Once again that’s it for this time. Please
continue to send in your comments, reports
and letters ready for the next article.

Thanks.

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**USE THIS COLUMN WHEN YOU THINK THERE’S NO HOPE FOR THAT ODD PROBLEM...SOMEONE, SOMEWHERE MIGHT BE ABLE TO HELP!**

Does any reader know of a company that produces a good logbook for
the short wave listener? George Brooks is looking for one that’s
horizontal A4 format, spiral bound and around 50-100 pages. He would
like one that has no limit to the number of lines per entry so that it can
be ruled off when completed. George Brooks, 73 Percy Road,
Ramsgate, Kent CT11 7JB.

A Grundig Satelit 210 model 7001 has lost some of its controls, the
KV2-W tuner selector knob and the tuner dial knob. Does anyone know
the whereabouts of spares for this piece of equipment. K. Coulbeck, 98
Legsby Avenue, Grimsby, Lincs.

Mr W Smith recently bought an AR900 UK scanning receiver. During his
initial ‘fumblings’ he confused the scanner and it covered a range well
outside the spec, but doesn’t know how he did it. Does anyone know
what to do? Mr W Smith. 36 Lundhill Road, Wombwell, Barnsley,
South Yorks S73 0RB.

Where can a c.w./RTTY/AMTOR program for the Atari 520 STFM
computer be purchased? R. McKinnon, 9 Brandywells,
Kingsnymphont, Umberleigh, North Devon EX37 9SP.

Has anyone got circuit information on a Sony 9-900U Mono TV. It was
built around the late 1970s, it has a 9in screen and seems to be 405/625
lines. Other information required is a mod for switching pos/neg. Mike
Evans, 120 Loughton Way, Buckhurst Hill, Essex IG9 6AR.

P.F. Thompson has recently bought the book Solid State Short Wave
Receivers for Beginners by R.A. Penfold and hasn’t been able to obtain
Denco tuning coils. The manufacturers say they are no longer made.
Can any reader help with a possible source, equivalents or winding
details? P.F. Thompson, Flat 3, 29 Cannon Place, Brighton, Sussex
BN1 2FB.

Does anyone have a copy of the September 1989 issue of SWM as
John Fryatt wants the ‘Hot Rodding the ICF-2002’ article. John
Fryatt, 22 Alverstone Road, Manor Park, London E12 5NJ.

Mr Hartwell has been told of an article which appeared in Popular
Electronics sometime between 1957 and 1960 describing a non-
portable microphone for picking up biosong. The unit was made up
of a bundle of aluminium tubes of different lengths. Harry Hartwell,
Flos Y Ffin, Llanfair Clydogan, Lanpeter, Dyfed, Wales SA48 8LL.

**Help-line**

**Circuit diagrams and technical information is being sought on the
Saflag oscilloscopes, type DT-520 by the Brighton College Electronics
Department. If you can help, the address is, Patrick Billingham
G4A0G, Brighton College, Eastern Road, Brighton BN2 2AL.**

Practical Wireless, March 1990
**REVCO WHEN QUALITY COUNTS**

**REVCON**

The UK's favourite discus composed of traditional British quality engineering. The REVCON works well without exaggerated advertising claims, it is designed to cover 50Ω to 500MHz, and thousands of satisfied users will testify to its efficiency. Unlike some manufacturers we do not claim a wider frequency coverage, and we do not quote inflated figures for gain. A gain figure is meaningless unless the reference point is stated.

Optional vertical whip feature: It is possible to fit a vertical whip section to a discus. We do not want to give you the "hand sell" where this vertical element is concerned, but there is some evidence that it may improve the performance of the antenna around the resonant frequency of the whip. That's why we make it an optional feature.

Another option is the N-type connector instead of the popular SO239. N-types give a better UHF performance, but they cost a bit more. The choice is yours. Because the REVCONE is British-made by a Company which has been in business for 30 years, you buy with confidence, knowing that there is back-up should anything go wrong.

**WIDE-BAND PRE-AMPLIFIERS**

The problem with omni-directional wide-band antennas is their lack of gain. The REVCO PA3 range of wide-band pre-amplifiers complement the antennas and compensate for their shortcomings.

The basic specification of the products is similar: coverage 20MHz-1GHz, at 1GHz; minimum gain 13dB, noise factor 5.5dB. Choose from a masthead version (PA3) or a masthead model is supplied with a special power unit which feeds the DC supply into the antenna feeder. No pos is provided for the PA3 as any 9-15V DC source is suitable (current requirement about 25mA)

The standard version of the PA3 has BNC sockets and is designated "PA3/B". Available to special order are the N-type sockets ("PA3/N") or SO239 ("PA3/S"). A special feature of the PA3 series is a high pass filter to attenuate frequencies below 20MHz; high power HF & MF Broadcast stations can be very troublesome.

**RADAC**

This Wide-band antenna offers an interesting alternative to the discus. It is simply an array of dipoles, but the clever bit involves arranging the dipoles to maximise bandwidth and minimise interaction. The RADAC can be set up for a range of frequencies from 27MHz to 500MHz, and because very good impedance matching can be achieved the user can specify any six frequency bands in this range for optimised performance, either for receiving, or for transmitting. For example, all the Amateur Bands from 10m to 70cm can be covered in one antenna. If you are in the PMR business, the RADAC can be customised for your needs.

**ON-Glass Antennas**

This type of antenna mount has been around for a long time, but they are very difficult to produce successfully at VHF. The Cellular Radio Industry has popularised the glass-mount, but there are fewer design problems at 900MHz, because the coupling assemblies are small. REVCO's extensive experience in making the UK's best Cellular On-glass has led to the production of superior quality VHF and UHF models. Here's a few facts which you should know:

- Configuring: apart from the question of effective power transfer to the outside world, you don't want too much RF floating around inside the car. It is not healthy for vehicle electronic systems, and possibly not good for humans either. REVCO glass mounts feature very efficient power transfer.
- Sticking power: no good if they fall off half way home. A properly installed REVCO stays on. Should you change your car, a refit kit is available.
- Flexibility: some of the competition has a multitude of loose components: the REVCO has 2 pre-assembled parts: inside and outside. What could be simpler?
- Weather-resistance: REVCO antennas are made from corrosion resistant materials so you can leave them out in the rain with confidence. It is not necessary to plaster the product with acrylate rubber to keep the water out. The REVCO glass mounts do cost a bit more, which reflects these superior features.

REVCO also make a full range of mobile antennas for frequencies from 27MHz to 900MHz, and new products are constantly under development.

Revco Electronics Ltd, Old Station Yard, South Brent, S Devon TQ10 9AL Tel: 0364 73394 Fax: 0364 72007

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INDEX TO ADVERTISERS

AHL Supplies .............. 64
ARE Communications ......... 24, 25, 32
Arrow .............. 12, 15
Antex .............. 17
Amateur Radio Communications ......... 45

Birkett, J .............. 102
Bredhurst Electronics .............. 9

Cambridge Kits .............. 93
Capco .............. 32
Cirkit .............. 4, 6
Colamor .............. 45

Datong .............. 93
Drewsbury .............. 82, 83

Dressler Communications ......... 79

E.R.A. .............. 93
Elliott Electonics .............. 102

F J P Kits .............. 93

Garex .............. 25, 89
GAT4NY .............. 102

Howes, CM Components ......... 46

ICS Electronics .............. 69
ICS Interest .......... 102

Icom (UK) .......... Cover i, 2, 3, 89, 84, 85
Kent, R A .............. 85

Lake Electronics .............. 102
Langrex Supplies .............. 89

Lee Electronics .............. 14, 40
London Amateur Radio Show ......... 55, 56

Lowe Electronics .............. 10, 11, 38, 39

Maplin Electronics .............. Cover i, 37
Merlin Systems .............. 64


Nevada Communications ......... 16, 100

Photo Acoustics .............. 46, 47
Quartal8 .............. 102

RSGB .............. 105
RST Valves .............. 89
Radio Shank .......... 112
Randam Electronics .............. 45

RAS Nottingham .............. 45
Raycom .............. 30, 31

Revco Electronics .............. 105

SRW Communications ......... 93
South Midlands Communications ......... 93


Tandy .............. 49

Technical Software .............. 97

Trends .............. 92

Ward Reg & Co .............. 15

Waters & Stanton .............. 80, 81

Wood & Douglas .............. 64

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