PROJECTS FOR THE 90s

PW Irwell QRP Transmitter
Active Receiving Antenna
PW 49'er Car Radio Short Wave Converter

PLUS - News, Reviews, Features,
10 Metre Page, Prize Puzzle
and Much, Much More

A Personal Message From HRH King Hussein JY1

JANUARY 1990
£1.60
The FT-1000 is a new top of the range all mode h.f. transceiver that is the result of more than 25,000 hours of intensive research by Yaesu's top design engineers. They have adopted a completely new approach to the application of digital and RF technology. The extensive use of surface mounted components has allowed six microprocessors and five Direct Digital Synthesizers to be integrated with a simple to use operator interface to give a highly reliable full featured transceiver that has been optimised for serious h.f. applications. Please write or call SMC or your local authorised Yaesu dealer for the full specifications of this dynamic new transceiver and discover how you can open up the bands.
ICOM Count on us!

IC-R7000, 25-2000 MHz
Commercial quality scanning receiver

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: Despatch on same day whenever possible.
Access & Barclaycard: Telephone orders taken by our mail order dept., instant credit & interest-free H.P.
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

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

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

**VISA & Mastercards:** Telephone orders taken by our mail order dept. instant credit & interest-free H.P.

Practical Wireless, January 1990

3
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
## Remarkable Value

- 18 ranges
- 10A dc current

### DC Volts:
- 200mV-1kV
- 200uA-10A
- Continuity and diode test
- Basic dc accuracy, ±0.8%
- Size: 128 x 72 x 33mm

### Price:
- £17.38
- £16.95
- £16.52
- 56-05315 ex VAT

### Measurement:
- Frequency measurement to 20MHz
- AC/DC current to 10A
- 24 ranges

### DC Volts:
- 200mV-1kV
- 200uA-10A
- Continuity and diode test
- Basic dc accuracy, ±0.5%

### Price:
- £31.96
- £31.16
- £30.39
- 56-05375 ex VAT

### Measurement:
- Frequency measurement to 20MHz
- AC/DC current to 10A
- 24 ranges

### DC Volts:
- 200mV-1kV
- 200uA-10A
- Continuity and diode test
- Basic dc accuracy, ±0.5%

### Price:
- £39.96
- £38.96
- £37.98
- 56-00135 ex VAT

## TO ORDER
Phone for same day despatch (0992) 444111 or use the order form below. Postage and packing is 90 pence per order.

Please despatch the following:

- **x** TM5315B at £20.89 (£17.38 + £2.61 VAT + £0.90 p&p)
- **x** TM375 at £33.65 (£29.28 + £4.39 VAT + £0.90 p&p)
- **x** TM5365 at £38.80 (£32.96 + £5.94 VAT + £0.90 p&p)
- **x** TM115 at £29.28 (£25.00 + £3.99 VAT + £0.90 p&p)
- **x** TM135 at £38.96 (£33.96 + £5.00 VAT + £0.90 p&p)
- **x** TM175 at £49.99 (£44.99 + £5.00 VAT + £0.90 p&p)

**Name:**

**Address:**

**Cheque**

**Postal Order**

**Access or Visa**

**Expire Date:**

**Signature:**

**Date:**

---

**Cirkit Distribution Ltd,**
Park Lane, Broxbourne, Herts EN10 7NQ
FREE FINANCE — BUY NOW SAVE MONEY

WOULD LIKE TO WISH ALL OUR CUSTOMERS OLD AND NEW A VERY HAPPY CHRISTMAS AND PROSPEROUS NEW YEAR

CHRISTMAS OPENING HOURS

HQ SHOWROOM
DEC 22/23—9.00am-1.00pm
DEC 27/28/29—9.00am-1.00pm, 2.00pm-5.00pm
JAN 1—Closed

SERVICE DEPT—Closed DEC 22—JAN 2

THE NEW FT1000

BRIEF SPECIFICATIONS

* General Coverage Receiver 100kHz-30MHz
* Ham bands TX 160-10m
* Modes CW, USB, LSB, AM, FM, RTTY and PACKET
* VFO steps 10Hz CW, SSB, RTTY, 100Hz AM, FM, PKT
* Auto antenna impedance range 16.7 to 150 ohms
* Selectable receiver bandwidths 2.4KHz, 5KHz, 10KHz, 250Hz
* Dual band receiver tuning and monitoring with balance control
* Power output up to 200 watts P.E.P. 50W AM
* Sensitivity preamp on SSB/CW 0.25 micro volts 10dB S/N
* D.D.S. Direct Digital Synthesiser
* Dual selectable noise blankers with adjustable threshold
* Frequency stability ± 0.02ppm (0 to +50°C) ± 0.04ppm (0 to +60°C), ± 0.05ppm (0 to +60°C)
* 99 memories

ADDITIONAL FEATURES

Other features include adjustable IF width, IF shift, IF notch and APF controls.
AGC presentable for fast, medium and slow + defeat, on/off selectable.
preamp + adjustable attenuator -6dB, -12dB, -18dB, Adjustable — mic gain, RF power o/p, processor and drive controls.
Built in electronic keyer with adjustable speed control.
Twin independent frequency displays with mode indication + much more.

FT736R THE KING OF VHF/UHF BASE STATIONS

* UP TO FOUR BAND CAPABILITY
* LSB/USB, CW & FM
* FULL DUPLEX CROSSBAND OPERATION
* MEMORY STORAGE OF UP TO 230 FREQUENCIES
* KEYPAD FREQUENCY ENTRY
* FOURTEEN VFO’s
* GLOBAL CALL CHANNEL
* PROGRAMMABLE CHANNEL STEPS
* ELECTRONIC KEYER OPTION
* REMOTE PREAMPLIFIER SWITCHING
* TXCO HIGH STABILITY REFERENCE OSCILLATOR

FT736R RRP £1359 C/W 2m & 70cms and full duplex

LEEDS
SMC (Northern)
Nowell Lane
Industrial Estate
Leeds, LS9 3JE Leeds (0532) 502686
9.30-5.30 Mon-Sat
Closed Sat afternoon

CHESTERFIELD
SMC (Midlands)
112 High Street
New Whittington
Chesterfield
Chesterfield (0246) 453340
9.30-5.30 Mon-Sat

JERSEY
SMC (Jersey)
1 Belmont Gardens
St. Helier
Jersey (0636) 77667
9-5 Mon-Sat

BIRMINGHAM
SMC (Birmingham)
540 Alum Rock Road
Alum Rock
Birmingham (021) 3573134
9.30-5.30 Mon-Sat

AXMINSTER
Reg Ward & Co Ltd
1 Westgate
West Street
Axminster
Devon EX13 7NY
Axminster (0357) 34818
9-5, 9-52 Mon-Sat

SOUTHWALES AGENT: John Doyle, Transworld Comms, Neath (0639) 633714 Day (0639) 642942 Eve. Closed Thursday.
What could Yaesu engineers do to improve on the hugely popular FTx90R series? The answer was easy, they designed and built the FTx90R2 series. The FT x 90R2 series of transceivers provide high performance and a 2 - 5W output, when used with 'C' cells or nicads, ideal for serious portable operators, or when combined with matching linears, an easy to use compact multimode mobile or base station.

What more could you ask from a transceiver?

**FT290R2** £429.00
**FT690R2** £429.00
**FT790R2** £499.00

All the above are supplied with FBA8, MH1068 and strap as standard.

**OPTIONS INCLUDE**
- FL2025 2m 25W LINEAR £115.00
- FL6020 6m 10W LINEAR £109.00
- FL7025 70cm 25W LINEAR £139.00
- FBA8 EMPTY CELL CASE £27.00
- MMB31 MOBILE BRACKET £17.50
- CSC19 VINYL CASE £8.50
- NC26C NICAD CHARGER £11.50
- FTS7 CTCSS UNIT £40.00

**LIGHT IN THE HAND AND ON THE WALLET**

The newest range of handhelds from Yaesu have all the very best in current electronic circuit technology combined with outstanding ergonomic design to produce a powerful yet extremely compact family of radios. The cases have rubber gasket seals around all the external controls and connectors to keep out dust, rain or spray and are fully compatible with all the existing FT23R accessories.

Top of the range must be the amazing FT470 Dualbander with a full 5W RF output on both 2m and 70cm (with FNB12). Dual independent IF circuits allow simultaneous reception on both bands with an audio balance control. Forty-two memories, 4 VFO's, 20 button keypad, defeatable Automatic Power Off and Power Saver are just a few of the functions available at the touch of a button.

Next in line are the FT411 and FT811, single band 2m or 70cm transceivers. Up to a full 5W RF output is available (with FNB 12). A 16 button keypad gives access to all the comprehensive user functions including forty-nine memories, dual VFO's, defeatable Automatic Power Off and Power Saver to name but a few.
COMET & HOKUSHIN ANTENNAS

New from Hokushin, an exciting range of high performance antennas, the WX1 has been a best seller for some time now, available in its big brothers WX2 and WX4. Both are featured in this section South Midlands and the mechanical construction the best we have seen yet. On the mobile front a new dual band tower, the HS-777S, very similar to the Comet CH-20U, is now available with our network analyser confirm its compatibility with its existing range of gitter and mag mounts. Also available are a new stabilizer tower and the HS-806, two new dual band antennas, the very slim HS-777VX and the compact HS-777VY. Both are suitable replacements for the 700 MKIII. For the HF enthusiast the compact 10W HSS-60 dual band driven element that is already light and very cleverly constructed.

NEW FROM CREATIVE CONCEPTS

COMET & HOKUSHIN ANTENNAS

WX2

VHF/UHF mobile
144/432MHz
50W gain
2000w max
$195.00

WX4

VHF/UHF Base
144/432MHz
7.5/10.6dB gain
2000w max
$185.00

HS-775S

Mobile
2m/70cm mobile
2m/70cm mobile
2m/70cm mobile
$125.00

HS-775S2

Fixed
2m/70cm mobile
2m/70cm mobile
2m/70cm mobile
$115.00

MOBILE ANTENNAS

2m 2 x 3/8 wave., £40.00
2m 2 x 1/2 wave., £40.00
2m 2 x 5/8 wave., £40.00
2m 2 x 2/3 wave., £40.00

DUAL BAND BASE ANTENNAS

2m/70cm mobile
2m/70cm mobile
2m/70cm mobile
2m/70cm mobile
$125.00

2m/70cm mobile
2m/70cm mobile
2m/70cm mobile
2m/70cm mobile
$115.00

DUAL BAND MOBILE

2m 2 x 3/8 wave., £40.00
2m 2 x 1/2 wave., £40.00
2m 2 x 5/8 wave., £40.00
2m 2 x 2/3 wave., £40.00

ANTENNA MOUNTS

GSGS

$12.50

SWM

$12.50

SWR

$12.50

CABLES & MOUNTS

$2.50

SOUTHAMPTON (0703) 255111
CHESTERFIELD (0246) 453340
AXMINSTER (0297) 34918

LEEDS (0532) 530606
BIRMINGHAM 021 327 1497

For full addresses see previous page.
**BREDHURST ELECTRONICS LTD.**
High St, Handcross, W. Sussex. RH17 6BW (0444) 400786

**PALOMAR TUNER-TUNER™**

**£99.95**

Do you need 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.

**PALOMAR SWR & POWER METER**

**£124.95**

The only meter that shows PEP output directly, accurately, instantly. Shows power and SWR on bright red lights. See PEP and SWR while you talk! Automatic “hands-off” SWR reading. Power ranges 20-200-2000 watts. Works from 1-30 MHz. Power required 12 V DC.

**PALOMAR PREAMPLIFIER**

**£119.95**

Can’t hear the weak ones when conditions are bad? Receiver lacks sensitivity on 20, 15 or 10? Get the world famous Palomar preamplifier. Tunes from 160 to 6 meters. Gives 20 dB extra gain and a low noise figure to bring out those weak signals. Reduces image and spurious responses too.

**PALOMAR R-X NOISE BRIDGE**

**£59.95**

Learn the truth about your antenna. The Palomar R-X Noise Bridge tells you if your antenna is resonant or not and, if it is not, whether it is too long or too short. It gives resistance and reactance readings on dipoles, inverted Vees, quads, beams, multiband trap dipoles and verticals from 1 to 100 MHz.

**Cables ETC.**

- UR95 50 ohm coax £0.400.10
- URM67 low loss coax £0.95 0.25

**Orders Only**

1:1 & 4:1 High Power Versions Also Available

- 1.7-30 MHz 350 W PEP. Reto to match 50/75/100/150/200/250/300/375/450/600/900 ohms. Specify ratio. Model PB

**£23.95**

**MAIL ORDER & RETAIL**

- Cannot be supplied through mail order or retail

- 24 HRS - PRICES CORRECT AT TIME OF GOING TO PRESS - E&OE
Most people know us as the sole appointed UK distributors for Kenwood amateur radio products. We have always stocked a wide range of other items, from transceivers such as the JST-135 to humble copper wire, so just for a change why not have a short selection of some of these different products. Read it carefully; you will be surprised at the variety.

### LOWE HF225 LOW COST HIGH PERFORMANCE GENERAL COVERAGE RECEIVER

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<td>General coverage receiver</td>
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<td>Narrow band FM and Synchronous AM detector</td>
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<td>GENIE PAD. Key pad for direct frequency entry</td>
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<td>Internal rechargeable nicad battery pack</td>
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<td>Active whip aerial. Ideal for portable use with B225</td>
<td>19.50</td>
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<td>Deluxe carrying case for HF125/HF225</td>
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Options for HF125 still available. Phone for details.

### JAPAN RADIO COMPANY QUALITY EQUIPMENT

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### VHF/UHF MONITOR RECEIVERS AND SCANNERS

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### SOFTWARE

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### ACCESSORIES

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### KEYS AND KEYERS

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25 YEARS IN AMATEUR RADIO

BT35S  Dry battery case for R35S. (batteries not included) ..... 14.51  1.50
LC35S  Leatherette case to fit R352/R35S and BP55S ..... 9.86  1.00
RB35S  Rubber flexible antenna for R35S ..... 6.70  0.50
TW35S  Telescopic whip for portable use with R352/R35S ..... 7.46  0.50
CH35S  AC charger for BP55S/BP35S ..... 8.50  2.00

EMOTATOR NEW RANGE OF ROTATORS
105TSX  Medium duty rotator with controller ..... 159.69  8.00
747TSX  Heavy duty rotator with controller ..... 347.24  8.00
1211  Lower mast clamp for 105TSX ..... 16.28  2.50
1217  Lower mast clamp for 747TSX ..... 35.35  2.50
452  Universal flexible coupling for 105TSX ..... 23.48  3.00
451  Universal flexible coupling for 747TSX ..... 31.12  3.00
300  Stayed support bearing 28-62mm mast diam. ..... 29.53  3.50
303  Mast support bearing 28-62mm mast diam. ..... 19.68  3.50

DAIWA ROTATORS AND ACCESSORIES
MR750E  Multitorque rotator round controller ..... 254.07  8.00
MR750PE  As above but with round and preset controller ..... 290.32  8.00
LMC  Lower mast clamps for pole mounting ..... 17.81  3.00
MR750U  Additional motor unit to increase torque and braking ..... 82.17  3.00

DAIWA POWER and SWR METERS
CN410M  3.5-150MHz mobile cross needle power/SWR meter ..... 61.72  1.50
CN460M  140-450MHz mobile cross needle power/SWR meter ..... 65.40  1.50
NS448  900-1300MHz SWR/Power 5/20W ..... 86.60  2.50
NS660P  1.8-500MHz SWR/PEP/RMS meter. ..... 115.00  2.50
U66YN  Extra couplers available ..... 140.72  3.00
SC20  20 metre extension cable ..... 29.21  1.00
CNW919  2M Power meter and antenna tuning unit ..... 147.40  3.00
DP810  Digital SWR/Power/Pep meter 1.8-1500MHz, 100MW-1.5KW ..... 132.00  2.50

AC POWER SUPPLY UNITS
PS30XM  Daiwa heavy duty PSU 30A max 24A rated ..... 129.50  8.00
PS120M  Daiwa AC PSU 3-15V variable 12A maximum ..... 79.50  8.00

MOBILE AERIALS HOKUSHIN RANGE
320  2m stainless 1/4 wave on PL259 plug ..... 3.30  1.00
RG4M  Base for all above units inc. coax ready fitted with PL259 ..... 6.26  1.00
12B  Car wing mount with SO239 top and bottom ..... 5.73  1.00
GSS  Heavy duty gutter/roof mount to take RG4M base ..... 6.26  1.25
HSTMB  Trunk mount base with SO239 socket and cable ..... 15.42  1.50
HS750N  145/435MHz Diplexer ..... 25.47  1.50
HS727VY  2/70 antenna 1/2 wave on 2m 5/8+5/8 on 70cm ..... 24.38  3.00
HS727VME  2/70 antenna 6/8 on 2m 5/8+5/8+5/8 on 70cm ..... 37.42  3.00
MA200S  Deluxe magnetic base. For most of above aerials ..... 24.00  2.00

NEW SUPER SLIM RANGE
VM2SS  Super slim 2m 1/2 wave mobile antenna ..... 19.53  3.00
VMT7SS  Super slim 70cm 1/2 wave mobile antenna ..... 17.39  3.00
VM200SS  Super slim 2m 2/70 hybrid mobile antenna ..... 23.54  3.00
SS2B  Small boot lip/hatch antenna base assembly. Fits some gutters ..... 22.32  2.00

BASE STATION AERIALS
HS64 80-100MHz HF vertical. Including loaded radial elements 1KW rating ..... 218.00  8.00
GS100  8 Band base station antenna ..... 109.25  8.00
GP23  High performance 2m 3 section collinear ..... 51.97  8.00
HSWX1  144/430MHz dual band base station vertical ..... 59.62  8.00
HSWX2  NEW High performance 144/430MHz. base station vertical ..... 79.72  8.00
GPV7  High performance 1020MHz 5/8+5/8+5/8 base station collinear ..... 45.59  8.00
REVCONE  30-500MHz Dipole antenna. British and well made ..... 32.50  8.00
DIJ3N  DIAMOND wide coverage aerial for scanning receivers 25-1300MHz ..... 79.34  8.00
LAB  Air band ground plane aerial ..... 18.42  2.50

ANTENNA ACCESSORIES
CS201  Four way 50 ohm coax switch. 0-500 MHz ..... 13.69  2.50
CS201G  As above but with N-type sockets ..... 35.00  2.50
CS401  Deluxe multi switch for 2m. 0-500 MHz ..... 69.09  2.50
CS4  4 way coax switch BNC connectors DC-1.5GHz ..... 30.39  2.50
ES  Small egg insulator. Glazed ceramic 3cm long ..... 0.61  0.50
EL  Large egg insulator. Glazed ceramic 5cm long ..... 0.79  0.50
HS50B  HF BALUN 1.8-500MHz. 1:1 ratio 1KW. ..... 24.14  2.50
TRAPKIT  Trap dipole kit including 7MHz. ..... 28.38  2.50
TRAPS  7MHz traps only to make up your own antenna ..... 12.56  2.50
CUWIRE  25m Pack 14SWG. copper ..... 8.62  1.50
CPC  Centrepiece insulator for dipole ..... 5.53  0.75

OTHER ACCESSORIES
WR500  The ever popular twin meter SWR bridge 1.8-150 MHz ..... 24.61  2.00
DL60  60 W dummy load with SO239 fitting ..... 10.96  1.00
WA1  AKD wavemeter. 120-450 MHz ..... 18.42  1.50
METEOR600  600 MHz frequency counter. Mains or battery ..... 29.54  2.50
1300HA  NEW MODEL handy frequency counter. With built in preamp ..... 159.00  2.50
2400H1  NEW MODEL 2400 MHz. handy frequency counter ..... 280.00  3.00
CC12  Deluxe carrying case for 1300HC/2400 ..... 9.91  1.00
PS13/24  Mains power supply for 1300HC/2400 ..... 8.50  2.00
TW535  Telescopic whip for 1300HC/2400 ..... 7.46  0.50
T414  Mult arm instrument vice system with magnifier ..... 6.34  1.50
MH1  Screw fixing mic clip ..... 0.22  0.50
MH2  Self adhesive mic clip ..... 0.29  0.50
MH3  Magnetic fixing mic clip ..... 0.32  0.50

Shops in GLASGOW Telephone 041-945 2626, DARLINGTON Telephone 0325 486121, CAMBRIDGE Telephone 0223 311230, BARRY Telephone 0446 721304, LONDON Telephone 01-429 3256, BOURNEMOUTH Telephone 0202 577760
All branches are closed all day Monday.

Practical Wireless, January 1990
Save £££'s now!

YES! OUR BULK BUYING MEANS THE BEST DEAL FOR YOU... TOP DISCOUNTS, TOP TRADE-IN PRICES

FINANCE AVAILABLE ON OUR DISCOUNT PRICES (subject to status)

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Fax: 0245 381436
Hours: 9–5 (Closed Thursdays)

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Unit 17, Six Harmony Row, Govan, Glasgow, Scotland G51 38A.
Tel: 041 445 3060.
Hours 8.30–5.30 Mon–Fri. (Closed Saturday).

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Latest calls 8.30pm please!

RSGB CREDIT CARD ACCEPTED
YOUR ORDER CAN BE TELEPHONED WITH CREDIT CARD DETAILS & DESPATCHED IMMEDIATELY!
FREE FINANCE ON MANY MAJOR ITEMS AT RRP. (Ask for details of qualifying items).

COMMENT!

In June 1965 when I started business as “LST Components” (from my callsign — G3LST); I choose Practical Wireless for my very first advertisement.

So our relationship is 24 years old and I am most sincere in wishing:

CONGRATULATIONS TO PRACTICAL WIRELESS ON THE NEW LOOK!

Incidently, if anybody has one of my 1974 adverts, send it to me & I'll send you a FREE LOGBOOK!! — nostalgia dies hard!

73 DE PETER G3LST

Practical Wireless, January 1990
NEW KENWOOD HF. TS-950S

TS950S “NOW AVAILABLE... £3199”

NEW! IC-24E
ICOM mini dual bander
2m & 70cm FM
DISCOUNT PRICE £365 incl. nicad, charger

TS140S — FREE CREDIT
Superb HF mini from Kenwood.
Dep: £173.00 + 6 payments £114.83.

IC — 32E
Best value yet in Dual band handys
ARROW PRICE £369!!!
(Incl. nicad & charger)

NAVICO AMR1000
A great 2m FM 25W Mobile.
SPECIAL pack price £247.00 with FREE MOBILE & ANTENNA GUTTER MOUNT.

FT747GX SPECIAL
DUAL-BANDER
Yaesu’s famous mini for 2m & 70cm Handy.
ONLY £389.00 Inc nicad & charger.

NEW! IC2400 FREE CREDIT
NEW ICOM 2m & 70cm FM 45 W Full Duplex. simultaneous receive.
£211 DEP. + 9 payments £47.11.

ARROW FOR THE BEST DEAL IN AMATEUR RADIO!!

NEW MT6000 Mobile/Base Scanner by Yupiteru only
£349.00 Superb! only equalled by the MTV5000 hand
scanner at only £275.00. They both cover 25–550 & 800–
1300 MHz.

And ARROW stock BEARCAT/UNIDEN, SONY, AOR,
STANDARD, You name it, we’ll give you a good price!

COMET ANTENNAS
An excellent performance combined with super quality at a BARGAIN price from our
directly imported range including:

C0120 5M -1 -Power 15/60/200W with PEP .5
CO2700 5W -1 -Power as above for 140–
CFX140 irides for 50/144/1432 WO

FULL RANGE OF EQUIPMENT FROM ALL MAJOR
MANUFACTURERS CAN BE SEEN & TRIED AT OUR
SHOWROOMS IN CHELMSFORD & GLASGOW. OUR AGENTS
IN WIGAN & LEICESTER WILL BE PLEASED TO
DEMONSTRATE ANY ITEM. CATALOGUES & COLOUR
BROCHURES ARE AVAILABLE ON MOST ITEMS, WE
APPRECIATE A STAMPED SELF ADDRESSED ENVELOPE,
WE WILL ALSO SEND YOU A QUOTE, WE CAN EVEN OFFER
FINANCE BY POST (subject to status) JUST CALL FOR PRICE
& TELL US WHAT YOU WANT OR HOW YOU WANT TO BUY.
**FEATURES**

Probably the world's smallest 2mtr Handheld
(Also available in 70cms)

- Size 110mm H x 53mm W x 32.5mm D
- 5 Watts @13.8V DC in, or CNB414 NiCad pack
- Adjustable output powers
- Programmable battery save
- Auto power off
- Presetable on/off periods via internal clock
- 5 scan modes, including memory scan
- 2 x 10 memory banks
- Switchable memories using rotary switch
- Rotary channel or keypad programmable
  (with CKP412 option)
- 4 multifunction keys for simple programming
- Expandable RX frequency range

"THINK SMALL-THE FIRST STANDARD"

**SPECIFICATIONS**

**RECEIVER:**
Circuitry Double Conversion Superheterodyne
Intermediate
Frequency 1st IF: 21.8 MHz (Upper heterodyne of C412 Series)
21.8 MHz (Lower heterodyne of C412E/C412 Series)
2nd IF: 455 kHz (Lower heterodyne)

- Sensitivity (12 dB SINAD) Less than 0.16 µV
- Threshold Squelch Less than 0.1 µV
- Selectivity (2 signal method) More than 50 dB
- Audio Frequency
  - Output 200 mW (at 8 ohm 10% distortion)
  - S/N Ratio at 1 µV
    - More than 25 dB (C412)
    - More than 28 dB (C112)
- Performance specifications are subject to change without notice.

**ACCESSORIES**

- CMP111 Speaker/Mic
- CMP112 Small size Spkr/Mic
- CNB412 7.2 V 400 M/A NiCad pack
- CNB414 12 V 600 M/A NiCad pack
- CWC150 Wall Charger for CNB412
- CWC151 Wall Charger for CNB414
- CAA12 Charging Sleeve
- CMC150 Mobile Charger
- CMB111 Mobile Bracket
- CAS150 Desk Top Charger
- CHP111 Headset Boom Mic
- CTN412 Tone Squelch Unit
- CTD412 D.T.M.F.
- CKP412 Key Pad
- CLC412 Case

**£239.00**

**DONT FORGET**


We are also main agents for Icom, Yaesu, Navico as well as Standard, so give us a call.

MAY I WISH YOU ALL A MERRY CHRISTMAS;
AND A VERY HAPPY NEW YEAR

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Practical Wireless, January 1990

Reg Ward & Co. Ltd.
1 Western Parade, West Street, Axminster, Devon, EX13 5NY.
Telephone: Axminster (0297) 34918

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<td>Narrow Switch &amp; Transmitter</td>
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We are now officially appointed Kenwood dealers for the South Coast - and carry the complete range in stock. Here's a selection:

- **TS950SD New Digit HF Transceiver**£3199
- **TM 231E 2 Mtr mob.**£289
- **TM 431E 70cm mob.**£318
- **TM 701E 2/70cm mob.**£469
- **TR 751E 2/70 mobile** CALL
- **TS 440S HF**£1138
- **TS 940S HF**£1995

We have just been appointed ICOM dealers for the South Coast. Call Paul Martin our ICOM specialist for info and prices.

- **IC - 2SE** CALL
- **IC - 4SE 70cm H/held** CALL
- **IC - 32E 2/70 H/held** CALL
- **IC - 3210E 2/70 Mobile** CALL
- **IC - R7000 Receiver** CALL
- **IC - R71E Receiver** CALL
- **IC - 725 HF TCVR** CALL
- **IC - 735 HF TCVR** CALL
- **IC - 751A HF TCVR** CALL
- **IC - 761 HF TCVR** CALL
- **IC - 2281 2m/45W** CALL
- **IC - 448E 70/25W** CALL

We probably carry the largest stocks of scanners in the U.K. Our New Bumper Catalogue features all the latest models. Here's a selection:

- **New Jupiter 11 H/held** £299
- **New Jupiter 11 Mobile** £199
- **BEARCAT 200 XLT H/held** £229
- **100 XLT H/held** £199
- **100 XL H/held** £179
- **55 XL H/held** £99
- **590 XLT Mobile** £199
- **760 XLT Mobile** £199
- **145 XL Base** £115
- **150 XL Base** £169
- **210 XL Base** £169

**SCANNER ANTENNAS**

- **Nevada Discone (50 - 700 MHz)** £24.00
- **WBI300 Discone (25 - 1300 MHz)** £59.95
- **PAIS Colinear (100 - 960 MHz)** £49.95

**TALK ATU'S**

- **TM 1000 1 KW ALL BAND ATU** £168
- **Balun Model TM1000B** £199

**BUILD YOUR OWN AMPLIFIER OR ATU WITH OUR RANGE OF HIGH POWER COMPONENTS**

- **Roller Coaster 30 µH** £28.00
- **Var. cap 250 pF (8kV)** £19.95
- **Var. cap 250+250 pF (8kV)** £28.00
- **Var. cap 750 pF (4kV)** £28.00
- **Turns Counter (For Roller)** £14.95
- **Empty ATU Case** £26.00

**TALK AMPLIFIERS**

- **B300P MOBILE AMPS**
  - **B150 150W (26 - 30MHz)** £229
  - **B300P 300W (6 - 30MHz)** £237.00
  - **B500P 500W (6 - 30MHz)** £299
  - **B303 200W (6 - 30MHz)** £114.67
  - **TC50DX 50MHz amplifier** £35.41
  - **B250 250W (6 - 30MHz) 24 volt** £115
  - **737 80W (26 - 30 MHz)** £35.41
  - **735 35W (26 - 30 MHz)** £18.54
  - **B110 110W (142-170 MHz)** £145
  - **BASE AMPLIFIERS**
    - **B132 240W (3-30 MHz)** £129
    - **BV131 250W (26-30 MHz)** £115
    - **B507 300 W (3-30 MHz)** £278

**STOP PRESS STOP PRESS**

JUST ARRIVED

The new fairmate H/Held Scanner. Just look at its incredible specifications.

- **1000 memory channels**
- **25 MHz-1300 MHz**
- **Wide Band FM/narrow FM/AM**
  - All fully selectable

Price £299 (charger extra £7.76)

**SEND IN NOW JUST £2 FOR OUR NEW BUMPER CATALOGUE (INCLUDES £2 VOUCHER)**

**189 LONDON ROAD, NORTH END, PORTSMOUTH, PO2 9AE ORDER HOTLINE (0705) 662145**
Some observers consider the radio hobby is dying. Others state that the pastime, while not growing, is still being involved by amateur, short-wave listener or constructor's point of view, is at least in terminal decline.

National radio societies the world over, with the possible exception of Japan, are reporting falling membership unless perhaps working in all aspects of the radio and electronics industry. Suddenly however, the majority of young people in industry seem to have become very much computer-orientated. Digital electronic systems are their reason for being, and radio communications and the other aspects of electronics as a job or pastime seems, with few exceptions, to have lost the ability to attract new and younger blood.

Why should this be? A walk down the main shopping areas of almost any town within the UK will show that there are many outlets for consumer electronics. Many towns have stores which components can be bought from, and for those not fortunate enough to have direct access to shops there are the various mail-order companies. Despite this, the hobby is still not attracting youngsters at the rate it should be, especially when the potential career prospects are considered.

I believe that the drop-off in recruitment - so to speak - is due to the almost total lack of publicity for the radio hobby in the UK. Certainly, in the last 20 years or so, the public have become aware of many new areas of new technology. Colour TV, video recorded computers, microwave cookers, CB radio, all are known, used and talked about by the public at large. It is not uncommon to find five and six-year-old children at work on computers during their school time. This has come about through advertising and is usually accompanied by excellent public relations. Availability of the product and necessary ancillary equipment at reasonable prices, backed by excellent user-friendly instructions and handbooks ensured success.

Radio hobbyst not only has always had the reputation of being a little odd. Perhaps we are, but the image of the eccentric radio amateur so beloved of the late great Tony Hancock, hasn't worn off quite yet. Perhaps that particular programme was made nearly 30 years ago.

The onset of the imported CB radio craze - for that's what it was for many people - brought the radio hobby to the notice of the popular media. Unfortunately, and with very few exceptions, the mass media within the UK did not know, or could not be bothered to find out the difference between licensed amateur radio stations and the American influenced CB service. If CB radio had been introduced to the United Kingdom some 20 years ago, the service could have developed into a form which would have made it much more acceptable to everyone. As it was, those with the power to assist in these matters chose to look the other way and pretend that the need did not exist. Unfortunately for all, the arrival of American 'CB' films suddenly provoked a great surge of interest. Just as suddenly the service was legalised, but the transatlantic influence meant that the ordinary English speaking listener/inter ested in the hobby...if it is coupled to a properly organised public relations drive.

Publicity for the radio hobby in Britain has usually been of a negative nature. Often it has been the result of a court case, or report in the media with only a tenuous connection to the hobby. Such reports can appear under headlines such as "Radio Ham obstructs emergency communications" or "Radio ham eavesdrops on neighbours 'phone calls" and so on.

Cases similar to those mentioned have appeared in the national press in various forms and under misleading headlines. Although many incidents have no connection with the hobby of radio, the negative publicity is read by many people.

America seems to be the home of public relations. Fillingly, the national society, the ARRL, representing the transmitting radio amateur, novice and listener in the USA, certainly has a high profile when it comes to publicity. You can be sure that there aren't many people in North America who don't have some idea what a 'Radio Ham' is!

The national society, the Radio Society of Great Britain and other groups spread the full support of their members to promote the hobby.

For too long, we've been that odd little group (you know...the people who hide themselves away in little rooms or sheds at the bottom of the garden or under the stairs) who only seem to appear at garden fêtes and exhibitions. It's time we stood up and showed ourselves to be what we are and that the hobby can lead to a lifetime interest or career for many people.

So, to help the hobby live on into its second century, why don't we all help each other? Why can't more experienced enthusiasts lend a hand to schools, clubs, youth organisations and other groups? For many years, dedicated teachers (often licensed amateurs) and club leaders have encouraged beginners. PWs applied them, and with the backing of Short Wave Magazine continue to support the hobby with constructive projects, technical features, news, latest developments and historical articles and much much more! Why don't you support yourself, your club and your hobby by helping others start off?

To survive into the next century, the radio hobby must have a public face. The RSGB's efforts in this direction must be supported by all. Stand up and be counted. Evangelise! Make sure you get the right publicity! Tell your local paper! They are all interested if it is LOCAL. PW, accompanied by Short Wave Magazine, will be with you all the way.

Merry Christmas, Happy New Year and great radio for the 90s!
Dear Sir,

I implore you to print the following words from the heart.

A few days ago the Council of the RSGB closed down my local repeater GB3NA. They told us the UKFM Group (Northern) was suffering from “Abuse”. The DTI refuted this saying they, the DTI, were satisfied that there had been no abuse and that they were satisfied as to the operation of GB3NA. The council did NOT give sufficient time to consult the GB3NA group. We were given 48 hours. I deplore this action which shows the RSGB is out of order, out of date and out of action which shows the group. We were given to consult the GB3NA to the operation of the following words.

Mike Dennison G3XDV, RSGB.

The RSGB replies:

Mike Dennison G3XDV, Assistant to the Secretary / Chief Executive of the RSGB (deputising for David Evans G3OUF, who was unavailable at the time) provided, on seeing a Copy of Mr. Caledon-Scott’s letter the following reply in answer.

“For some time the Society has received complaints from a number of sources about the operating practices of some users of the South Yorkshire VHF repeater GB3NA. The RSGB’s Repeater Management Group sent a letter to the local repeater group, the UK FM Group (Northern), about this several months ago. At the last meeting of the Council the RSGB’s elected governing body, it was decided to close the repeater down for one month whilst officers of the Society had meetings with the repeater group and others in the repeater’s coverage area to discuss how to improve operating standards. It must be emphasised that there is no suggestion that the UK FM Group (Northern) are operating the repeater illegally. Council’s decision was made after careful consideration of views put by the DTI, the Society’s own specialists and local elected representatives.

Although the DTI have been involved and have made a visit to one station in South Yorkshire, it is understood that they do not regard the abuse as serious enough for them to act further. However, the RSGB feels that, as licence holder for the repeater, it has a responsibility to ensure that operating standards are as high as possible. The closure was simply to create a climate which would lead to positive decisions on cleaning up the behaviour of a small but vociferous number of repeater users.”

Mike Dennison G3XDV, RSGB.

GB3NA Update

As we were preparing for press, the RSGB provided an update on the situation and we are pleased to hear that GB3NA returned to service on Thursday November 23. The RSGB also took the opportunity to remind us that they had: “Negotiated with the licensing authority for permission to run amateur repeaters in the UK some 17 years ago. That the UK was one of the first countries in Europe to have repeaters. The Society has negotiated each of the 400+ repeater licences, including GB3NA.

They hold and pay for each of these licences plus public liability insurance for all repeater groups.

The RSGB administers the repeater network, provides information and technical support, and holds contracts with major site owners offering favourable terms for repeater groups.”

J. Caledon-Scott G4LRS (Life member GB3NA group), Barnsley, South Yorkshire.

G3XFD comments:

It is indeed unfortunate that such things are happening in amateur radio. Other repeaters appear to have problems and I have had some personal experience of some odd operating standards (to say the very least) since my return to v.h.f. (144MHz band mobile working). All I can say is that such behaviour from a small minority can do our hobby a great deal of harm, particularly when the incidents are reported in the mass media (often without the full facts!). I can only implore everyone to work together and give amateur radio a positive image. Be first with the good news! Readers should also be aware that January’s Keylines were written before the GB3NA shut-down came to our attention.

R. A. E. German G3OZT

Southampton

Sir,

I feel I must write to you to say how much I enjoyed the “Wordsearch” competition, it’s a nice change from the heavy technical majority of PW’s content. Amateur Radio consists of a good number of enthusiasts who are much older than they would like to be and don’t have much use for the high-tech stuff.

S. A. Carrigan G4OUJ

Wardle, Rochdale

Enjoy this January’s competition!!!
Clues
Across
1 Crystal manufacturers (1,1,1)
5 Meaty enthusiast (3)
7 Sunny radio signals (5)
9 RA 17L is nearly mischievous (5)
11 Morning frequency (1,1)
14 Prefix for Bolivia (2)
15 G (7)
16 CM or CO (4)
18 Limited Warrington company initially (1,1,1,1)
20 Prefix for Estonia (2)
21 Transmission connections between numbers (5)
23 Prefix for Norway (2)
24 19th Century high frequency experimenter, Sir Oliver (5)
25 Fishy receiver?! (5)
29 Prefix for Spain (2)
30 Stay on station (5)
31 Prefix for Pakistan (2)
32 Tidious contact waves on Severn (4)
34 River meet (4)
35 Frequency twinner (7)
36 Prefix for Chile (2)
37 Volume increase will turn (2)
39 Abnormal reception or eccentric enthusiast! (5)
41 Marvellous het (5)
44 Random access memory for sheepish computer (3)

Down
1 Regulatory body for independents (1,1,1,)
2 Initially noisy measurement (1,1)
3 Old man (1,1)
4 Prefix for Japan (2)
5 Prefix for Korea (2)
6 Locator (3)
8 Region (4)
10 RST or Q (4)
12 Smaller than average equipment (5)
13 Part 6 of Making Waves takes to the air reflectively (5)
14 Prison rooms in parallel (5)
17 Twin white bear transistor (7)
19 Less blessed gets signals (7)
21 Dependent resistors need low weight (5)
22 Hear reliable noise (5)
26 Connecting lead (5)
27 Important controls for twiddling! (5)
28 PT manufacturer (5)
33 Transmission brink (4)
34 Snare antenna catches several bands (4)
36 Common CB location (3)
38 Give money for equipment (3)
39 Frequency modulation (1,1)
40 Sheffield suppliers (1,1)
42 G prefixed area (1,1)
43 Mail order component company (1,1)

Complete the crossword, fill in the form below and send your entry to PW Publishing Ltd., January 1990 Crossword Competition, Enefco House, The Quay, Poole, Dorset BH15 1PP.
Closing Date 11 January 1990.
The Editor's decision on the winner is final, no correspondence will be entered into.

Name
Address
Postcode

Subscription □ Vouchers (please specify) □

PRIZES...PRIZES...PRIZES...PRIZES...PRIZES...PRIZES...PRIZES

First prize winner can choose either a one year PW subscription or £20 in vouchers for the book service.
The two runners-up can choose from either a six month PW subscription or £10 in book vouchers.

Practical Wireless, January 1990
Kit News
The latest edition of the Kit News news sheet is available from Cambridge Kits if you mention Practical Wireless when you send them a 9 x 4in envelope. It contains details of the kits available as well as tips and modifications. Each kit is supplied complete with case, screws, etc.
Cambridge Kits, 45 Old School Lane, Milton, Cambridge CB4 4BS.

QRP Contest
The eighth annual Practical Wireless 144MHz QRP Contest will take place on Sunday 17 June 1990 0900-1700UTC.
The 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.

Motorised Antenna Mount
Among their satellite products, Chaparral Communications Inc have the PolarMotor. This is a motorised satellite antenna mount with a range of features. The drive components are fully encased and it has been designed specifically for the European satellite communications market.
The PolarMotor translates electrical commands from the satellite receiver into mechanical location requirements for a dish of up to 1.3m. It then physically moves the dish into the correct position to receive signals from specific satellite.
It is capable of a full 180° horizontal arc and the integrated gear drive moves the PolarMotor through the 180° arc in less than 50 seconds.
The PolarMotor will be available from January 1990 and the price should be around £199.00. It is shipped completely assembled and factory tested and comes with an installation manual.
Chaparral Communications, 10 Campbell Road, Hanwell, London W7 3EA. Tel: 01-579 6587.

Mid Winter Sports
The G-QRP club will be holding the annual mid winter sports during the period December 26 to January 1 inclusive. An opportunity to work many countries on many bands. Not a contest as such, but is ideal for the Christmas period. Details from George Dobbs G3RJV. Tel: (0706) 31812.

DUBUS Contest
In order to further DX activity, DUBUS Info sponsors annual v.h.f./u.h.f. contests. These contests are held on the last full weekend of January, March, May, July, September and November from Saturday 1400 to Sunday 0200UTC.
Eligible entrants are all European radio amateurs (single op), operating within the terms of his/her normal licence. The frequency band and the mode (c.w. only or mixed) determine the section. For example a 430MHz station using ‘phone (and maybe c.w.) would be in the 430/mixed; a 144MHz station working solely in c.w. would be in the 144/c.w. section. A station may enter only one section for the duration of one contest.
The contest call is CO DX TEST in c.w. and CO DX CONTEST in telephony. The contest OSO exchange consists of RSIT) and the European ORA locator, e.g. 579 EL68f.

Scoring
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<th>201-300km</th>
<th>301-500km</th>
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<th>501-700km</th>
<th>&gt;700km</th>
<th>701-1000km</th>
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* The final score is the product of QRB points and QRA square points. For example 3000 QRB points and 25 squares on 23cm would earn you a total of 3000 x 25 x 5 = 375000 points.

Each section’s best three entries will receive a certificate. The callsign accumulating the highest number of points per mode during the calendar year will be awarded the DUBUS DX Trophy.
Neither duplicate contacts nor those via artificial or extra-terrestrial reflectors and through transponders/repeaters count any points. The partner station’s QTH information should permit an accurate enough distance determination.
Contest logs should be submitted to the adjudicator(s) not later than the last day of the month that follows the contest.
Logs for 432MHz and above go to:
Frank Fischer DL4EA, Maarweg 135a, D-5000 Koeln 30, West Germany.
Logs for 144MHz go to:
Edmund Ramm DK3UZ, PO Box 1338, D-2358 Kaltenkirchen, West Germany.
**Enhanced Teststation**

Crotech Instruments Ltd., has launched a new oscilloscope-based Teststation, the 4445. This combines a dual-channel 25MHz oscilloscope with a frequency counter and function generator in one package.

The frequency counter is a 20Hz to 35MHz unit, with an 8-digit display. Measurement accuracy is ±20p.p.m. with a ±30p.p.m. stability from 0 to 50°C.

The function generator operates over a five decade range from 1 to 100kHz and generates sine, square and triangular waveforms as well as a t.t.l. output to an accuracy of ±5%. The output drive level is up to 7.5V (peak to peak) into 600Ω and 15V (peak to peak) into an open circuit. Source impedance is 600Ω.

Crotech Instruments Ltd. Tel: (0480) 301818.

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**Longer Lasting...**

Duracell have introduced their new battery onto the market. Apparently it lasts up to 20% longer, contains little mercury (.02%) and no cadmium and has a shelf life of four years with the date stamped on both the pack and battery. Some packs of batteries also carry a Duracell Battery Guide in the pack. You should see the new batteries on sale nationwide.

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**RAF Award**

The Worked RAF Waddington Club Members Award is designed to promote the club and encourage on the air activity between club members and all other radio amateurs.

The award will be available to all licensed amateurs and s.w.l.s who have made simplex contacts or heard 25 club members on or after 6 November 1989.

To claim the award, log extracts including callsign, date, time, frequency, mode and club membership number of the station worked, should be submitted to the club secretary. Submissions must be verified by two licensed amateurs but this requirement is waived for club members.

The cost of the award will be £1 (or 50p to club members). A list of club members callsigns is available from the club secretary on receipt of an s.a.e.

Dave Bloomfield G0KUC, 8 Sunningdale Drive, Boston, Lincs.

Practical Wireless, January 1990

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**Voltage Indicators**

Two new instruments available from TMK are simple, hand-held voltage testers.

Both models use two probes to measure a.c. and d.c. voltages to 440V in seven ranges with i.e.d. indication and input protection to 500V. Electromate also indicates voltage polarity, has a diode and lamp check facility as well as audible and visual continuity testing. This unit measures 152 x 33 x 32mm. Whereas the Voltmate only measures 185 x 32 x 32mm.

Electromate costs £33.75 and Voltmate costs £4.95 (both prices excluding VAT).

TMK Instruments, Building 3, GEC Estate, East Lane, Wemby, Middlesex HA9 7PJ. Tel: 01-900 3355.
Bouvet Island Expedition

After almost two years of discrete development, planning and negotiations, if all goes as expected a 12-member radio operating team led by the Legion of Indianapolis DXers will attempt to start off the new decade with a bang when they land at Bouvet Island. Beginning on February 2, they should be there for a 10-12 day scientific research/radio operation.

The group consists of an 18-man landing team which includes geochemical, marine biologic and paleontological research scientists, survival and rescue experts, scuba divers, rock climbing specialists, emergency medical technicians and a two-man film/photography team representing the National Geographic Society's Magazine and the television programme Explorer.

The radio operating team will establish and man seven transmitting stations (3 s.s.b., 3 c.w. and 1 satellite). They aim for simultaneous contest-style operation intended to provide two-way radio contacts or s.w.l. receptions with all interested DXCC chasers world-wide. Special emphasis will be given to Pacific rim stations and low-band enthusiasts. They should be using all amateur bands from 1.8 to 28MHz including the new WARC bands as well as the OSCAR satellite.

The callsign to look out for is 3Y0B.

Where is that Satellite?

Swift Television Publications are offering a more unusual satellite service for installers. They will produce a print-out for any location listing the azimuth and elevation (for fixed satellite systems) for the 30 satellites which beam signals across Europe. For motorised polar mount dishes, modified polar and apex elevation angles are given.

The cost of each print-out is £3.00. If you would like further details, contact:
Swift Television Publications, 17 Pittsfield, Cricklade, Swindon, Wilts SN6 6AN. Tel: (0793) 750620.

Hot & Cold DMM

The latest GoldStar B4 series digital multimeter from Alpha Electronics can also double as an accurate digital thermometer. The B433, shown in the photograph, measures from 20 to +150°C with the supplied resolution.

The large and clear liquid crystal display indicates d.c. voltage to 1000V and a.c. voltage to 750V.

Both alternating and direct current are measured to 10A, resistance to 20MΩ and capacitance to 20µF with a 1pF resolution.

The unit comes with safety test leads, battery, spare fuse, operator’s manual and temperature probe. It costs £64.50 excluding VAT.

Alpha Electronics Ltd., Unit 5 Linstock Trading Estate, Wigan Road, Atherton, Manchester M29 0QA. Tel: (0942) 873434.

Cable Glands

BoplaFlex cable glands provide a direct connection between enclosures and cables. A synthetic rubber seal provides waterproofing and protects against the ingress of dust. The cable glands are moulded in glass-filled nylon and are coloured light grey to match Bopla’s range of enclosures.

A slotted internal structure provides strain relief for the cable and a ratchet construction prevents excessive tightening during assembly. They are available in eight sizes, for cable diameters from 7 to 36mm.

Bopla Ltd., 29 Faraday Road, Aylesbury, Bucks HP19 3RY. Tel: (0296) 399999.

High Power Capacitor

Nevada have introduced a new addition to their range of British made a.t.u. components, a 750pF high power variable capacitor. The capacitor uses high quality material and each one is hand assembled and tested before despatch. The capacitance range is from 2 to 750pF, it weighs 600g and measures 145 x 100 x 105mm. The TC750 is priced at £26.

Nevada, 189 London Road, North End, Portsmouth, Hants PO2 9AE. Tel: (0705) 662145.
Catalogues

A wide variety of catalogues have arrived this month, all different shapes and sizes. At one end there are the Electromall and Maplin catalogues and at the other there’s price lists and information sheets from Jandek.

The Electromall catalogue weighs some 1.87kg! Some of the new products included in the November to February edition are Sharp calculators, advanced graphic i.c.s, microprocessor crystals, infra-red emitters and detectors, weather resistant tywaps and satellite cable - to mention only a few.

You can order from the Electromall catalogue, using your credit card, 24 hours a day. Mail order transactions must be accompanied by a cheque or postal order.

Electromall, PO Box 33, Corby, Northants NN17 9EL. Tel: (0536) 204555.

The Maplin catalogue is some 575 pages in length. With this issue comes an offer of a handy continuity tester with all orders over £10. Recognising the increased interest in communications, this section has been increased by one third and includes a range of new mobile transceivers. The similarly expanded computer section features a 3-button serial mouse together with a 3-button track-ball, ideal for creating graphics. You can place credit card orders day or night with Maplin too.

Alternatively you can visit one of their twelve shops, all the addresses are given at the front of the new catalogue. The telephone number for mail order is (0702) 554161.

The new colour catalogue from Henry’s is available by post or from their shops. The cost is £1.00 for callers and an s.a.e. with a £2.00 stamp for mail order. The catalogue contains purchase vouchers totalling £90.00. Supplements are regularly issued and there are three available now: test instruments, electronic components and security equipment.

Henry’s Audio-Electronics, 404-406 Edgware Road, London W2 1ED. Tel: 01-723 1099 for components and 01-724 0323 for communications.

Jandek have a range of kits now available, details of which can be obtained from their price list/information sheet.

Jandek, 6 Fellows Avenue, Kingswinford, West Midlands DY6 7ET. Tel: (0384) 298900.

Multi-function Meters

Six new pocket-sized digital multimeters are now available from Cirkit Distribution which offer a combination of facilities previously found only on larger, more expensive, units.

The TM175 series range from the basic TM175A which features d.c. and a.c. voltage ranges, direct current measurement, resistance as well as continuity and diode testing) to the advanced TM175. The top of the range model also measures capacitance from 2nF to 20µF, frequency up to 10MHz, hfe, logic, temperature and I.E.D. test facilities.

The prices for these meters start at under £20.00. For more details, contact:

Cirkit Distribution Ltd., Park Lane, Broxbourne, Herts EN10 7QO. Tel: (0992) 444111.

Special Event Stations

GB6RB: To celebrate the birthday of Robert Burns, this station will be operated by Ayrshire RAYNET from the Land O’ Burns Centre in Alloway on Saturday January 27. The station will be active on 145MHz F.M., 3.5/7MHz ‘phone and 14MHz RTTY, AMTOR and ‘phone.

There is a commemorative A4 size certificate for all contacts and s.w.l. reports. UK stations need to send a second class stamp with their OSL card or s.w.l. report, EEC countries send 1 IRC and other countries 2 IRCs. Send to PO Box 36, Prestwick, Scotland KA9 1AL.

For more information on this station, contact:

GM4SUC, Tel: (0292) 43127.

NEW STYLE PW

SAVE UP TO £3.50 - SUBSCRIPTION RATES HELD UNTIL 31.1.90

If you already have a subscription you can still take advantage of our offer, but you must quote your subscription number.

Please indicate the type of subscription required:

PRACTICAL WIRELESS 1 YEAR

☐ £15.00 (UK) (NEW RATE WILL BE £19.00 AFTER 31.1.90)
☐ £18.00 (Europe) (NEW RATE WILL BE £21.00 AFTER 31.1.90)
☐ £19.00 (Rest of World) (NEW RATE WILL BE £22.00 AFTER 31.1.90)

SHORT WAVE MAGAZINE 1 YEAR

☐ £19.00 (UK)
☐ £21.00 (Europe)
☐ £22.00 (Rest of World)

SPECIAL JOINT SUBSCRIPTION 1 YEAR ONLY

☐ £30.00 (UK) (NEW RATE WILL BE £32.00 AFTER 31.1.90)
☐ £33.00 (Europe) (NEW RATE WILL BE £35.00 AFTER 31.1.90)
☐ £35.00 (Rest of World) (NEW RATE WILL BE £37.00 AFTER 31.1.90)

Prices current at December 1989

Subscription to commence with issue dated

Practical Wireless, January 1990
These new models from ICOM add a new dimension to the mobile scene. Enjoy the freedom of the open road and experience the advantages of simultaneous dual-band operation.

They are capable of receiving on both MAIN and SUB bands at the same time. While operating on one band, you can monitor a second band for activity. It is very easy to switch between the MAIN and SUB bands allowing you to reply immediately to calls received on either bands.

Full duplex operation lets you transmit on one band while receiving on the other for telephone style contacts. Each band can be independently regulated using separate volume and squelch controls.

Both models incorporate 20 memory channels and a call channel for each band, these memory channels store all the information needed for repeater operation.

For 23cms operation the IC-2500 features an AFC function which automatically tunes the receive frequency to the transmit station frequency. The AFC function eliminates the need to retune if a stations transmit frequency is off centre.
IC-751A High Performance HF All-Band Transceiver

- **Amateur Bands**
  - 160m - 10m.

- **General Coverage Receiver**

- **105dB Dynamic Range**

- **100W Output (40w A.M.)**

- **32 Memories**

- **Electronic Keyer**

- **CW Semi/Full Break-in**

- **HM36 Microphone**

The ICOM IC-751A was created for the ham operator who demands high performance whether entering contests, chasing DX or just simply enjoying the shortwave bands. It is an all mode solid state transceiver with a host of features designed for the crowded HF bands of today.

Additional features include 9MHz notch filter, adjustable AGC, noise blanker, RIT and XIT. A receiver pre-amplifier and attenuator provides additional control when required. The FL32 9MHz/500Hz CW filter is fitted as standard with CW sidetone on Rx and TX modes. On SSB the new FL80 2.4KHz high shape factor filter is fitted.

The transmitter is rated for full 100% duty cycle with a high performance compressor for better audio clarity. With 32 memory channels and twin VFO’s, scanning of frequency and memories is possible from the transceiver or the HM36 microphone supplied.

The IC-751A is supplied for 12v operation but can be used with either internal or external A.C. power supply. It is fully compatible with ICOM auto units such as the IC-2KL linear amplifier and the AT500/100 antenna tuners.

Options available:- PS35 internal AC power supply, PS15 external AC power supply, EX310 voice synthesizer, SM8 desk microphone and SP3 external loudspeaker.
Construction

It is all too easy, in these days of the expensive, all-singing, all-dancing Far Eastern black box, to forget that building your own equipment is an excellent way of getting onto the bands. We also tend to forget that power is not always a guarantee of success. Beginning in this issue and using these two ideas, this article, by The Reverend G. C. Dobbs G3RJV, describes a low power 7MHz transmitter. This easily built transmitter, using only a good communications receiver, is an excellent way to put together a first station, or as a compliment to the main station.

The PW Irwell. A QRP CW Transmitter

Amateur Radio is a strange hobby, on the one hand most of the equipment we use these days is commercial, and yet at heart many amateurs would like to be active on the bands with home-built equipment. The excuses for not using home-built equipment usually involve lack of time or lack of expertise. Some are a little more novel. A valve fan recently wrote to me bemoaning the lack of new circuitry for valve equipment. He said with valves he can understand and visualise what they are doing. But added that he had noticed in the RSGB Handbook section on transistors that “silicon is a conductor with no free electrons when pure, but, it can be doped with impurity”. The writer added, “Is this the sort of thing a gentleman would do?”.

This little project brushes aside all such excuses. It is inexpensive and simple to build, uses dependable circuitry and if built with care, should work first time. It is also a project suitable for any gentleman, or lady!

The Irwell is a QRP c.w. transmitter for the 7MHz band capable of 3 or 4 watts of r.f. output. Used alongside a station receiver or the receive portion of a transceiver, it provides a viable little QRP transmitter. Currently there is a lot of QRP c.w. activity on the 7MHz band. Listen around 7.030MHz most days and you will hear a variety of QRP signals, many of them from members of the
G QRP Club. You will find them making contacts all over the UK and Europe, and sometimes more substantial DX contacts.

These circuits are dependable rather than original. Experienced constructors of QRP equipment will recognise the transmit board as the G3RJV favourite transmitter circuit and the v.f.o. board as 'everyones favourite v.f.o. circuit'. All of the components are easy to obtain. The only pieces of test equipment required are an analogue multimeter, a home-made diode r.f. probe and a monitoring receiver or frequency counter.

The Irwell is divided into three sections, each with its own printed circuit board which can be built and tested individually. Although printed circuit boards are shown, and these are available from PW, the circuits could also be built on perforated matrix board.

The Oscillator

The variable frequency oscillator (v.f.o.) is the obvious board to build first. It is perhaps the most difficult board and it is recommended that this be built and tested before the transmitter board is added. I have often heard tales of woe about v.f.o. construction: oscillators that will not oscillate, oscillators that refuse to stay on frequency and oscillators that sound like a sick frog.

The circuit in Fig. 1.1 is a version of the v.f.o. circuit that has become a classic for radio constructors in recent years. It has stood the test of time, being based upon an original insulated gate f.e.t. oscillator circuit described by W2YM in QST of December 1966. This is the Seiler, parallel tuned, form of the Colpitts circuit. A diode is added in the oscillator gate input to provide a degree of automatic bias to aid stability. The two stage buffer amplifier, TR2 and TR3, has negative feedback to reduce the effects in changes of the output on the frequency stability of the oscillator.

Whatever the merits of this circuit, it has proved itself in many variations over the years because it works. If I require a v.f.o., almost without exception, this is the circuit I will use. It seems to combine good frequency stability with a high output. No matter which circuit is used, good frequency stability in a v.f.o. depends largely upon the manner in which the circuit is built and the choice of frequency determining components.

An oscillator must be built in a sturdy and mechanically stable manner, wherever possible in its own screened box. All components must be rigidly mounted and good solder connections are essential. The variable capacitor, C1a, is a good quality air-spaced component. Capacitors C1-4 are part of the frequency determining circuit and low temperature coefficient capacitors are required. Negative temperature coefficient capacitors are often quoted but are almost impossible to obtain and silvered mica capacitors are expensive and often large. In this v.f.o., polystyrene capacitors are used to good effect.

The tuning capacitor, C1a, has a value of 10pF which more than covers the c.w. sector of the band. A Jackson C804 type is ideal if expensive, but a surplus air-spaced variable capacitor, if it is of good quality, will also be suitable. I used a surplus capacitor in the prototype which had a nominal value of around 30pF and carefully pulled off vanes until I obtained the required v.f.o. coverage. The inductor L1 consists of 25 turns 0.4mm enamelled copper wire close wound on a standard 4.8mm

Fig. 1.2

Practical Wireless, January 1990
The completed
Irwell

The v.f.o. is built on a single printed circuit board as shown in Fig. 1.2. It is not a compact layout because v.f.o. circuits are usually more stable if the layout is not crowded and the interconnection tracks are well separated. Both the component layout, and track pattern are shown in the drawings. The board fits nicely into the inexpensive Miniford Engineering Box type A8. The variable capacitor is secured on an aluminium L shaped bracket which allows a small 6:1 epicyclic inline drive to be fitted inside the box. Avoid using the cheaper friction slow motion drives which are prone to backlash. The drive has to be accurately aligned with the capacitor shaft to prevent binding. In doubt slot the holes for adjustment and tighten when in position - I always do that!

The v.f.o. cut-off control, R9, is not mounted inside the box. The back of the box has two 1000pF feed-through capacitors for the two supply lines and a non-capacitive feed-through for the output. Do not confuse them... I know of more than one constructor who has used a feedthrough capacitor for the output and wondered where the v.f.o. signal had gone....the capacitor had decoupled it to ground of course!

The coil former for LI is mounted vertically by pushing its base into a tight fitting hole drilled in the board. The earthy end of its winding is soldered directly to the board. The top end of the winding is secured to a stiff tinned copper wire, of 1.0mm diameter or larger, which connects between C2 and the fixed vanes of C1a. Another similar wire connects the moving vanes of C1a to the ground of the printed circuit board. Capacitor C1 is also soldered between these two wires.

Testing of the v.f.o. is simple, if a frequency counter is available, connect a short length of wire to the output and wonder where the v.f.o. signal had gone....the capacitor had decoupled it to ground of course!

Testing of the v.f.o. is simple, if a frequency counter is available, connect a short length of wire to the output and listen for the signal on a receiver tuned to the 7MHz band. After carefully checking the component positioning and wiring, connect both power inputs to a low power 12 volts supply. Close the vanes of C1a, then the core of L1 may be gently rotated until the signal is heard at 7MHz, or displayed on the counter. The frequency will shift after the lid is added to the box, so cut a hole in the box lid in line with the core of L1 to enable adjustments to be completed once the lid is in place.

Shown in Fig. 1.3 is the circuit of a simple r.f. probe which may be used to align the transmitter board, but it can also be used to check the output of the v.f.o. Using this probe and a 20kΩ per volt multimeter the output from the prototype v.f.o. read about 0.6V.

This concludes building the v.f.o. Part Two will continue with the transmit amplifier and changeover board.

PW

Practical Wireless, January 1990
January 27: The Lancastrian Rally will be held at the University of Lancaster. Sue Griffin G1OHH. Tel: (0524) 64239.

February 24: The Rainham Radio Club 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 on G84RRR 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 SU22. Terry G6VEG. Tel: 091-264 8196.

March 9-10: There will be an amateur radio show at Picketts Lock Centre, Picketts Lock Lane, Edmonton, London N9. Details from: London Amateur Radio Show, 126 Mount Pleasant Lane, Brickell Wood, Herts AL2 3XO.

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, south-west of Birmingham. Rally opens at 11am. There will be three halls plus a marquee, the usual trade stands, flea market, a large Bring & Buy, bar and snacks with talk-in on S22. Admission 50p.

April 15: The Centre of England Amateur Radio Rally will be held at the Motorcycle Museum, Bickenhill, near the NEC, Birmingham. It’s being held in three of the large exhibition halls and free ample parking. Frank Martin GA4UMF. Tel: (0977) 704067.

April 21-22: The RSGB are holding their Convention and Exhibition at the NEC, Birmingham.

May 13: The VHF Convention and Exhibition at the NEC, Birmingham.

 HOW MUCH ? HOW DIFFICULT 
 Intermediate 

Resistors

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Electrolytic 16V radial lead: 4.7μF C17

Miscellaneous

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Coils and inductors

L1 26.0 4mm (28 s.w.g.) enamelled (e.c.) wire on former with core, see text.
L2 40.0 tapped at 20.0 4mm (e.c.) on T50-2 toroidal core.
L3 40.0 tapped at 20.0 4mm (e.c.) wire. on T50-2 toroidal core.
L4 40.0 tapped at 20.0 4mm (e.c.) wire.
L5 40.0 tapped at 20.0 4mm (e.c.) wire.
L6 18.0 4mm (e.c.) wound on a T37-2 toroidal core.
L7 21.0 4mm (e.c.) wound on a T37-2 toroidal core.
L8 18.0 4mm (e.c.) wound on a T37-2 toroidal core.
RFC1 1mH fixed inductor (Cirkit 7BS series suitable).
RFC2 10.0 25mm (32 s.w.g.) e.c. wire on a ferrite bead (Cirkit 26-43000101 type suitable).

How Much? How Difficult Intermediate
HAPPY NEW YEAR FROM RAYCOM!
FREE CELLULAR CAR TELEPHONE ON ALL PURCHASES
SUBJECT TO RACAL AIRTIME LICENCE APPROVAL - FITTING EXTRA £39+VAT ON MOST CARS

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 automatic 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 RRP!)

£299.00 .. save £39.90

COBRA SR-925

With coverage from 29-512MHz (with gaps), 16 memory channels, 2-speed search, high sensitivity (0.3 mV) and 1 watt of audio this scanner is ideal for beginner and enthusiast alike! Raycom adds £30 worth of free antenna, cable, plugs and sockets and drops the price to just £77 deposit and monthly payments of just £16! Why wait, send for written details now!

£159.99 .. save £30.00

ICOM IC-725

ICOM's latest addition to the family, the 725 gives a full 100 watts of multi-mode power and the second rig to use the DDS (Direct Digital Synthesizer) system. 10 Hz steps for smooth tuning, auto squelch and 10 memories, and many 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 Y2-sized antenna .................................. £14.95
Fist mic .................................................. £21.00
Total regular price ....................................... £964.94
Raycom package price ................................... £849.00

SAVE £116!

Raycom Credit Card is available on this pack, just £35 deposit and monthly payments of just £21. Why wait, send for written details now!

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 £39.95 - 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 - just £36 deposit and £36 per month!

£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 ........................... £14.95
Total regular price ....................................... £513.85
Raycom package price ................................... £479.00

SAVE £35!

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

ICOM IC-3250

An accessory bundle that gives you more power, more memory and the most advanced input monitor yet. The IC-3250 is the second rig to use the DDS (Direct Digital Synthesizer) system. 10 Hz steps for smooth tuning, all mode squelch, 26 memories and many 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-3250 .................................................. £749.00
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G5RV 1/2-sized antenna ................................ £14.95
Fist mic .................................................. £21.00
Total regular price ....................................... £873.94
Raycom package price ................................... £749.00

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Raycom Credit Card is available on this pack, just £35 deposit and monthly payments of just £21. Why wait, send for written details now!

ICOM IC-3250

An accessory bundle that gives you more power, more memory and the most advanced input monitor yet. The IC-3250 is the second rig to use the DDS (Direct Digital Synthesizer) system. 10 Hz steps for smooth tuning, all mode squelch, 26 memories and many 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-3250 .................................................. £749.00
FM TX/RX (AM RX) board ................................ £40.00
20 Amp PSU ........................................... £129.99
G5RV 1/2-sized antenna ................................ £14.95
Fist mic .................................................. £21.00
Total regular price ....................................... £873.94
Raycom package price ................................... £749.00

SAVE £135!

Raycom Credit Card is available on this pack, just £77 deposit and monthly payments of just £21. Why wait, send for written details now!

ICOM IC-7000

An accessory bundle that gives you more power, more memory and the most advanced input monitor yet. The IC-7000 is the second rig to use the DDS (Direct Digital Synthesizer) system. 10 Hz steps for smooth tuning, all mode squelch, 26 memories and many 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-7000 .................................................. £749.00
FM TX/RX (AM RX) board ................................ £40.00
20 Amp PSU ........................................... £129.99
G5RV 1/2-sized antenna ................................ £14.95
Fist mic .................................................. £21.00
Total regular price ....................................... £873.94
Raycom package price ................................... £749.00

SAVE £135!

Raycom Credit Card is available on this pack, just £77 deposit and monthly payments of just £21. Why wait, send for written details now!

YAESU FT-470

Yaesu's new dual bander is ex-stock at last and packed with features - dual display, dual band monitor, 4 VFO's and 42 memories, power savers, auto power off, CTCSS, DTMF autodial and a wide range of options - SAE for information sheet.

Regular retail prices:
FT-470 .................................................. £389.00
FNB-11 nicad 7.2V, 600mAh ................................ £34.50
Wall charger ........................................... £17.71
Soft carry case ........................................ £10.58
Broadband mag-mount antenna ........................ £14.95
Model 411 ............................................. £59.00
Total regular price ....................................... £466.74
Raycom package price ................................... £425.00

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!
RAYCOM EXCLUSIVE ACCESSORIES AND UPGRADES

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 460 MHz) 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 SAE for an information leaflet.

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!

R1312 - 13.8 Volts at 12 Amps

25 Watt Transceiver Rated

Designed for business and amateur radio use, these conservatively rated units make an ideal match for a 25/35 watt base or mobile unit requiring 8 amps continuous or up to 15 amps surge. Utilising full spec. Motorola devices these units are individually tested under maximum load conditions and are designed and manufactured in Britain exclusively for Raycom.

- 13.8 volt fully regulated
- 8A continuous, 12A 40% TX/RX, 15A surge
- Overvoltage and short circuit protected

R1312 13.8V 12 amp PSU £59.50 inc. VAT
R1320 13.8V 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

HR1300 discone .................. £59.50

BB-145S

Broadband MagnMount

Another exclusive Raycom import, the BB-145S is a broadband ¼ wave mag mount antenna for mobile scanners and 2 metre transceivers. Supplied complete with 4 metres of quality coax and PL259 plug, this easily installed antenna is compact in size due to the integral loading coil and is specified for 138-172 MHz, but often loads at 70 cms!

BB-145S magmount ................. £14.95

Practical Wireless, January 1990
By popular demand, we bring back those two unloved characters "Bern & Bren". Bernie has been in hiding due to the many contracts out on him & Brenda has been to Brazil rounding up the coffee beans!

CHRISTMAS GREETINGS AND A VERY HAPPY NEW YEAR FROM ALL AT A.R.E.

Brenda and Bernie wish all friends and customers seasonal greetings and hope to meet as many as possible during the coming year.

We, of course, will continue with our policy of importing amateur radio equipment from Japan at the best possible prices and pass on the savings to the amateur. Needless to say, all our imports are guaranteed and a good stock of spares are available. We import Kenwood, Standard and Yaesu but our Icom equipment is supplied by Icom U.K. since their prices and service cannot be bettered abroad.

A.R.E. will be close from mid-day Friday 22nd December and will re-open at 9.30 Wednesday 3rd January, 1990.

Opening Hours Monday-Friday 9.30 to 5.30
NOW OPEN SATURDAY MORNINGS 10.00-1pm

BUY THE BEST — BUY

CAPACITORS, ROLLER COASTERS AND BALUNs
BUILD YOUR OWN A.T.U. FOR £66.10
CAP-255 £17.90
CAP-25T £21.80
R/COAST £26.40 + £4.50 p&p
BUILD YOUR OWN LOOP WITH OUR NEW CAPACITOR AND MOTOR ASSEMBLY 60, 40, 30 £99.50
10, 12, 15, 17, 20 £55.15 + £3.00 p&p

FEATURES OF LOOP ANTENNAS
- It has a very high Q
- It has a resistance from 300 millohms to never more than 0.8 of an ohm
- Has a bandwidth from 3kHz to 50kHz
- Has an SWR of 1.1 to 1 for low bands
- Will operate at extremely high level
- The loop has a vertically polarized radiation pattern containing both very high and very low angle radiation (ideal as a DX antenna)
- Does not require an A.T.T.Unit
- Depending on the model used it only occupies from 80cm 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 £65.50 + £30.00 p&p
THIS OFFER INCLUDES CONTROL BOX, CLAMPS AND CABLES.
Radio Personality

A Personal Message To
The World Of Amateur
Radio Communications
From HRH King
Hussein JY1

Amman
28 October, 1989

My involvement in Amateur Radio goes back to the early sixties. I look at Amateur Radio as a means of self-education in many fields apart, from the field of Communications. I learnt more about different parts of the world through the many fellow Radio Hams I came into contact with.

It has long been my belief that only through communication can people know each other and eventually come to understand the different peoples which is one important step towards attaining world peace.

I would like to mention that a great service is provided by Radio Hams especially during emergencies and natural disasters when they provide help to people in need throughout the world.

A Radio Ham should never hesitate to pick up the mic, listen carefully, never mind if the signal is weak, and to spend the time and the effort to lend a hand to someone who is in need of help.

God bless you all.

73s

JY1

Feature

Our hobby attracts people from all walks of life. In coming months the Personality Profile will feature many more enthusiasts from the wide world of radio and electronics.
Droitwich... Engraved on the Dial

The BBC Long Wave Radio 4 transmitter located at Wychbold, near Droitwich in Hereford and Worcester, is a prime example of a station whose name has been engraved on the dial for generations and has been re-equipped to provide many more years service to the nation.

Droitwich entered service on Thursday 6 September 1934. Surprisingly, when the importance of the station is considered, the 150kW transmitters were started up by the briefest and most informal ceremony of all, a wave of the hand from Admiral Sir Charles Carpendale, the Controller of the BBC. The first programme broadcast by the station began with The BBC Orchestral led by Lawrence Turner and conducted by Aylmer Buest playing Eric Coates The Merry-makers.

The first day's duty for the transmitter only involved the half-hour programme in the afternoon followed by another in the evening. However, the 150 press-men, who had completed their journey to the then rather rural surroundings by Midland Red bus, had witnessed the baptism of a transmitter which went on, and has continued to provide outstanding service for the BBC and listeners in Britain and Europe.

By October 7 the new transmitter had taken over the entire National Programme from the Daventry transmitter and the latter was then used for the important Empire Service.

Work to test the suitability of the Wychbold site had begun as far back as 1932. Geographical location, plus the proximity of the Worcestershire salt-mines, played an important part in the decision to choose the site, some 26km south of Birmingham. The aim from the beginning was to provide a national service on long waves and the transmitter and associated equipment were set many precedents for the BBC.

Tallest Masts

The twin 215m stayed-lattice masts were considerably taller than the previously highest BBC mast of 153m, and are still in service. Power supply engineering at the new station also broke much new ground, in that the diesel-driven generators provided a.c. rather than d.c.

Until the public electricity supply reached the station in mid-1940, the station was powered entirely by four 750h.p. diesel engines, mounted on a 900-tonne concrete block floating on cork to reduce vibration. Each generator was coupled directly into a 470kW 3-phase alternator set. The alternator outputs were at 415V and the h.t. supplies for the transmitters were obtained from mercury-arc evacuated steel tank rectifiers. Transmitter filament supplies were obtained from specially isolated motor-generator sets to ensure safety, as each valve filament could be as high as 20kV above earth potential.

The main building housing the transmitter, which was designed by the Marconi Company in close cooperation with BBC engineering staff, is seen as being very much in the 1930s style by interested modern motorists as they drive by on the nearby M5 motorway. The square-edged, flat-roofed, building with tall windows and long hallways is very much of its period and even now, some 55 years on, the buildings and transmitting masts can be an awe-inspiring to those who drive by, especially if they happen to be listening to Radio 4 as they do so!

Droitwich also had regional programme service duties. The original method of providing the extra antenna was by running the necessary wire up one of the two long wave supporting masts. As these masts were so high, the BBC equipped them with electrically powered lifts, the first time that such an installation had been provided as an aid towards maintenance.

Several interesting problems arose during the design of the station. For example, it was necessary to produce a good response characteristic from the long wave antenna, which had an asymmetrical impedance characteristic at the driving point. A solution was found by placing a suitably designed matching network between the transmitter and the feeder to the antenna. The network enabled a substantially flat frequency response to be provided for modulating frequencies between 30Hz and 8kHz.

The transmitter required six valves in the output stage, four working and two spare. It was necessary to use valves capable of dissipating approximately 120kW, but none were available when the station was planned!

New Valve Type

This problem was solved by the Marconi-Osram Valve Co which designed the type CAT14 valve, requiring anode potentials of 20kV. It was decided to use series modulation in the penultimate r.f. stage of this transmitter but this provided another problem in that a specially designed filament-supply motor-generator sets were required as the valve filament supplies were up 20kV above earth.

The especially designed output valves for the new transmitter required a new approach for the e.h.t. supply. This was solved by using mercury-arc rectifiers. Teething problems caused by the evacuated steel tank mercury arc rectifiers
backfiring (more than one anode striking at one time) causing a loss of supply, became so severe at one stage that a temporary thermionic rectifier was installed to supply the 30A 20kV h.t. until a solution was found.

The Droitwich building itself was a departure from normal BBC practice in that the transmitter hall was built with two storeys. The water-cooled valves had to be supplied with cooling water through long hoses to provide enough insulation against the unusually high anode voltage.

Transmitter units were installed on the first floor, with their hose coils mounted on the ground floor in the lower parts of the units, which also housed the coils and capacitors associated with the anode circuits and the transducers. The ground floor also accommodated the rotating machinery supplying the filament power, auxiliary h.t. and grid-bias to both regional and national transmitters. All these machines were operated remotely from a large control desk on the first floor.

A 50kW medium wave transmitter was installed later and entered service carrying the Midland regional programme on 17 February 1935, replacing the Daventry transmitter. The regional transmitter used a directional antenna system suspended from triatics on one of the main long wave masts. The radiation pattern was adjusted to increase the signal strength in the Birmingham area and the north Midlands generally.

Preparations for War

War in Europe was now approaching fast and the BBC were planning ahead, trying to envisage every conceivable situation. The Corporation had to plan to provide a service to the nation in the event of hostilities, and at the same time deny the enemy incidental direction finding facilities from individual transmitters.

How the BBC, with valuable help from the GPO Dollis Hill laboratories in London, overcame this problem along with the wartime precautions and preparations, make very interesting reading. For those wishing to learn more on this fascinating aspect of radio broadcasting history I recommend Edward Pawley's book BBC Engineering 1922-72. Although long out of print, most reference libraries will be able to locate a copy of the book for those interested.

Unfortunately, the Air Ministry would not allow the Droitwich long wave high power transmitter, with its nationwide coverage, to work in wartime. The lack of other high power long wave transmitters elsewhere in the UK to act as 'spoilers', to stop the station from being used as a radio beacon by enemy aircraft, brought this situation about. It was accepted, however, that the transmitter could be used exceptionally for the radiation of urgent navigational warnings issued by the Admiralty.

Wartime Role

Droitwich did not fall silent during the war years, but ended up being converted to medium wave service for the duration and played an important role for the rest of the war. At the beginning of hostilities, the term Overseas Service had replaced Empire Service and the Overseas and European together constituted the External Services. When the plans for wartime broadcasting were put into effect, the frequency of 1149kHz was used during the hours of darkness for the European Service transmissions.

Wartime Role

At first, three 50kW regional transmitters located at Brookmans Park, Moorside Edge and Westerglen - were synchronised on this frequency, but on October 7 the Droitwich transmitter (converted from long waves) with its power output increased to 200kW joined the group. Another regional transmitter, located at Washford, joined this network on 5 November 1939.

Successful experiments with horizontal polarisation at the BBC’s Star Point transmitter in Devon, led to the erection of a horizontal dipole antenna at Droitwich for the 1149kHz transmissions. This antenna was brought into service on 17 February 1940, and during the hours of darkness the 1149kHz transmitter at Droitwich radiated alone.

When France fell in June 1940, there was an urgent need to increase the power of the existing European service transmissions and to carry them on more frequencies to reduce the chance of enemy jamming. The most ambitious project associated with this requirement was the installation of a transmitter at Droitwich with, for those days, the exceptionally high output power of 400kW on medium wave.

There was neither the time or manpower available to design a single transmitter of this advanced type. It was decided to install two 150kW transmitters then under construction by the Marconi Company and attempt to operate them in parallel. For the Droitwich application their output power was increased to 200kW, with a slight increase in distortion. Operating transmitters in this way was an innovation which was to have far-reaching effects in later years. The new high power transmitters were installed on the main site in an austere, separate two-storey building, and became known as HPMW.
The impressive facade of Droitwich Transmitter Station dwarfed by the twin 215m masts and dramatised by a wide-angle lens
BBC Photograph

Peace Returns

With peace in Europe once again, Droitwich was again playing its important role in the national and external services of the BBC. The station radiated the Light Programme until 1978, when the old names were replaced with the now familiar Radio 1, 2, 3 and 4. Radio 4 was then transmitted on long wave as the new all-UK service. Three transmitters provided national coverage on 200kHz, with Westerglen in Central Scotland and Burghead near Inverness in the Scottish Highlands providing coverage for the northern part of Britain.

Synchronisation of the carrier frequencies for the three transmitters was operated for some years, following the introduction of the UK-wide Radio 4 service. The engineering department of the BBC arranged that the nulls caused by the cancellation of the carrier waves from the separate transmitters were located in the region of Hadrian’s Wall in Northumberland! The nearest large centres of population, Carlisle and Newcastle, being provided with medium wave relay stations to fill any gap in the service.

Today, although Radio 4 is not a 24-hour service, the modern 500kW Droitwich transmitter is on-air around the clock. For insomniacs, and the many listeners abroad, the BBC World Service from the Droitwich transmitter is on 198kHz from around 0045 to 0545UTC. It moved to this frequency from 200kHz in accordance with the WARC long wave bandplan changes in February 1988.

Celebrations

On 6 September 1984, the BBC commemorated the 50th anniversary of the start of broadcasts from Droitwich by holding a special dinner in the transmitter hall. Derek East, the BBC’s Chief Engineer Transmission, who presided at the dinner with Engineer in Charge Arthur Morris, invited the Mayor and Mayoress Droitwich as the guests of honour.

Derek East summed up the feelings of many during the dinner by saying, “In the 30s Droitwich was a name on the listener’s radio dials. They knew the name Droitwich for its radio service as well for its spa. Numbers like Radios 1, 2, 3 and 4 do not have the same personality, but Droitwich continues as an honoured name in the transmitter world”. He went on to say, “This anniversary is especially appropriate at this time when we are installing only the second replacement transmitter since 1934. All three transmitters have been supplied by Marconi, indicating the long term association the BBC has had with British industry. Technology has not stood still and this latest transmitter will use a new modulation system and has a conversion efficiency of some 70 per cent. This compares with the 30 per cent for the old transmitter...a significant saving in power costs”.

Such was the situation in 1984. But what lies in the future for long-wave broadcasting? Will the advent of the newly commissioned commercial long wave service, jointly operated by RTE and Radio Luxembourg in the Irish Republic, bring new life to an old service? Time only will tell, but for I.f. broadcasting enthusiasts and those who travel abroad, a quote from the BBC Engineering Information Service will be of some comfort.

“Regarding the future of long wave broadcasting, because of the absence of interference from other transmitters and the nationwide coverage possible with just three transmitters, its future in the BBC is assured.” Hopefully Droitwich will always be engraved on the dial and liquid crystal displays of the future!

Droitwich Control Room in February 1935 showing motor-generators and split-level building
BBC Photograph

36 Practical Wireless, January 1990
Testing! Testing! Testing!

Professional Equipment
At Amateur Prices

1 GHz Universal Counter Timer

This high quality, 10Hz to 1GHz multiple function counter has an 8-digit, high brightness, 7-segment LED display and a high stability crystal oscillator for maximum accuracy. The meter has six function switches — 3 Frequency Modes, Period, Totalise and Check Modes. A HOLD switch allows you to halt the display whilst the count continues. The unit has heavy-duty rubber feet and a fold-away tilt stand. Supplied with a 2m mains lead, a 1m lead with a BNC plug at one end and red and black crocodile clips at the other, plus a comprehensive operator’s manual.

20MHz Triple-Trace Oscilloscope

A precision laboratory 3 channel — 3 trace oscilloscope packed with features you’d expect to pay TWICE the price for:
* Sensitive vertical amplifier 1mV/div allows very low level signals to be easily observed
* 150mm rectangular CRT has internal graticule to eliminate parallax error
* X-Y mode allows Lissajous patterns to be produced and phase shift measured
* TV sync separator allows measurement of video signals
* 20ns/div sweep rate makes fast signals observable
* Algebraic operation allows sum or difference of Channel 1 and 2 to be displayed
* Stable triggering of both channels even with different frequencies is easy to achieve
* 50mV/div output from Ch 1 available to drive external instrument e.g. frequency counter
* Hold-Off function permits triggering of complex signals and periodic pulse waveforms

Multipurpose Dip Meter

A multipurpose transistor dip meter covering the range 1.5MHz to 250MHz in six overlapping ranges. This unit can be used as a dip meter or absorption wavemeter and an audio signal output is also provided for connection to a crystal earpiece. Battery check function. Supplied with a comprehensive operator’s manual.

Co-Axial Cable Stripper

This handy stripper tool will quickly become indispensable. Removes the inner and outer sheath of co-axial cables simultaneously and will accommodate cables from 4mm to 7mm diameter.

Maplin ELECTRONICS

Credit Card HOTLINE

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Phone before 5pm for same day despatch

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Send this coupon to P.O. Box 3, Rayleigh, Essex SS6 8LR

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Practical Wireless, January 1990
Rumours have abounded for some months that Kenwood were once again about to take the HF transceiver market by the throat, and with the announcement of the TS-950S those predictions have proved to be true. It is an undisputed fact that Kenwood HF transceivers have always led the way, and it seemed almost impossible for their design team to make significant advances on the success of the TS-940S. — but they have.

We don't have to tell you that the receiver performance is outstanding; a noise floor of -140 dBm will do that. Nor do we have to mention the ease of use; Kenwood has an enviable reputation in this area. What we must give a few hints about are some of the new operating aids which Kenwood have included, such as a dual receiver which allows you to listen up to 500 kHz away from your operating frequency — even during transmitting; such as the revolutionary digital signal processing option which gives improvements of up to 10 dB in carrier and unwanted sideband suppression; variable transmit bandwidth; adjustable rise time of the CW envelope; and much more.

The photograph and this brief text can only give a hint of what the TS-950S can deliver — the full story can only be told by a visit to your Kenwood approved dealer or a browse through some detailed literature, but take it from me that once again, Kenwood have shown the way forward in HF transceiver design.

TS950SD Includes DSP-10, SO-2, YG455C1, YG455CN-1, YG455S-1 and YK88C-1, (with integral Auto ATU). £3199.00
TS950S Transceiver with integral Auto ATU. £2499.00
DSP-10 Digital signal processor unit £399.00
SM230 Station monitor with Pan Display £773.00
SO-2 High stability TCXO £99.00
SP950 External speaker £87.55
YG455S-1 Extra SSB filter £112.57

LOWE ELECTRONICS LTD.
Chesterfield Road, Matlock, Derbyshire DE4 5LE Telephone 0629 580800 (4 lines)
Sole Appointed UK Distributor for KENWOOD Amateur Radio
The new series of FM mobiles from Kenwood really do have more of everything; more power (50W on 2 metres), with three power levels (50W, 10W, 5W); more usable sensitivity (better than 0.16 microvolts for 12dB SINAD); more channel spacings (5, 10, 12.5, 15, 20, 25 kHz); more flexibility using the RC-20 controller and IF-20 interface (up to 4 transceivers from one controller); more memories (20 multi function); and even more bands, because the full range consists of the TM-231E for 2 metres, the TM-431E for 70 centimetres, the TM-531E for 23 centimetres, and finally the TM-701E for dual band 2/70 FM.

Every function that you could ever want is included in the specification - there is even an optional digital speech store which will store received or transmitted messages of up to 32 seconds, allowing the operator to quickly check or return any call. Even the microphone has been designed to give you full control of the transceiver from one hand, with tone burst, memory recall, VFO recall, and UP/DOWN functions provided; but the UP/DOWN is not just operating frequency but memory channel number and even the frequency of the built in sub-audible tone encoder.

There is even a fourth button on the microphone which can be user programmed to select MHz steps, or repeater shift, or reverse repeater, or digital record selection, or low power; all as you wish. Extremely comprehensive and easy to use in the Kenwood manner.

This exciting new range of FM mobiles from Kenwood is now available at your approved Kenwood dealer. Try them out; you will not be disappointed, particularly with the prices. As I said “More of everything, except cost”.

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<td>TM-701E</td>
<td>(2/70)</td>
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OUR COMPLETE LINE OF PORTABLE POWER TOOLS.

When you’re talking Yaesu handhelds, power takes on many meanings.
Like maximum RF output. Sophisticated microprocessor control. Deceptively simple operation. Even cost savings—as most accessories are interchangeable throughout the line.
Added up, it’s no wonder amateurs choose Yaesu HTs more than any others.

FT-470. DUAL-BAND OPERATION PERFECTED.

FT-411 SERIES. MAXIMUM SINGLEBAND PERFORMANCE.

FT-23R SERIES. SMALL, SMART, RUGGED.
Want more information? Call (0703) 255111
Or call into your local authorised Yaesu dealer and ask about the FT-470, FT-411 and FT-23R Series handhelds. The power in handheld performance.

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.

Prices and specifications subject to change without notice.
PW 49'er In-car Short Wave Converter

The car radio has for too long been overlooked as a useful piece of equipment for the radio constructor. However, by virtue of the fact that they are designed to work in an environment filled with electrical interference, most receivers of this type are built in a well screened case. This makes them ideal for use as a tuneable i.f. for use with receive converters. All the hard work is done for you, the radio alignment, audio amplifier, etc. All you need to supply is a 12V d.c. power source and a loudspeaker. This project is designed primarily to make additional use of the car radio and provide a very useful facility, that of being able to receive one of the most popular short wave broadcast bands.

The ‘49’er’ will prove to be of great value to anyone touring abroad by car, as the BBC World Service in English can be heard all over Europe on the 6MHz band. Additionally, the English service of Radio Netherlands from Hilversum provides an excellent range of programmes for the listener.

When the reception of short wave broadcasts is not required, a built-in switch restores reception of medium waves again and also disconnects the internal 9V supply to the unit.

**How it Works**

A block diagram of the converter, which is designed around the ubiquitous SBL1 double-balanced mixer, is shown in Fig. 1 and the circuit diagram for the unit is displayed in Fig. 2. Signals picked up by the car antenna appear at the input of the unit via SK1. You will also note that the signal path is fed via S1c to one contact on S1a, this is to provide a by-pass route for the antenna when the converter is not in use. The other set of contacts on S1b are used to remove the supply from the converter when it is being by-passed. Thus, with the converter switched off, the car radio antenna is connected as usual directly to the radio for normal l.w., m.w. and f.m. reception, if your set is so equipped.

With the converter switched on, L1 tunes the car antenna electrically to resonance on the 6MHz band. The signals are then coupled to TR1 via T1 where they are amplified approximately 10dB by a single gate f.e.t configured in common gate mode. From this stage, the signals are matched by T2 in to the 50Ω port of an SBL1 double-balanced mixer assembly (X1).

The local oscillator signal is provided by a crystal oscillator operating at 5MHz. The oscillator is trimmed into resonance by C5 and L2. The output of the oscillator is matched to X1 via L3 which provides the necessary low impedance to drive X1.

A signal in the 49 metre band (f5) minus the local oscillator frequency (fO) produces two intermediate frequency (f5 + fo) and (f5 - fo). The latter falls in the passband of the car radio when it is switched to medium wave reception.

**Construction**

The component layout and double sided track patterns of the p.c.b. are shown in Fig. 3. The board is made from copper clad, glass fibre material. The upper surface is used as a ground plane. All holes, other than those used for earthing pins 2, 5, 6 and 7 of mixer X1, crystal XL1 and some pins T1 and T2, should be cleared to prevent a short circuit when the components are mounted on the board. This may be done by using a drill bit to countersink the upper copper surface.

When the board has been prepared, first solder in the resistors, followed by the capacitors. Note that C2, C3 and C4 have one lead bent to facilitate soldering to the ground-plane. Care should be taken to bend the leads by using fine nosed pliers.

Next, the coils L1, T1 and T2 should be inserted, followed by L2/L3, C6, Mixer X1 and finally the two semiconductors TR1 and TR2. Three Veropins are used to provide easy connections to the board when fitted inside the die-cast box which houses the converter. Inductor L2 is wound around the circumference of the toroid leaving a small gap to accommodate the winding of L3.

Finally, check for any solder bridges and mount the unit in the die-cast box. I used an input socket as an antenna match.
Resistors
- 0.25W 5% Carbon film
- 22Ω 1 R1
- 27Ω 1 R5
- 470Ω 1 R3
- 4.7kΩ 1 R2
- 10kΩ 1 R4

Capacitors
- Miniature ceramic plate
  - 15pF 1 C1
  - 82pF 1 C5
  - 100pF 1 C3
  - 270pF 1 C4
- Monolithic ceramic
  - 0.1µF 1 C2
- Miniature foil trimmer
  - 2.36pF 1 C6

Inductors
- L1 Toko KANK 3333R
- L2 25 turns 24 s.w.g.(e.c.w.)
- L3 3 turns 24 s.w.g (e.c.w.)
- L2 and L3 wound on a single T50-2 toroidal core

Transformer
- T1 Toko KANK 3334R
- T2 Toko KANK 3333R

Semiconductors
- BF244 1 TR1
- 2N2222A 1 TR2

Miscellaneous
- X1 SBL1 block mixer; PL1 car radio type coaxial plug; SK1 chassis mounted socket to match PL1; die-cast box approx. 120 x 95 x 38mm; PP3 Battery clip; S1 3-pole 2-way slide switch (or 4-pole 2-way); rubber grommet; 500mm of low-loss 75Ω coaxial cable; p.c.b.; 4 off 6BA countersunk machine screws; 2 off 0.25in brass spacers; 4 off 6BA nuts; 2 off 6BA solder tags; connecting wire; XL1 5MHz HC-18/U crystal.

Inductors & mixer are available from:
- Cirkit Distribution Limited.
  - Park Lane,
  - Broxbourne,
  - Herts EN10 7NQ.
  - Tel: (0992) 441306.

Car radio coaxial connectors are available from:
- Maplin Electronic Supplies Ltd.
  - PO Box 3,
  - Rayleigh,
  - Essex SS6 8LR.
  - Tel: (0702) 552911.

Crystal XL1 is available from:
- Cricklewood Electronics Ltd.
  - 40 Cricklewood Broadway,
  - London NW2 3ET.
  - Tel: 01-452 0161
Normally found on car radios. Similarly, PL1 on the flying lead that connects the converter to the car radio is of a matching pattern. Connectors of this type can be obtained from scrap car antennas or from sources such as Maplin Electronics or car accessory shops.

All r.f. routes within the box should be made in miniature coaxial cable. A solder tag clamped by one of the screws holding S1 can be used as an earth come anchor point for the screen of the flying lead which connects the converter to the car radio. The converter draws approximately 15mA from an internal PP3 battery (B1), which in the prototype was secured to the die-cast box by a small piece of double-sided sticky tape. This method of mounting also prevents vibration between the case and the battery when the converter is used in the vehicle.

Alignment

Once the converter has been installed in the enclosure and the connections to the board have been made, disconnect the antenna lead from the car radio and insert it into SK1 on the converter. Then you should connect the output lead of the converter with its plug PL1 directly into the car radio antenna socket. Switch the car radio on and the converter off. The radio should function normally. If it does not, then there is a wiring fault on S1. If all is well, you should then tune the car radio to 1089kHz (Radio 1 to the less initiated...!). If all is well, switch on the converter. If nothing is heard, set T1 and T2 so that their cores are 2 to 3mm below the tops of the screening can. Now adjust C6 until a signal is heard. This signal should be Radio Luxembourg on 6090kHz which is audible almost continuously through the day and night. Once you have the signal, peak L1 for the loudest setting, then find a weaker station by tuning the car radio and peak L1, T1 and T2 for maximum strength. That completes the alignment, all you have to do now is to screw on the lid and find a suitable mounting location for the converter in the car. Happy listening you lucky Forty Niners!

PW

Practical Wireless, January 1990
Anouncing the NEW TS950S/SD HF Transceiver from Kenwood

Features of the TS950SSD
- Clearly the TS-950S is an all band, all mode (USB/LSB/AM/SFM/FSK) HF transceiver, incorporating a general coverage receiver (100kHz to 30MHz)
- A major operating feature is the inclusion of a second receiver system designated the "Sub Receiver" which allows the operator to receive signals within ±500kHz of the current operating frequency. The sub receiver has its own independent display, IF system, tuning control, frequency increment selection, noise blanker, noise blanker level control, and AF gain control.
- The sub receiver remains silently whilst transmitting on the main VFO.
- The DSP-10 Digital Signal Processor. The initial supplies of the TS-950S will have the DSP-10 factory fitted, although purchasers of the later shipments of TS-950S will be able to fit the DSP-10 should they subsequently wish to. The DSP-10 gives significant improvements in receiver performance, and is the first unit of its type to be fitted to amateur radio equipment. The performance advantages are summarised as follows:
- Digital processing provides improvements in receiver and transmitter performance in the areas of spurious response and unwanted sideband suppression. Carrier and unwanted sideband suppression are improved by 10dB compared to the standard TS-950S.
- Digital signal processing allows for the first time the facility for an operator to select one of four audio bandwidths on the transmitted signal. The digital filtering gives flat in band response with extremely sharp out of band rejection, and without signal distortion.
- CW operation without key clicks. The use of digital filtering results in a keyed waveform free from the key clicks generated by analogue methods. The operator can select fast or slow rise time on the keyed waveform to suit band conditions of his own preference.
- A new DCO (Data Control Oscillator) provides an extremely accurate and clean FSK transmission.
- On receive, the digital signal processing is synchronised with the operation of the SSB IF slope tuning so that the audio bandwidth always exactly matches the receiver if response.
- TMW transmit power output.
- The TS950SSD PA uses devices running from a 50 volt supply rail. This not only gives 150 watts RF output, but materially improves the 3rd order IMD performances of the transmitter.
- An automatic ATU is fitted to the TS950SSD, and the transceiver will not be available without this feature. The ATU microprocessor controller software has been written to include memory of ATU settings so that no time is wasted when moving from band to band. There is an additional feature in that the tuner may be manually controlled with subsequent memorising of the manually determined settings. IT WILL NOT MATCH A LONG WIRE.
- Receiver performance is excellent. With the AIP (advanced intercept point) off, and the 500Hz filter in use, the noise floor is ~ -149dBm. With the AIP on, the noise floor is ~ -140dBm, intercept point > +20dBm, and the IDR 2026. This performance will be hard to beat, and puts the TS-950S ahead of any competitor.
- In the TS-950SSD, the following IF filters are fitted to:
  - YG-445C1 250kHz
  - YG-445C1 500kHz
  - YK-88C 1 500kHz
  - YG-455C-1 4kHz
- Filter selection is by clearly labelled front panel buttons, which allow independent choice of both 0.5MHz and 455kHz filters. Whatever filter combination is chosen, it can be memorised along with filter settings and IF system, tuning center, frequency increment selection, noise blanker, noise blanker level control.
- CW VBT (Variable Bandwidth Tuning) is enabled in the CW mode together with the CW pitch control. The VBT control allows the IF bandwidth to be varied without affecting the centre frequency.
- CW AF VBT. Using time multiplied switched capacitor filters, the AF VBT provides a steep sided variable bandwidth AF filter which can be used in conjunction with the CW VBT to give outstanding CW receiver performance.
- A true IF notch filter is fitted to the TS-950SSD.
- Dual mode noise blanket system (polar or "woodpecker") with adjustable blanking level.
- 0 to 30dB RF attenuation in 10dB steps.
- AGC switchable On/Sow/Med/Fast.
- All mode squelch is provided.
- In the TS-950SSD the high stability TCXO reference is fitted as standard, giving a reference accuracy of ±0.5ppm between ~10°C and +50°C.
- For the CW operator there are specially attractive features.
  - Built-in high performance electronic keyer.
  - CW full 8K and semi 8K.
  - Variable BFO pitch control in the CW mode.

Additional features
- All mode TX power output control from 10W to full power.
- Built in speech processor.
- Monitoring of transmit signal, with adjustable level.
- Display dimming.
- Built in interface for computer control.
- Programmable tone encoder for FM repeater use.
- VOX operation.
- Provision for optional speech synthesiser VS-2
- 1MHz marker.
- Built in heavy duty AC power supply and speaker.
- Display "Lock" to prevent accidental changes.
- Adjustable VFO tuning knob torque.
- Built in 5kHz AM filter.

NEW TS950S/SD Price List

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<td>TS950S</td>
<td>£112.57</td>
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</tbody>
</table>

Only the TS950SSD will be available for the first couple of months, so PLACE YOUR ORDER NOW so as not to be disappointed.

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Practice Wireless, January 1990
The Father of Amateur Wireless

Hugo Gernsback was born in Luxembourg on 16 August 1884 and received his technical education at the Ecole Industrielle in Luxembourg and later at Bingen Technikum in Germany. His field was electrical engineering. Like many of his European contemporaries, the 'New World' beckoned and, in his case, it seemed the ideal place to market an improved design of dry battery he had invented. He arrived in New York in 1904 at the age of 20.

Wireless telegraphy had by this time established itself as the new medium of communication. Marconi had already spanned the Atlantic, the great passenger liners on this route were now able to communicate with a land station throughout their passage and the number of wireless telegraphy stations in the United States was increasing dramatically. There were no licensing restrictions and little demarcation between Government, commercial and the few stations that were operated for pleasure.

Company Established

The entrepreneurial spirit of Gernsback was aroused. He saw a demand for the marketing of wireless expertise and components and set about making plans to meet it. Within the year the Electric Importing Co. was established in an office three metres square at 32 Park Place, New York; the first firm in America to sell only experimental electrical goods.

From the start, Gernsback earned the reputation of giving a 'square deal'. He was one of the first businessmen to take advantage of mail order and he built up a sizable list of agents and customers throughout the United States. Business flourished and in 1905 he took over larger premises at 87 Warren Street, which provided better manufacturing facilities. In the November 1905 edition of the Scientific American he advertised what was to become the "first complete home radio ever offered to the American public". The kit consisted of a miniature spark transmitter with a one inch coil, coil-heater and all other necessary components including batteries. A guaranteed range of one mile was claimed.

Expansion

Early in 1908 the company moved once more to buildings at 80-86 West Broadway which provided six times as much floor space as the Warren Street premises. Expansion continued and in 1909 a large retail store was opened 69 West Broadway. It was a unique store in New York and became the 'Mecca' for all local wireless enthusiasts. By 1910 the offices and factory had again reached saturation level and the company purchased its own five storey building at 233 Fulton Street. The premises next door were acquired in 1912 thereby doubling the company's total available floor area to 2,500 square metres.

At this time the Electric Importing Co. were receiving 900 letters a day and shipping out on average 300 orders. Business was conducted with wireless enthusiasts all over the world. A European office was opened at 23 Rue Henri Maus, Brussels. EICO were the largest manufacturers of this type of equipment; raw material was purchased by the ton or car load. The company also controlled more patents on experimental and wireless apparatus than any other organisation in the US.

Hugo Gernsback had the knack of knowing just what this new breed of wireless devotees wanted. He was in fact one of them and spent much time in experimenting and testing new devices which his company subsequently marketed. The Electric Importing Co.'s catalogue was a wealth of information for anyone new to the art. Part One: 'Wireless' contained more than 200 pages and was beautifully illustrated with engravings of the various items on offer.

Services Offered

Gernsback offered a service that would be impossible to supply in this day and age. For a 2c stamp to cover postage, his engineering staff would "cheerfully answer free of charge any and all technical questions relating to our goods' Questions on 'hook ups' etc., not bearing a direct relation to the goods sold cost 10c. Also for 10c, the Company's drafting department would provide diagrams and connection data. The catalogue included one sales aid that would not seem out of place in today's marketing scene: A FREE Wireless Course. The book contained 20 coupons (numbered 1 to 20) each representing a lesson. Lessons ranged from 'Principles of Magnetism' to 'New Transmitting Systems' and 'Aerials' etc. By enclosing a coupon with each 15 order spent on components, the corresponding lesson would be forwarded. For a 20 order the complete course was sent in a cloth binder. This was remarkably good value as most textbooks on wireless, and especially the ones that were written in a language the layman could understand, were neither numerous or cheap.
Wireless Association Of America Formed

As a follow up to the Company's catalogue, Gernsback founded Modern Electrics in 1908, the first magazine which eventually devoted itself almost entirely to wireless telegraphy. The circulation increased rapidly and through the journal's readership, Gernsback formed the Wireless Association of America, the first national amateur wireless organisation, in 1909. This was five years prior to the incorporation of the American Radio Relay League (ARRL). The WAA published the Wireless Blue Book which appeared yearly and contained a list of all US Government, Commercial and Amateur wireless stations in alphabetical order with call signs and locations. It also included a three colour wall chart of the USA showing Government Stations. This for an annual sum of 15c. By 1910 the circulation of Modern Electrics had reached 30000.

In the early years of the Century there was no legislation or restriction on the use of wireless apparatus on the North American Continent. This contrasted starkly with the situation in the UK where up to and including WWI the authorities apparently did everything possible to hinder layman wireless experimenters. Inevitably, a free for all on the air waves developed and continued until chaos reigned. Interference was caused due to interaction and mistuning of the now thousands of stations that were active on the medium and long wave band. Much of it was due to obsolete equipment, often in operation at Government stations. Wireless Legislation introduced in 1912 brought some semblance of order to the radio spectrum in use at the time. During the years running up to this legislation, Hugo Gernsback endeared himself to the American Ham operators by outspokenly challenging the authorities in their attempts to curtail amateur wireless operations.

The Roberts Bill

The first attempt at silencing the amateur fraternity (who were unequivocally labelled the villains) was in the Roberts Bill. Gernsback, at first single handedly, fought the Bill tooth and nail. Through a stirring editorial in the January 1910 issue of Modern Electrics he inspired 8000 wireless amateurs to lobby their congressmen in Washington by letter and telegram. Hundreds of newspapers picked up Gernsback's editorial and all endorsed and applauded his views. The public as a whole turned against the Roberts Bill and it was eventually abandoned.

The Burke Bill and the Depew Wireless Bill appeared shortly afterwards and suffered a similar fate. Due to opposition instigated by Gernsback through the columns of Modern Electrics neither were seriously considered as legislation.

In December 1911 the Alexander Bill was put forward and although it met many of the amateurs' pleas, Gernsback felt it was not acceptable in its original draft. In the editorial columns of his publication he put forth what was to become an historical recommendation. That the amateur should be allowed an input power of 1kW and that operation should be permitted on wavelengths below 200 metres. These regulations are still in force today.

Unfair Legislation

In March 1912 Gernsback once again put pen to paper and in a letter to the New York Times, protested against unfair legislation, outlining the shortcomings of the Alexander Bill. The writer realised, perhaps more than anyone else, that this Bill, in some form or other, would eventually become law. He therefore felt it was his last chance to champion the rights of the wireless amateur. His concentrated efforts produced results and Alexander and his advisers subsequently acceded to the overwhelming pressure. It is significant that the relevant section of the Bill followed Gernsback's recommendations, as set out in the February 1912 issue of Modern Electrics, word for word. The Alexander Bill, now amended, passed the United States Senate on 7 May 1912 and transferred to the House of Representatives the following day. On 13 August 1912 it was signed by President Taft and became law.

In the United States in 1913 a licence was not needed provided the sender's wireless signals did not cross the State border. This was ideal for amateurs in the centre of Texas but restrictive for enthusiasts in New York City. The Gernsback catalogue went to great pains to list the type of equipment which would keep the 'unsuspecting' radio amateur off the air. In a letter to the New York Times, Gernsback pointed out that the figured maximum power had no relationship to the actual equipment used. The Wireless Association of America (WAA) was formed in 1912. Gernsback was elected chairman of the organisation, in 1909. This was five years prior to the incorporation of the American Radio Relay League (ARRL). The WAA published the Wireless Blue Book which appeared yearly and contained a list of all US Government, Commercial and Amateur wireless stations in alphabetical order with call signs and locations. It also included a three colour wall chart of the USA showing Government Stations. This for an annual sum of 15c. By 1910 the circulation of Modern Electrics had reached 30000.

The 'Transcontinental' was the top of the range receiver in 1913. It featured a 0.1µF condenser (left) and a detector with finely balanced swivel ball handle for use with any mineral substance. Using a 70′, four-wire antenna on top of their New York building, the manufacturers claimed to have regularly copied Colon in the Panama Canal - a distance of 2200 miles. Complete with the headphones, the cost was $24.00.

Mounted on an opal glass base, this key could be used for signalling with up to 12in spark coils and up to 30A. It followed a style that had been used by telegraphists on land line circuits before the turn of the century. The design was still in use until a few years ago. Price $1.75.

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The 'Intercity' sending outfit. This was ready assembled and needed only a 4-wire antenna, 25 feet above ground. A 1in spark coil was used with 2in spark gap. With the supplied five dry batteries, a range of up to five miles was claimed. The price, $8.45.

With the 'built-in' antennas shown, this set had a range of 50 feet. With a good antenna, up to three miles could be achieved. Its design goes back to very early wireless and was used for experiment and instruction. It used a precision decoherer which, with a 50Ω relay, would ring a bell. The cost with dry cells was $5.25.

"Adjustable Condenser". The complete condenser comprises the stand and six Leyden jar condensers. Each jar had a spring clip at the top and small round metal knobs on the bottom. The jar could be snapped into position in seconds. Price $2.50.

Advertisement appearing in Scientific American in November 1905. It was the first radio kit ever to be offered to American wireless amateurs.

Gemsback encouraged all to take out a licence. He pointed out it was a great honour to hold one. The licence was free and not too difficult to obtain. If you lived any distance from a radio inspector you took an oath before a notary public that you were conversant with the law and that you could transmit a wireless message.

The Gemsback organisation produced components as well as complete transmitting and receiving outfits. They even supplied the materials to make the component. One novelty, patented in 1910 was an 'adjustable condenser' consisting of six Leyden jars fitted in clips held in a frame of 'well seasoned oak'. From two to six jars could be used to obtain the correct capacity. Use of the Leyden jar considerably increased the duration of the spark and subsequently the range of the transmitter. The foresight of Gemsback in many areas is remarkable. One example is his reference to selenium which he sold in metal sticks at $1.50 an ounce.

"This peculiar substance is a conductor of electricity while exposed to light rays. An insulator in the dark it will close a relay when a match is lighted near cell. SELENIUM WILL SOLVE MANY PROBLEMS DURING THIS CENTURY".

Gemsback continued with his writing but now changed course to produce fiction. In 1911 he had written what is often regarded as the very first Science Fiction novel Ralph 124C41+. The title apparently translated his visions of the future: "One to foresee for one". In it he described and even illustrated a mechanism that could be likened to modern day radar. In 1926 he began publishing Amazing Stories, one of the first magazines to carry science fiction writing as its main theme. But he still maintained a keen interest in wireless. He founded WRNY Radio New York and conducted television experimental broadcasts in 1928. Gemsback also continued his association with the newcomer to wireless. Radio Amateur News was initiated in August 1919 and what was to become perhaps his most well known wireless book Radio for All, was published in 1922. He died in 1937 in New York City.

Not only in America, but amateurs throughout the world, owe much to Hugo Gemsback, the 'Father of Amateur Wireless'.

Station. In 1913 there were over 700 000 amateur stations in the USA.

Licence Encouraged

In June 1913 a new publication appeared from the Gemsback stable. The Electrical Experimenter was devoted entirely to publishing experiments on electricity and wireless. The magazine appeared monthly and a year's subscription was $50. It was an immediate success and the following year incorporated an updated "Experimental Electricity Course" in 20 lessons. (Gemsback's pioneering Modern Electrics had now been incorporated into Popular Science).

Hugo Gemsback apparently played no part in the formation of the ARRL in January 1914. However, this is not surprising as the organisation at this time was confined to members of the Hartford Radio Club, Connecticut. It was some years before the League was to become known to every radio amateur throughout the world.

New Publication

First Science Fiction Novel
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WEATHER SATELLITE SYSTEMS

SPECTACULAR NEW ATARI ANIMATED SYSTEM

Garex are proud to announce that they are the first appointed dealer for this incredible new Timestep product. Featuring a color-coded Atari interface unit, it is supplied by Garex and is designed to work seamlessly with the Atari ST1040 computer. The basic weather system includes a Microwet dish and receiver, frame store, 12in b/w monitor, and all plugs and cables included. Nothing more to buy: dish, microwave, and other packages require no computer or software and can be up and running within 10 minutes. The basic Microwet system is complete, plug-and-play, fully featured image processing program. The Superb high resolution pictures (600 pixels x 400 lines) are compatible with "PIXmate," a course, all plugs and cables.

NEW COMMODORE "AMIGA" INTERFACE AND SOFTWARE

This systems works similarly to the Atari interface, being complete with all software and colour-keyed Atari interface unit. Optional 16 grey scale adaptor for colour monitor. £24.95 per set.

WEATHER SATELLITE SYSTEMS

GAREX VHF PREAMPLIFIERS

- Miniature — General Purpose
- Up to 26dB gain
- 3dB bandwidth ±3MHz (at 145MHz)
- Low noise
- Input and output impedance 50 ohms
- 1dB compression at 100dBm
- Saturated output +15dBm
- Supply voltage 8.7V DC at 5-10mA
- Stock Versions (fully assembled, aligned and tested boards) 6in, 4in, 2in
- Other frequencies, special options, cased versions

GAREX VHF RECEIVERS

- Excellent sensitivity (typically 0.4uV for 10dB SINAD)
- Duplex selective (10.7MHz and 455kHz IFs)
- Choice of IF bandwidth from "W - SAT" to "12.5kHz" PMR standards
- The basic receiver is a single channel crystal-controlled.
- Multi-channel option.
- 2 watt audio output stage having a low quiescent current
- Input and output impedance 50 ohms
- 3dB bandwidth ±3MHz (at 145MHz)
- Low noise
- Supply voltage 8.7V DC at 5-10mA
- Stock Versions (fully assembled, aligned and tested boards) 6in, 4in, 2in
- Other frequencies, special options, cased versions

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A Tuned Active Antenna

The modern home tends to have a smaller garden which is insufficiently large to put up a good wire antenna for the lower h.f. bands. This could be a disadvantage to anyone living in these circumstances, but now this very effective tuneable active antenna from Adrian Knott G6KSN changes all that. It should prove more than adequate for even the tiniest of flats, and choice of frequencies covered would also prove very useful at holidays locations.

Whilst many of us possess communications receivers and listen to the h.f. bands, be it amateur, commercial, or broadcast stations, unfortunately we do not all have sufficient space to string up a nest of dipoles cut to our favourite bands, particularly if these happen to include Top Band or some of the lower marine or aeronautical allocations. Thus, it seemed to be a good idea to me that an antenna of small physical size, but with the performance comparable of the full sized dipole could be constructed.

Initial experiments using a short whip feeding into a source follower, then into a one or two transistor amplifier, were disappointing on the lower frequency ranges. This was especially true on topband where swamping and cross modulation from m.w. broadcast stations masked all but the strongest signals. Subsequent investigation revealed that non-linearity in the front-end f.e.t., was the major cause of the problem. Tuning the input stage removed these problems at a stroke. Navigation beacons on topband became audible during the afternoon, suggesting a very respectable sensitivity. A further improvement is achieved by mounting the antenna remotely and feeding the receiver via a coaxial line. It was for these reasons that a remote tuning system was developed along with an indoor power supply and switchable attenuator unit.

Mast-head Unit

The circuit diagram of the remote head unit is shown in Fig. 1. This remote unit may be constructed to cover various portions of the h.f. band, and L1 should be chosen from the range of approximate values shown in Table 1 later in the project, to resonate with Varicap diode D5 over the required band. A short whip antenna is fed to the gate of the f.e.t. TR1., which has protection diodes D1-D4 between the gate and the 0V line. Coil L1, in conjunction with Varicap D5 form the input tuning circuit. The tuning voltage for D5 is filtered by the CR network C3, R2 and C2, then passed via the isolating resistor R1 to the cathode of D5.

The decoupling of source resistor R3 by capacitor C4 provides a degree of gain with TR1, the output of which is fed through blocking capacitor C5 to the wide band amplifier made up of TR2 and TR3. This amplifier has a gain which remains substantially constant over the whole h.f. band and provides a good match to the coaxial line conveying the signal to the indoor unit. The 15V power supply line is filtered and decoupled by capacitors C7 and 8 to reduce noise and power lead pick-up. These capacitors may be omitted if the whole system is built in one metal box, but must be included if the antenna is remote to the power supply unit.

Construction and Technique

On the prototype boards, components were mounted on the copper side of the board, as shown in Fig. 4a and 4b. The isolated areas for items were produced by cutting the copper away to form 'islands' in the correct places. This, by the way, was an early form of surface mounting practiced by many home constructors.

Indoor Unit

Shown in Fig. 2 is the mains p.s.u. and tuning control unit. Transformer T1 is a small 15V 100mA double insulated type with the secondary output going to the diode bridge made up of diodes D6 - D9. Entry of r.f. interference at this point is minimised by paralleling each diode with a capacitor (C9-C12). An I.e.d. D10 and its limiting resistor R9 give a visual indication that the unit is switched on. After filtering by C13 the output voltage is stabilised using a single low power 15V regulator i.e. IC1. An occasional problem with these i.c.s is a tendency to oscillate at a low v.h.f. frequency. These tendencies are countered by capacitors C14 and 15, which should be mounted as close as possible to the i.c., preferably using the minimum lead length. Capacitor C16 provides further hum and noise reduction.

Tuning control R10 picks off a portion of the 15V rail and passes this the remote unit tuning voltage filter mentioned earlier. At times a degree of signal attenuation will improve reception quality, and so two switchable attenuator pads have been implemented as shown in Fig. 3a. Switch S1 controls a combination of resistors R11 to 13 which form a 10dB pad whilst maintaining a constant impedance close to 50Ω. Similarly S2 and its associated resistors form a 20dB attenuator pad. These attenuators are not to be taken as exact, but have been calculated and the nearest preferred resistor values used. The layout of the attenuator switches, which should be mounted as close together as possible.
possible using screened coaxial lead for input and output connections, is shown in Fig. 3b.

Testing

Construct the p.s.u. board of the indoor unit and assemble the rest of the unit, but do not connect the output lines at this point. Check that the mains fuse is no greater than 3A, and that the mains connections are safely connected and insulated where appropriate. Finally check that all components are in their correct position and orientation. Switch the unit on and with a multimeter set to read 25V d.c. full scale, measure the voltage across C13. This should be in the region of 20 - 23V, and the l.e.d. D10 should illuminate. Transferring the leads of the meter across C16 to measure the voltage, should result in a reading of 14.5V to 15.5V. If this is the case then measure the voltage available on the slider of R10. It should be possible to obtain a voltage which may be varied between 0V and the voltage across C16.

When all is well, connect the negative side of the power supply to one of the pins of the output socket SK1 and the positive connection to another of the pins. The tune voltage is connected to a third pin. Matching the pins used, solder the control cable conductors to the plug. As the connections are made take note of the colour of the wires and what voltages they carry, this will be needed later.

Construct the remote mast-head unit, taking care to use the correct islands and to orientate the components correctly. At this point the working position of this remote unit must be decided, as the positioning of the various sockets depends on this. In the prototype the antenna was at one end, with the output, SK5, and control, SK6, sockets at the opposite end to exit vertically downwards in normal use. Drill the box and mount the sockets in the correct positions. Using the colour scheme noted when wiring the indoor unit, solder the remote end plug to the control cable, and make note of the pins used at this end.

Inductors see text and Table 1.

Semiconductors

Transistors

BC548 1 TR3
BC549B 1 TR2
2N3819 1 TR1

Integrated Circuits

78L15 1 IC1
(low power 15V regulator i.c.)

Diodes

i.e.d. 1 D10 (colour of choice)
MVAM115 1 D6 (27-560pF Varicap)
1N4001 4 D6-9
1N4148 4 D1-4

Miscellaneous

15V 100mA transformer; 3A fuse and chassis mounted fuse holder; low power three core mains cable; Mains on/off switch; 2 x 2 pole miniature change over switches; Diecast aluminium box 121 x 95 x 29mm for the remote head unit; Suitable aluminium box, approximately 150 x 120 x 50mm, for the main indoor unit; Coaxial plugs and sockets plus coaxial cable; two pairs of plugs & sockets, plus lightweight 3 core control cable; Single strand connecting wire of various colours; Suitable knob for the tuning control.
corresponding pins of the socket, connect the 0V line to area marked -V in Fig. 4b and the 15V line to the land marked +V in the same diagram. Finally connect the tune volts line to the land on the positive side of C3.

Carefully check all connections, components and orientations, and, if all is as it should be, connect the remote masthead unit to the indoor unit using the control cable. Monitor the voltage across C3 in the remote unit, it should be the same as the output voltage from the p.s.u. Also check the tune volts line in the remote unit, this should slowly follow the movement of the wiper of R10, and be variable between both supply rail limits. If this is not the case switch off and recheck all the connections.

Assuming that all is well then connect the short antenna to socket SK4 and the remote unit to the input of the attenuator pads via a suitable length of coaxial cable. The output from the attenuators should be connected, via a second piece of coaxial cable, to a communications receiver. Tune the receiver to the low end of the band of interest and set the tune volts to minimum. Noting the level of noise on the receiver, slowly rotate R10 to increase the tune voltage. The level of noise should peak and then decrease as the remote unit is tuned towards the higher frequencies. Retune the receiver to about twice its original frequency setting and retune the remote unit to peak the noise or signal level again.

At this point check the operation of the attenuators. Tune to a fairly strong constant signal, and operate both switches individually. If the receiver has a signal strength meter, an indication of their action should be obvious. However if no meter is fitted, a slight change in audio output may be the only indication of the attenuators coming into circuit.

Retune both the receiver and the remote unit to discover the upper and lower limits of coverage of the system. The frequencies at the both ends will vary with temperature, so if the band of interest is to be found at an extreme end, the next inductance value up or down should be chosen to place the required frequency towards the centre of tuning.

In Use

In use the antenna has been found to give impressive results on very weak stations, but at the same time copes very well with the end-stopping signals of the 6MHz band without signs of overload or cross modulation. This antenna has proved invaluable to the author and it is hoped that it may be of interest to others where space is at a premium.

In Use

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Ten metres, or the 28MHz band, is a mystery band. It's at the top of the hf spectrum, dead most of the time but is rumoured to possess mystical powers every eleven years or so. In this monthly column, John Petters G3YPZ aims to explain matters and point the finger in the right direction of an exciting part of amateur radio.

The secret of getting good results on the 28MHz band (I Omni) is mainly dependent on two things, a good sensitive receiver and a good dedicated antenna.

The Receiver

Historically, multi-band transceivers have suffered badly from a lack of sensitivity on the band. Unfortunately, 28MHz seems to have been almost an after-thought - after all it is dead most of the time - and when it is open the DX is so strong anyway!

This line of thinking has for years masked the true capabilities of this unique part of our spectrum. Current state-of-the-art rigs seem to be quite reasonable, but if you are using an FT-101, or even older, a KW-2000 then you will need to improve the front-end.

A simple m.o.s.f.e.t. pre-amplifier, as shown in Fig. 1, will put more than a bit of life into any of the older receivers.

The component values are as follows:

TR1 3SK88, BF960, 961 or 981
R1 68kΩ
R2 22kΩ
R3 100Ω
C1-3 10nF monolithic chip capacitors
C4 10nF (not critical as to type)
C5-6 5-65pF trimmers
L1-2 8 turns, 22 gauge wire close wound on 0.25in former tapped at 2 turns from the earthy end.

The pre-amplifier should be constructed on double-sided p.c.b. The use of monolithic chip capacitors is recommended for decoupling as this will reduce the risk of instability. A ferrite bead can also be inserted in the drain of the m.o.s.f.e.t. if problems persist. It may also be necessary to screen the input and output coils from each other.

Of course, some form of switching would need to be used if operation is intended for a transceiver. I personally would advise a relay, powered from the p.t.t. line, as opposed to an r.f. sensed switch, in the interest of preserving the m.o.s.f.e.t. All components are readily available from suppliers such as Cirkit plc at Broxbourne and Maplin Electronics. Cirkit also do a range of Toko coils which include r.f. coils for 28MHz. These can be used in place of the home-brew types described previously.

The pre-amp should give something in the region of 20dB gain and should reveal a lot of weak, but workable signals especially on inter-G contacts and satellite working.

For those using converted CB rigs on f.m., there are numerous mods to improve the RX performance. The Icom 1050, LCL JWR and DNT rigs all benefit from changing the front-end m.o.s.f.e.t. to one of the types already mentioned, as well as replacing the ceramic i.f. filter with the 10.695MHz crystal filter available from Cirkit plc. It is just a matter of the filter change and terminating the input side with a 1.8kΩ resistor down to ground.

These mods alone will substantially improve results. There are further mods to mixers, etc., that can also be tackled.

For those using rigs with bipolar front-ends the easiest way to improve matters is to use the external pre-amp.

Next month we will look at 28MHz antennas, mobile operation and your reports.
The Yaesu FT-1000 HF Transceiver

Digital Signal Generation

For the first time in their transceivers, Yaesu have used a direct digital synthesis (d.d.s.) method of local oscillator generation, the FT-1000 having two 10-bit d.d.s. together with three further 8-bit d.d.s. all controlled by their relevant microprocessors. No voltage controlled oscillators with their phase noise problems, but instead a handful of digital i.c.s providing the required signals. Twin internal receivers each with their own v.f.o.s together with an optional digital received audio storage facility whetted my DX chasing appetite, I was pleased to have the first UK review model.

Main Features

Priced at £2995, the set covers every WARC h.f. amateur band on transmit, together with a general receive coverage facility over 100kHz to 30MHz. In line with the ever-increasing trend of efficient digital modes of communications, dedicated 'packet' and 'RTTY' modes of operation are fitted alongside the traditional I.s.b., u.s.b., a.m., f.m. and c.w., a switching time of around 18ms being provided for fast c.w. break-in as well as rapid data transmit/receive switching.

The transmitter gives a controllable output of up to 200W, with p.t.t., VOX, MOX, c.w. break-in and automatic TNC-controlled transmit switching methods provided. A c.w. keyer is also built-in with variable speed and weight controls. Switching, a.l.c. and frequency band information sockets are provided on the rear panel to allow automatic control of an external linear amplifier.

Two Internal Receivers

Twin receivers are provided which can each be used on different operation modes and receiver bandwidths if needed. They normally use the same antenna and front end filters, but a plug-in band pass unit at £69 is available to provide reception capabilities over any frequency split. Two separate v.f.o. knobs control the individual receivers, the set having a stereo output socket together with a panel mounted balance control to feed the received audio to 'left' and 'right' channels if required, giving you a new experience when you plug stereo headphones in! An additional antenna socket is also fitted to the rear panel for receive-only use, for 1.8MHz band DX chasing for example, this may be used either with or without the band pass unit and is switched from the front panel.

Receiver Circuitry

A quadruple conversion system is used on receive, with a high first i.f. of 73.62MHz being followed by further i.f.s of 8.215MHz, 455kHz, and 100kHz, the final i.f. not being used on f.m. Four crystal filters are provided as standard in the 8.215MHz i.f. and a further two filters in the 455kHz i.f., providing main receiver bandwidths of 250Hz, 500Hz, 2.0kHz, 2.4kHz and 6.0kHz. As well as this, the sub receiver comes with 2.4kHz filters in both its second i.f. of 7.68MHz and its third i.f. of 455kHz, and additional filters may be fitted in either receiver for more selectivity.

Fourteen 5-pole main channel front-end bandpass filters are automatically switched in, depending upon the band selected (together with another eleven in the sub-receiver filter if fitted). Following these, a cascade dual j.f.e.t. r.f. amplifier may be switched in or out of the receiver front-end, the receiver itself claiming a massive 106dB two-tone dynamic range (with +32dBm 3rd order intercept point) to alleviate problems from the many high-powered h.f. signals to be found. Switching in the preamp gives a noise floor of -138dB to make sure weak signals on 10m and the like are able to overcome the noise. A double balanced mixer ring using four high Idss j.f.e.t. comes next, and a front panel control lets you select either direct mixer feed, in-line pre-amp, or three steps of attenuation according to band conditions. No more problems with the chap down the road wiping your receiver out when the rare DX appears, providing the neighbouring transmitter is 'clean' of course!
Digital Communications

For those amateurs who like to communicate using their computers helping them, dedicated sockets are provided for connection of both a packet TNC and a RTTY/AMTOR base-station terminal unit, with corresponding front panel mode selector buttons switching these in. A built-in microprocessor controls the audio frequency shift keying in transmit and receive. RTTY and AMTOR, these can be set back to the standard 1275Hz mark tone or to the alternate 2125Hz tone as used with some American terminal units, and together with these, either 170Hz, 425Hz and 850Hz shifts may be used.

A significant and very useful point is that the narrow i.f. filters can be switched in or out of use as needed, with the receiver passband being automatically centred onto the signal frequencies. The receiver frequency display then showing the actual centre of the two transmitted tones. This allows you to make the best use of the narrow filters rather than having to put up with s.s.b. bandwidths with resultant QRM problems on busy bands.

Computer Control

In common with Yaesu's other base-station transceivers, many of the set's functions can be controlled via a c.a.t. (Computer Aided Transceiver) serial data socket on the rear panel, using standard RS-232 data through an interface unit. Existing software that works with the FT-747 may also be used with the FT-1000 with suitable modifications as required for the extra filters provided. With the UK licence now allowing remote control of our main station through a radio link, this provision should find much use, and more to come, and it is interesting to note that a Greek amateur already runs a h.f. packet BBS with c.a.t. auto-QSY control from off-air users commands!

CW Use

As individual amateurs have their own preferences, the FT-1000 lets you select a b.f.o. offset of 700, 600, 500 or 400Hz, and tune with them, direct with i.f. filters a variable audio peak filter gives a further amount of selectivity. For those who like a tuning aid, a phase-lock loop `spotting' i.e.d. lights when you've correctly netted onto a c.w. signal, flashing in synchronism with the received c.w. However for the real DX chaser, a c.w. netting oscillator can be used so you can put your c.w. signal exactly where you want it in relation to the DX station's signal, or indeed, in relation to all the others calling him! Full break-in switching is provided, and an internal c.w. keyer is fitted with which you can vary the weight ratio in 15 steps, from 1:3 to 1:4.5 dot/dash ratio.

Received Audio Storage

A novel optional fitment is the DVS-2 digital recording option, being a small unit around the size of a TV remote control which plugs into the set via a lead. This unit stores the received audio continuously, and memory selectors and v.f.o. let you chop and change frequencies to your heart's content, with the `RPT' button switching in a 100kHz repeater shift for 28MHz f.m. use. An "M CK" button lets you see what you've stored in the set's 99 tunable memories to save you keeping a channel list to hand. The "SPLIT" function lets you operate split-frequency to one S point. An RX MIX control acts as a balance knob to vary the relative audio levels from the two receivers, and a "MONI" provides an off-air final r.f. monitor of your transmitted signal through the set's speaker or headphone socket to let you hear what you really sound like. Below these are further rotary controls to let you adjust the mic gain, TX power from 20-200W, r.f. processing level, TX drive, receiver squelch and noise blanker threshold, together with the usual receiver audio and r.f. gain controls.

Along the bottom of the panel are a row of buttons switching in the r.f. speech processor, the TX monitor facility, and the two noise blankers, one with a narrow pulse width for ignition interference and the like, the other being wider for over-the-horizon radar pulse interference. Memory selectors and v.f.o. let you chop and change frequencies to your heart's content, with the 'RPT' button switching in a 100kHz repeater shift for 28MHz f.m. use. An "M CK" button lets you see what you've stored in the set's 99 tunable memories to save you keeping a channel list to hand. The "SPLIT" function lets you operate split-frequency to one S point. An RX MIX control acts as a balance knob to vary the relative audio levels from the two receivers, and a "MONI" provides an off-air final r.f. monitor of your transmitted signal through the set's speaker or headphone socket to let you hear what you really sound like. Below these are further rotary controls to let you adjust the mic gain, TX power from 20-200W, r.f. processing level, TX drive, receiver squelch and noise blanker threshold, together with the usual receiver audio and r.f. gain controls.

Internal ATU

To let you get on with working stations rather than tuning antenna matchers, an automatic a.t.u. is internally fitted as standard. This has a matching range of 3:1 s.w.r., i.e. it can tune out the impedance mismatch from some off-resonance antenna but may not, of course, match long wire or G5RV antennas. As well as an automatic adjustment being started when required, 39 a.t.u. memories are fitted for quick recall of previously used settings depending on which band and which part of the band you happen to be operating on at any time. If that isn't enough, then the a.t.u. setting controls are also accessible, through the transceiver's c.a.t. socket by an external computer.

The Front Panel

Looking at the front panel of the set, at first is quite bewildering, but a quick "tour around" the controls nicely describes the set's other facilities. At the top left, next to the usual Power, VOX and MIX out, are buttons to select the external receive antenna, and a 'DIM' facility to dim the set's display for all-night DX chasing sessions. Below these, rotary controls let you switch the meter functions to read either a.l.c. level, compression, p.a. collector current or p.a. collector voltage, attenuation in line when needed, every 6dB corresponding to one S point. An RX MIX control acts as a 'balance' knob to vary the relative audio levels from the two receivers, and a 'MONI' provides an off-air final r.f. monitor of your transmitted signal through the set's speaker or headphone socket to let you hear what you really sound like. Below these are further rotary controls to let you adjust the mic gain, TX power from 20-200W, r.f. processing level, TX drive, receiver squelch and noise blanker threshold, together with the usual receiver audio and r.f. gain controls.
Communication decoders

AFR-1000 Automatic CW-RTTY Decoder

The microprocessor-controlled POCOM AFR 1000 CW-RTTY Decoder automatically processes radio teletype signals in accordance with Baudot No. 1 and No. 2, ARQ/FEC (BITOR/SPECTOR/AMTOR) and CW (Morse telegraphy) standards and corresponds to the latest state of the art. The AFR-1000 Automatic Decoder is remarkable for its value for money. Its moderate price makes it particularly suitable for the cost-conscious RTTY beginner. Unlike the other models in the AFR series, however, it cannot be upgraded for special codes.

FEATURES

- Fully automatic recognition of CW, ARQ-FEC and BAUDOT No. 1 and No. 2 teletype signals with automatic decoding, independently of the shift position.
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The POCOM AFR-1000 is extremely easy to use and very simple to operate. The AFR-1000 is simply connected to the loudspeaker outlet on the shortwave receiver. Operation is confined merely to choosing the mode required. No tiresome testing of the baud rate and shift position. Two LED's indicate the active operation states in each case.

The baud modulation rate measurement facility is a complete new innovation in a unit in this price range. Knowledge of the baud rate permits reference to special codes, specific radio services, etc., and makes it possible to shed light upon a radio teletype signal. The display is provided on the screen or printer linked to it to 1/1000 baud (e.g. 96.245 bauds) with quartz accuracy and within a measuring range of approx. 30 to 250 bauds.

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The efficient monitoring of the complete SW-range calls for the use of modern receivers which should offer a large amount of operating comfort. Recently good receivers such as the popular ICOM R-70 and the JRC NRD-515 have become available on the market, but they lack the optimal microprocessor-supported operating possibilities. These requirements are fulfilled by the intelligent programmable frequency controller POCOM PFC-100 from Poly-Electronic.

The use of up-to-date circuit technology contributes to the class of this innovation which meets the highest demands of all active SW-listeners. Together with one of the two receivers (ICOM/JRC) the PFC-100 permits an unsurpassed degree of operational ease due to the consequent use of a microprocessor and comfortable software.

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switches for use on either receive and/or transmit, together with a 'CLEAR' button to zero the clarifier. Above these are the automatic a.u.w. controls to switch the tuner in or out, together with a 'START' button to commence tuning for a match. At the top right is the M.Scan button which starts the set hunting through all its memory channels for those who like to know everything that's going on around the spectrum.

To the left of the main tuning knob are the single-press mode buttons, to the right is the band-change keypad, this doubles as a direct frequency entry keypad, above which are the single-press buttons for altering the receiver i.f. filter selection. The smaller sub-v.f.o. knob controls just that facility, and either v.f.o. knob may be locked to prevent accidental change.

On The Air

After the required 'tour round' the controls to familiarise myself with its operation (i.e. 'Where's the On/Off switch?'), I went the antenna and power leads and a power supply had by having a good listen around using a variety of antennas.

The first thing I noticed was that all the bands seemed quieter than usual, but comparing the set with my normal receiver showed that all the signals were there, but what was missing was all the background 'mush' due to internal mixing products. Switching in the front-end pre-amp brought the level of signals up, but the result was still a nice 'clean' band, even 7MHz (40m) in the evening! Tuning through the strong broadcast station 'intruders' on 7MHz didn't bring up the usual hack-wrap type noise from the set's synthesiser at all, but instead strong tuned signals just came in cleanly, and went away similarly cleanly. Mind you, listening to European 14MHz (20m) signals at the weekend was certainly an eye opener - I could quickly find the stations who were using the 'alternative' method of speech compression, i.e. tuning their drive level up to maximum and shouting down the microphone!

As a critical test of the set's capabilities under demanding conditions, I tried a little 'DX Chasing' during a recent h.f. contest, where stations galore were crammed into the bands, all trying to work each other. Within a few hours just using the set's 200W on s.s.b., I had worked over 50 DX stations including HK (Honduras), V4 (St. Kitts Nevis), OHO (Aarland Is.), FS (French St. Martin), VP2E (Anguilla), PJ8 (Netherlands St. Maarten), P4 (Netherlands Antilles), VP9 (Bermuda), HI (Dominican Republic) and VP3 (Turk Is). I was most impressed! The secret was in being able to receive the often very weak DX stations in the presence of much stronger interfering signals, coupled with use of the set's filters, notch, and shift controls which really did have a positive effect. The various controls often fell into place with my fingers easily, but I must say I was most annoyed when I accidentally touched the 'M.Scan' button at the corner of the set and lost the DX station I was about to call, with no record of what the frequency was! A band change and very careful re-tune was then needed, with me quietly cursing to myself.

Changing bands by pressing the appropriate 'BAND' button, always placed the set on the last-used frequency in that band, this was very useful as it saved a re-tune each time. Likewise the last-used mode and filter bandwidth on that band was always recalled, which was a nice touch! With this facility fitted, I found I rarely used the v.f.o. memories for amateur band frequencies, slowly filling them up instead with broadcast and interesting utility frequencies for easy selection, when I wanted a change from amateur radio.

During longer 'ragchew' QSO sessions on the i.f. bands using an essentially non-directional antenna, I often found that I could copy other stations better than they could copy me, even though with 200W I was usually running more power than they were. Reports of "You're strength nine but the continental QRM is proving a problem" were typical, again showing the set's QRM rejection capabilities. And in the clearer conditions, the transmitted audio were very good, even with the r.f. processor turned up which one would normally expect to degrade the signal quality even if the weak-signal readability was improved. On 28MHz (10m) f.m., again I received good reports on my transmission but I sometimes found quite a bit of distortion on received speech due to the 6kHz filter used on f.m. With the odd station running around ±4kHz to 5kHz deviation this filter was unfortunately too narrow, but what I did do was bring up the tuning to the v.f.o., from 10Hz steps to 100Hz steps which made tuning easy. A minor criticism is that I found the repeater button was hidden from normal view by the v.f.o. knob, and I had to be careful to bend my head down to check I was pressing the right button!

Using the set on h.f. packet was an absolute pleasure, pressing the 'PACKET' mode button the mode started cycling between s.s.b. with 200Hz shift for 300 baud use, and f.m. with 1000Hz shift for 1200 baud use, automatically switched in the connections to my external TNC plugged into the rear panel. Listening around the 14.099MHz area with the narrow filter selected showed good results, with screens full of data being displayed on my computer.

In all, I was very pleased indeed with the on-air performance, with the only 'moans' of the odd awkward button position being fairly minor as the vast majority of the set's multitude of functions were extremely easy to operate. My log-book certainly looked a lot more healthy after the review period!

Technical Results

The transmitter delivered in excess of the specified power output, with just a slight back-off of only 5% the theoretical s.s.b. inter-modulation distortion, i.e. the amount of 'spreading' of the signal, showed the transmitter p.a. to be very linear indeed, no doubt due to 30V supply used to feed the MRF422 output p.a. transistors. Even with the processor in, the signal was very narrow, although when crankling the level up to 20dB the inner products came up in level.

On receive, the performance was often beyond the limit of the latest professional measuring equipment, with no measurable trace whatsoever of synthesiser phase noise. This noise often causes many expensive transceivers to fail in their rejection of closely-spaced interfering signals (look at the spate of 'add-on' phase noise reduction p.c.b.s in the past!). Several days worth of r.f. testing in the lab just confirmed the good performance that was found on air, what more can be said?

---

Yaesu's latest 'Flagship' transceiver clearly lives up to its name, and much thought must have gone into its design, it certainly is a departure from their traditional type of equipment. The set was extremely easy to use due to the simple one-touch controls, with many of the various knobs and buttons being sensibly placed for easy location. The twin receive facility was very useful due to the simple one-touch controls, with many of the various knobs and buttons being sensibly placed for easy location. The twin receive facility was very useful due to the simple one-touch controls, with many of the various knobs and buttons being sensibly placed for easy location. The twin receive facility was very useful due to the simple one-touch controls, with many of the various knobs and buttons being sensibly placed for easy location.
Lab Results

Receiver
Sensitivity: Input level in µV p.d. required to give 10dB S/N, 0dB attenuation;

<table>
<thead>
<tr>
<th>Freq (MHz)</th>
<th>CW/LSB</th>
<th>AM/WM</th>
<th>30% Mod</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>1.0µV/0.7µV</td>
<td>1.0µV/0.5µV</td>
<td>1.0µV/0.3µV</td>
</tr>
<tr>
<td>3.7</td>
<td>0.7µV/0.5µV</td>
<td>0.8µV/0.5µV</td>
<td>0.9µV/0.4µV</td>
</tr>
<tr>
<td>7.1</td>
<td>0.5µV/0.3µV</td>
<td>0.6µV/0.2µV</td>
<td>0.7µV/0.1µV</td>
</tr>
<tr>
<td>10.1</td>
<td>0.4µV/0.1µV</td>
<td>0.5µV/0.1µV</td>
<td>0.6µV/0.1µV</td>
</tr>
<tr>
<td>14.1</td>
<td>0.3µV/0.1µV</td>
<td>0.4µV/0.1µV</td>
<td>0.5µV/0.1µV</td>
</tr>
<tr>
<td>18.1</td>
<td>0.2µV/0.1µV</td>
<td>0.3µV/0.1µV</td>
<td>0.4µV/0.1µV</td>
</tr>
<tr>
<td>21.1</td>
<td>0.1µV/0.1µV</td>
<td>0.2µV/0.1µV</td>
<td>0.3µV/0.1µV</td>
</tr>
<tr>
<td>24.6</td>
<td>0.0µV/0.1µV</td>
<td>0.1µV/0.1µV</td>
<td>0.2µV/0.1µV</td>
</tr>
<tr>
<td>28.6</td>
<td>0.0µV/0.1µV</td>
<td>0.1µV/0.1µV</td>
<td>0.2µV/0.1µV</td>
</tr>
</tbody>
</table>

AM Sensitivity, pre-amp on;
Input level required to give 10dB S/N;

<table>
<thead>
<tr>
<th>Level</th>
<th>1.5MHz</th>
<th>5.0MHz</th>
<th>10.0MHz</th>
<th>15.0MHz</th>
<th>20.0MHz</th>
<th>25.0MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5µV</td>
<td>1.6µV</td>
<td>1.9µV</td>
<td>3.1µV</td>
<td>3.1µV</td>
<td>3.1µV</td>
<td>3.1µV</td>
</tr>
</tbody>
</table>

Blocking;
Increase over 10dB S/N level of blocking signal degrading S/N by 6dB; measured at 10.7MHz and 21.4MHz, c.w., 500Hz bandwidth 0dB attenuation;

<table>
<thead>
<tr>
<th>Level</th>
<th>100kHz</th>
<th>1MHz</th>
<th>2MHz</th>
<th>3MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;105dB</td>
<td>&gt;105dB</td>
<td>&gt;105dB</td>
<td>&gt;105dB</td>
<td>&gt;105dB</td>
</tr>
</tbody>
</table>

3rd Order Intermodulation Rejection;
Increase over 10dB S/N level of signals spaced by 50kHz giving identical 10dB S/N signal; measured at 14MHz, c.w., 500Hz bandwidth, 0dB attenuation;

<table>
<thead>
<tr>
<th>Level</th>
<th>50kHz</th>
<th>100kHz</th>
<th>200kHz</th>
<th>300kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;95dB</td>
<td>&gt;95dB</td>
<td>&gt;95dB</td>
<td>&gt;95dB</td>
<td>&gt;95dB</td>
</tr>
</tbody>
</table>

IF Rejection;
Difference in level of relative signals at the 73.62144Hz first Intermediate Frequency and 14MHz, u.s.b. 2.4kHz filter, 0dB attenuation;

<table>
<thead>
<tr>
<th>Level</th>
<th>85.3dB</th>
</tr>
</thead>
</table>

IF Notch Rejection
Rejection of 1kHz beat signal; 14MHz u.s.b. 2.4kHz filter, 0dB attenuation;

<table>
<thead>
<tr>
<th>Level</th>
<th>27.0dB</th>
</tr>
</thead>
</table>

S9+110dB, S9+20dB, S9+30dB, S9+40dB, S9+50dB, S9+60dB

RX Effective Bandwidth;
Measured single signal effective bandwidth, 14MHz u.s.b. 2.0kHz bandwidth

<table>
<thead>
<tr>
<th>Level</th>
<th>-3dB</th>
<th>-6dB</th>
<th>-10dB</th>
<th>-20dB</th>
<th>-40dB</th>
<th>-60dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6kHz</td>
<td>-1.25kHz</td>
<td>-2.0kHz</td>
<td>-2.2kHz</td>
<td>-2.2kHz</td>
<td>-2.2kHz</td>
<td>-2.2kHz</td>
</tr>
</tbody>
</table>

SBB TX Two-Tone Inter-modulation distortion;
Measured on 14MHz with 1200Hz and 1800Hz tones, at onset of a.l.c., shown as dB below p.e.p. level.

<table>
<thead>
<tr>
<th>Processor Off;</th>
<th>10dB Processing</th>
<th>20dB Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0dB</td>
<td>-36dB</td>
<td>-40dB</td>
</tr>
<tr>
<td>10dB</td>
<td>-41dB</td>
<td>-43dB</td>
</tr>
<tr>
<td>20dB</td>
<td>-41dB</td>
<td>-43dB</td>
</tr>
</tbody>
</table>

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Card No.

Valid from to

Signature

Tel:

(2)

Name

Address

Postcode

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We continue with Type 3, where one impedance is purely resistive and the other comprises resistance and reactance in series. The resistive part of the complex impedance being a higher value than the pure resistance.

The circuit of the matching network is shown in Fig. 21.1.

(i) Let the higher value of the resistive part of the complex impedance be designated $R_A$ and the lower value of the pure resistance $R_B$, regardless of which is source or load.

(ii) Change $R_A$ and $X_A$ to their parallel equivalents, $R_A'$ and $X_A'$

(iii) Let $p = \frac{R_A'}{R_B}$

(iv) Let $q = \sqrt{(p - 1)}$

(v) Determine $X_1 = +\left(\frac{R_A x q}{q}\right)$

(vi) Determine $X_2 = -\left(\frac{R_A'}{q}\right)$

(vii) Determine $X_3 = \left(\frac{-X_A'}{X_2 - X_A}\right)$

For our worked example, we'll match a pure resistance of 50Ω to an impedance of 250Ω in series with a reactance of -10Ω.

(i) $R_A = 250$ and $R_B = 50$

(ii) $R_A' = \frac{250^2 + (-10)^2}{250} = 250.4$

(iii) $X_A' = \frac{250^2 + (-10)^2}{-10} = -6260$

(iv) $p = \frac{250.4}{50} = 5.008$

(v) $X_1 = +\left(\frac{50 x 2.002}{100.1}\right) = +100.1$

(vi) $X_2 = \frac{-250.4}{2.002} = -125.1$

(vii) $X_3 = \left(\frac{-6260 x (-125.1)}{-125.1 - (-6260)}\right) = -127.65$

The resulting network is shown in Fig. 21.2

Checking the arithmetic, $Z_i$ (in Fig. 21.2) should work out to be 250Ω in series with a reactance of +10Ω, to resonate with $X_A = -10Ω$.

(i) Find parallel equivalent of $R_B$ and $X_1$

$$R' = \frac{50^2 + 100.1^2}{50} = 250.4$$

$$X' = \frac{50^2 + 100.1^2}{+100.1} = +125.08$$

(ii) $X$ in parallel with $X_3$ is :

$$\left(\frac{+125.08}{-127.65}\right) = +6212.6$$

(iii) Finally, the series equivalent to 250.4Ω in parallel with a reactance of +6212.6Ω is :

$$R' = \frac{250.4 + (+6212.6^2)}{(250.4^2) + (+6212.6^2)} = 250$$

$$X' = \frac{(250.4^2) + (+6212.6^2)}{(250.4^2) + (+6212.6^2)} = +10.08$$

So the check gives 250Ω in series with +10.08Ω, which near enough resonates with $X_A = -10Ω$ to give 250Ω.

Type 4

Where one impedance is purely resistive, the other comprising resistance and reactance in parallel. The pure resistance being a higher value than the resistive part of the complex impedance.

The circuit of the matching network is shown in Fig. 21.3.

(i) Let the higher value of the pure resistance be designated $R_A$ and the lower value of the resistive part of the complex impedance $R_B$, regardless of which is source or load.
(ii) Change $R_B$ and $X_B$ to their series equivalents $R_B'$ and $X_B'$.
(iii) Let $p = \frac{R_A}{R_B'}$
(iv) Let $q = \sqrt{p}$
(v) Determine $X_1' = (R_B' \times q)$
(vi) Determine $X_1 = -(R_A q)$
(vii) Determine $X_3 = X_1 + (-X_B')$

This example will be to match a pure resistance of 100Ω to a complex impedance of 65+50Ω in parallel with a reactance of +50Ω.

(i) $R_A = 110$ and $R_B = 65$
(ii) $R_B' = \frac{65}{65^2 + (+50^2)} = 24.16$
$X_B' = \frac{65^2 - (+50^2)}{65^2 + (+50^2)} = +31.41$
(iii) $p = \frac{24.16}{110} = 0.54$
(iv) $q = \sqrt{0.54} = 1.885$
(v) $X_1 = +24.16 \times 1.885 = +45.54$
(vi) $X_2 = -\frac{110}{1.885} = -58.36$
(vii) $X_3 = +45.54 + (+31.41)$

$= +14.13$

Resulting in the values in Fig. 21.4.

Checking the arithmetic:
(i) Using the series equivalents of $R_B$ and $X_B$ ($R_B'$ and $X_B'$) add $X_1$ to $X_B'$:
$+14.13 + (+31.41) = +45.54$
(ii) Find parallel equivalent of 24.16Ω resistance in series with +45.54Ω:
$R' = \frac{24.16^2 + (+45.54)^2}{24.16} = 110$
$X' = \frac{24.16^2 + (+45.54)^2}{(+45.54)^2} = +58.36$

So we have +58.36 in parallel with $X_1$ (-58.36) which is a parallel tuned circuit. This in turn is in parallel with 110Ω which results in a resistance of 100Ω. It worked again!

Type 5
One impedance purely resistive, the other comprising resistance and reactance in parallel. The resistive part of the complex impedance being a higher value than the pure resistance.

The circuit of the matching network is shown in Fig. 21.5.

As an example, let's match a complex impedance of 230Ω resistance in parallel with a reactance of -80Ω to a pure resistance of 75Ω.

(i) $R_A = 230$ and $R_B = 75$
(ii) $p = \frac{230}{75} = 3.067$
(iii) $q = \sqrt{3.067 - 1} = 1.4376$
(iv) $X_1 = + (75 \times 1.4376) = +107.82$
(v) $X_2 = -\frac{230}{1.4376} = -160$
(vi) $X_3 = \frac{160 - (-80)}{160} = +10$

See Fig. 21.6

Arithmetical check:
(i)
$R' = \frac{75^2 + (+107.82)^2}{75} = 230$
$X' = \frac{75^2 + (+107.82)^2}{+107.82} = +160$
(ii) We have a reactance of +160 in parallel with $X_3$ (+160)

and this is in parallel with 230Ω

So $Z_1$ in Fig. 21.6 is 230Ω resistance in parallel with +80Ω reactance, just the right value to cancel the -80Ω $X_A$, leaving the 230Ω required.

Type 6
Both impedances complex comprising resistance and reactance in series.

The circuit of the matching network is shown in Fig. 21.7.
Let the higher value of resistance be designated $R_A$ and the lower value $R$ regardless of which is source or load.

(iii) Change $R_A$ and $X_A$ to parallel form $R_A'$ and $X_A'$.

(iv) Let $p = R_A/R$

(v) Let $q = 4(p-1)$

(vi) Determine $X_1 = +R_5 \times q$

(vii) Determine $X_2 = -(R_A'/q)$

(viii) Determine $X_3 = (-X_5) + X_1$

For a Type 6 example, we’ll match a complex impedance of 400Ω resistance and -60Ω reactance in series, to another complex impedance of 50Ω resistance and +100Ω reactance, also in series.

(i) $R_A = 400\Omega$ and $R_B = 50\Omega$

(ii) $R_A' = \frac{400^2 + (-60^2)}{400} = 409\Omega$

(iii) $X_A = \frac{400^2 + (-60^2)}{-60} = -2726.7\Omega$

(iv) $p = \frac{409}{50} = 8.18$

(v) $q = \sqrt{(8.18 - 1)} = 2.6796$

(vi) $X_1 = +R_5 \times q = +133.98\Omega$

(vii) $X_2 = -(R_A'/q) = -152.63\Omega$

(viii) $X_3 = (-X_5) + X_1 = -161.68\Omega$

The drawing Fig. 21.8, at the top of the next column, shows diagrammatically, these values determined above. The arithmetic then follows on underneath from there.

(i) Add $X_3$ to $X_5$:

$$+(33.98) + (+100) = +133.98\Omega$$

(ii) Find parallel equivalent of 50Ω resistance in series with +133.98Ω reactance:

$$R' = \frac{(50^2 + (+133.98^2))}{50} = 409\Omega$$

$$X' = \frac{(50^2 + (+133.98^2))}{+133.98} = +152.64\Omega$$

(iii) Find the value of the effective reactance of $X_4$ in parallel with $X'$:

$$\frac{(-161.68)(+152.64)}{(-161.68)(+152.64)} = +2730\Omega$$

So this gives us $R' = 490\Omega$ and $X' = +2730\Omega$ in parallel.

(v) Convert the 490Ω resistance and +2730Ω reactance in parallel to their series equivalents:

$$R = \frac{409(+2730)}{409^2 + 2730^2} = 400\Omega$$

$$X = \frac{409^2(+2730)}{409^2 + 2730^2} = +59.93\Omega$$

(vi) So $Z_{in}$ in Fig. 21.8 is 400Ω resistance in series with +59.93Ω reactance which is near enough to tune out the reactance of $X_A$ and provides the required match.

Next month we continue looking at the more complex impedance matching circuits.
### JUPITER RANGE

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The Morse Machine MM-3

The MM-3 is contained in a neat package, 51x196x120mm with input/output sockets on the rear face of the unit. The photograph shows the control keypad on the right and a panel displaying abbreviated commands on the left. It takes up the minimum of space, and being equipped with rubber feet, it sits firmly on the operating table while the controls are used.

The main features of the Morse Machine are:
1. Electronic keyer with speeds variable from 2 to 99 w.p.m.
2. 8000 character total memory capacity in up to 20 separate memories.
3. Morse trainer
4. Automatic serial number insertion and incrementing for contests
5. QSO simulator
6. Serial interface for personal contacts
7. Beacon mode facility

Electronic Keyer

The unit has a lot more going for it than others on the market. One frequent criticism of Morse sent by electronic keyers is that it sounds impersonal, too perfect, and soulless. Furthermore, in most keyers there is no provision for 'iambic' keying, where pressing the paddle lever to and fro. The MM-3 offers this facility and is able to perform the operation as the dots electronically and the dashes manually in the old way. The dot speed is set by the 'speed' control, and the dash by the index finger. This is the right handed convention and I, being left handed, was delighted to see that AEA had catered for me by allowing the paddle contacts to be changed around with a software command rather than by turning the paddle upside down. What attention to detail!

The MM-3 will allow those who use a bug key to have the benefit of having the MM-3 generate the dots electronically and the dashes manually in the old way. The dot speed is set by the 'speed' control or input via the keyboard. Furthermore (and this has not been possible in other units) the same style of keying can be loaded into the memories.

The more usual modern style of paddle keying is via a single or dual lever paddle. The convention being that the dot contact is activated by the thumb and the dash by the index finger. This is the right handed convention and I, being left handed, was delighted to see that AEA had catered for me by allowing the paddle contacts to be changed around with a software command rather than by turning the paddle upside down. What attention to detail!

I use 'iambic' keying, where pressing the contacts at the same time produces an alternate stream of dots and dashes. It means that letters such as 'C' can be produced with the minimum of finger movement. Other operators prefer not to use iambic and make a 'C' by pushing the paddle lever to and fro. The MM-3 can be put into any of these modes by a software command. Needless to say, AEA have recognised that once the operators preferences are loaded, the operator will want them there every time the unit is switched on, so data is held in battery backed RAM.

Going back to the original comment about the anonymous sound of electronic c.w., the operator can not only vary the ratio of dots and dashes to make the dots longer or shorter than they should be, but also decide if there is to be automatic spacing in between characters or to have the spaces dictated directly by the movement of the paddle. The big benefit of the MM-3 is that you can customise your code in every conceivable way. There is no other keyer on the market with such a wide range of user set options.

Other features that you would expect, such as selectable sidetone volume, etc., are there. Other nice touches such as being able to vary the sidetone frequency via the keyboard. Oh yes, the keyer sounds great on the air too!

Memories

A total of 8000 characters can be inserted into memory either from the paddle in the conventional way, or downloaded from a PC via the serial port. Although 8000 characters for more than one would normally ever need, there is a 'big chip' option available to take the memory up to 32K if required. The memory contents can be sent to 20 memory addresses in the battery backed RAM which can be recalled from the keypad. This can be useful for storing an entire contact including name, QTH, etc., or for storing and sending a long 'CQ DX'. AEA have not yet found a way of stopping the UB5s from replying!

Morse Trainer

The trainer mode sends randomly generated Morse characters for a predetermined duration, but in user selectable ways. You can select increasing, decreasing or constant speeds as required. There is also the option to send the characters in 'Farnsworth' mode where if the practice is at 12 w.p.m., the individual letters will be sent faster than that, but the spaces between the exaggerated - the overall speed being 12 w.p.m. Many people find it easier to learn code by the Farnsworth method and convert to conventional spacing later.

The default setting for the trainer contains the character set used for the USA FCC code test. The content goes beyond the UK test as punctuation is included. In addition letters, numbers and
punctuation signs are all mixed into the practice generated. For the 'experts' there are two more advanced character sets containing such gems as the Swedish 'A', the Spanish 'N' and the dollar signs (the Morse is ...-. etc. Just the job for a wet evening when the bands are awful).

Via the serial port, the MM-3 can be used to echo the practice Morse the trainer sends, or to reproduce your own sending practice on screen. The unit is extremely versatile, catering for the full range of needs between the beginner and the c.w. expert who wishes to check his receiving speed capability.

Contest Keyer

In most c.w. contests the contest exchange consists of the RST plus serial number, zone number, etc., or a combination of all three. Part of being a successful c.w. contestor is down to finding time in between the contacts to check on the multipliers worked, work up the log and check for duplicates whilst running the pile ups at maybe 200 QSOs per hour. To do so without the aid of an electronic keyer is just about impossible. The designers at AEA have created a practically real live contest keyer, as they have allowed the format of the serial number to be tailored to the operators preference. In case readers think that much is being made of a small point here, the issue of what constitutes the best format of the contest exchange always causes lively debate among the contest fraternity, but they all agree that they would like a means of tailoring the exchange to their exacting needs. The MMM-3 makes this possible.

QSO Simulator

Amateurs who pass the Morse test often have every intention of using the code on the air, but then find out:

(a) that letters and numbers are all jumbled up together confusingly and that other amateurs are using weird abbreviations like 'BCNU' instead of "I'll see you" and so on.

(b) that instead of a nice clear signal coming across from a practice oscillator, there is terrible QRM and ARN and it is a problem to copy anything.

(c) What's the point as everything else is going far too fast anyway.

In the circumstances many give up, and are lost forever in the world of telephony, never to discover the delights of the code.

The MM-3 has all the answers! As well as the virtually real live contests, there is an excellent user handbook containing a glossary of amateur abbreviations, there is an amazing user mode where you can conduct simulated QSOs at your preferred speed, without ever going on the air.

Putting the Morse Master into user mode, you are invited to either simulate contacts, to call CQ or answer other calls.

Not quite believing it, I programmed the MM-3 to send replies to me at a maximum speed of 30 w.p.m.

This is what happened:

   YDX - QSO CQ CQ DE GW3YDX GW3YDX PSE K
   MM-3 - GW3YDX DE WSYSA WSYSA AR
   WSYSA DE GW3YDX BT GM OM BT TXN FER CLO BT HR NAME IS RON BT BACK TO YOU BU YDX
   MM-3 - GW3YDX DE WSYSA BS RON MISSED SOME OF THAT BT DIDNT GET MY RST OR UR QTH BT UR RST 589 589 ES QTH PORT ARTHUR, TXN BT NAME IS NORM NORM BT SO HWY GW3YDX DE WSYSA K
   YDX - WSYSA DE GW3YDX BT PSE UR NAME AGN? WSYSA DE GW3YDX K
   MM-3 - GW3YDX DE WSYSA BS RON HAD QRMM BT ISSED QTH AND RST BT HR NAME IS NORM, RIG IS TEN-TEC ARGOSY......

Aside from the absence of QRM it is all very real-sounding. As well as being the ultimate answer to all TVI problems, the QSO simulator allows you to practice at your own speed and to become familiar with the abbreviations in the 48-page handbook which will allow the novice to learn the all as they are sent in the QSO simulator module.

All the calls in the simulator are from the USA. In two weeks of testing, I did not find any repeated call signs and nearly worked all states without switching the rig on!

Serial Interface

The principal use of the serial interface will normally be to echo practice characters on the screen. However, it can also be used to control the keyer and the memories from a home computer keyboard.

The serial ports can also be connected to a packet TNC, so that the ASCII which would normally go to the computer, is converted into c.w. It was very strange to hear packet signals coming from the local BBS, and slowed down to a speed one can copy. This facility offers blind operators the possibility of copying packet transmissions without an expensive ASCII to speech converter, although the Morse Machine is not the total answer, as v.h.f. 1200 baud packet will result in very fast c.w. - indeed if it is converted directly to c.w! The converted ASCII is of necessity only what is translated within the MM-3 buffer.

Beacon Mode

In some areas of communication, such as meteor scatter or moonbounce, it is desirable to send for a fixed period and then receive for a fixed period. The MM-3 incorporates an internal timer to allow the user to do this.

I thought that would be jolly useful for contests when there is a dead period - usually in the middle of the night - when one calls CQ with very few replies. Unfortunately, to return to normal memory mode it is necessary to press several buttons to get it back there and, after sending a serial number with the auto incrementor you have to press several buttons to get back into beacon mode. Using the beacon in a contest to call CQs every 15 seconds for instance is unfortunately not of benefit for that reason. Nevertheless, the beacon mode is useful for some special modes as detailed previously, and indeed for beacons.

Overall Verdict

The Morse Machine is a well conceived, easy-to-operate and user friendly piece of code wizardry. It is not cheap at £169.95, but one has to consider it against other equipment on the market and see what it has to offer. There is nothing currently available which has all the MM-3 has, and even the outline of its facilities given here is far from exhaustive. Given the superb contest facilities and the big memory capacity, the unit is strongly recommended for those reasons alone. For the new amateur who is learning the code and who intends to stick with it, the Morse Machine is a very good buy.

The Morse Machine is available from ICS Electronics Ltd., Unit V, Rudford Industrial Estate, Ford, Arundel, West Sussex BN18 0BD. Tel: (0903) 731101.
Printed circuit boards for Practical Wireless constructional projects are available from the PW PCB SERVICE. The boards are made in 1.5mm glass-fibre, and are fully tinned and drilled. All prices include postage, packing and VAT for UK orders.

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The HEMT - A very high performance microwave device

In many cases it is important that these very low noise amplifying devices used should be able to provide a low noise performance in room temperature operation so as to avoid the need for a supply of liquid nitrogen or even liquid helium. The microwave m.e.s.f.e.t. (metal semiconductor f.e.t.) in gallium arsenide has met such needs for some years, as it provides excellent characteristics for low noise amplification at frequencies up to about 20 GHz or even more.

HEMT/MESFET Comparison

After the introduction of a special type of f.e.t. known as the h.e.m.t. (high electron mobility transistor) in 1979, the microwave world has found this device to be an increasingly attractive competitor to the m.e.s.f.e.t. The h.e.m.t. is especially useful at frequencies of the order of some tens of GHz where the limitations of the m.e.s.f.e.t. became more apparent.

The structure of the h.e.m.t. is basically similar to a m.e.s.f.e.t. in which an improved performance is obtained by specially formed layers of more than one type of semiconductor material. Thus h.e.m.t.s are more expensive to produce than m.e.s.f.e.t.s and are therefore unlikely to displace them at frequencies of a few GHz or less unless noise considerations are exceptionally critical.

One of the most important parameters affecting the performance of both m.e.s.f.e.t. and h.e.m.t. devices is the gate length (typically a fraction of a micron). It is very difficult and costly to fabricate devices with the extremely short gate lengths required for optimum low noise performance at the highest frequencies. The cost of such high frequency devices is increased further because the proportion of short gate length devices in each batch which have to be rejected is greater than in the case of devices with longer gates for lower frequencies. At the present time, state-of-the-art gates 0.25 μm in length can be produced by electron beam lithography; this involves the use of an expensive machine which takes time to write each individual device pattern. The price for h.e.m.t.s are currently of the order of a few tens of pounds per device.

The more expensive devices are therefore reserved for applications where very low noise performance is required at the highest frequencies. In general the performance of a h.e.m.t. with a 0.5 μm gate length is comparable with that of a gallium arsenide m.e.s.f.e.t. of half the gate length.

A further advantage of the h.e.m.t. over the m.e.s.f.e.t. is its lower power dissipation which can be of considerable importance in some satellite communications applications.

HEMT devices are now available commercially, especially from various Japanese manufacturers. Fujitsu of Tokyo originally developed the h.e.m.t. and owns the name 'h.e.m.t.' in Japan, but some others have marketed the devices as 'hetero-junction f.e.t.s'. Other names for the h.e.m.t. include the m.o.d.f.e.t. (MODulation doped f.e.t.), the t.e.g.f.e.t. (Two dimensional Electron GaAs f.e.t.), the h.i.f.e.t. (Hetero-Interface f.e.t.) and the s.d.h.t. (Selectively Doped Heterostructure Transistor).

Construction

The h.e.m.t. structure is basically similar to that of a m.e.s.f.e.t. and involves a source, a drain and a Schottky gate. Although the gate potential regulates the current flow between the source and the drain as in a m.e.s.f.e.t., it is the difference in the layers of the underlying semiconductor materials which distinguish the h.e.m.t. from the m.e.s.f.e.t. and which provides its improved performance.

The construction of a typical h.e.m.t. device is shown in Fig. 1. It contains a lattice-matched hetero-junction between two compound semiconductors (often gallium arsenide and gallium aluminium arsenide). The crystal lattice must be closely matched to minimise lattice strain, aluminium gallium arsenide having a lattice spacing within 0.1% of that of gallium arsenide. Extremely abrupt hetero-junctions can be grown by such techniques as molecular beam epitaxy (m.b.e.).

Electrons from the donor silicon atoms in the aluminium gallium arsenide layer can move through the crystal until they fall into the lowest available energy states. In the h.e.m.t. device these energy states are in the gallium arsenide close to the hetero-junction interface.

This results in the accumulation of electrons in an extremely thin layer which has a thickness of less than 10nm. The electrons are said to form a two dimensional electron gas. Thus the h.e.m.t. is a quantum semiconductor device. There are no donor atoms intentionally present in the undoped gallium arsenide layer, so the electrons in the two dimensional electron gas do not undergo impurity scattering.

High Mobility

Therefore they have a greater mobility than electrons in a piece of bulk gallium arsenide, namely about 6500 cm²/V-s at 300K, corresponding to a velocity of about 2 x 10⁷ cm/s. This is about twice the mobility of electrons in a m.e.s.f.e.t. (Mobility is the speed at which they move under a given electric field). In a h.e.m.t. cooled in liquid nitrogen, the mobility increases to some 80 000 cm²/V-s (depending on the epitaxial structure).

The gas forms because of the greater affinity of
the electrons for the positive undoped gallium arsenide layer. The two dimensional gas forms the carrier channel between the transistor source and the drain. The low noise of the h.e.m.t. relative to a m.e.s.f.e.t. of similar gate length is believed to be due to the two degrees of freedom of the electron in a h.e.m.t. as compared with three degrees of freedom in the m.e.s.f.e.t. Thus there is less random motion of the electron flow in a h.e.m.t. and this leads to less noise.

The mobility of the electrons may be further increased by employing a thin layer of undoped aluminium gallium arsenide adjacent to the hetero-junction interface. This layer provides more separation between the electron gas and the ionised centres which scatter the electrons and therefore reduce their mobility.

The structure of the h.e.m.t. produces not only higher electron mobility, but also a higher sheet carrier density (of the order of $1 \times 10^{12}$ per cm$^2$) and a higher saturation velocity. These factors result in the h.e.m.t. having a higher transconductance and a lower noise figure than gallium arsenide m.e.s.f.e.t.s with comparable gate lengths.

The Gate

A Schottky barrier gate, implanted on top of the doped layer, is used to control the number of electrons in the two dimensional channel via depletion or enhancement. A bias applied to the Schottky barrier gate can be used to modulate the number of electrons in the channel and hence can control the conductivity of the device.

In contrast to the operation of the normal f.e.t., the width of the channel remains fairly constant in a h.e.m.t., but the number of carriers present is modulated. Hence the alternative name of m.o.d.f.e.t. for the h.e.m.t. Electrons in a h.e.m.t. move in the very thin layer, travelling parallel with the hetero-junction interface.

It is possible to manufacture both enhancement and depletion mode h.e.m.t. devices by suitable gate metallisation, layer thicknesses and doping levels. A feature which renders h.e.m.t.s particularly attractive for the future is their planar structure, which should enable them to be easily made by conventional silicon v.l.s.i. processing methods.

As in other high frequency f.e.t. devices, it is essential to employ a very short gate length to obtain low noise at high microwave frequencies.

One might expect a still better performance from h.e.m.t.s at low temperatures, since the two dimensional electron gas mobility at 77K is about 60 000cm$^2$/V-s. Unfortunately, low temperature h.e.m.t. performance is affected by deep electron traps.

Performance

The noise figures of h.e.m.t. devices manufactured by Toshiba are compared with some of the company's m.e.s.f.e.t. in Fig. 2. It can be seen that the h.e.m.t. devices generally offers a lower noise figure than m.e.s.f.e.t. devices at the same frequency. The S8902 and the S8901 have gate lengths of 0.3$\mu$m and the S8900 is 0.25$\mu$m.

Although the h.e.m.t. devices will operate at higher frequencies with lower noise than the corresponding m.e.s.f.e.t. devices, h.e.m.t.s are more costly and their short gate length necessitates a reduced power handling capability. Toshiba is hoping to develop indium gallium arsenide h.e.m.t.s with noise levels about 0.6dB at 12GHz, but they are not expected to be available until later this year.

Fig. 2: The noise figures of Toshiba h.e.m.t. devices

Fig. 3: Noise and gain figures
Performance; it allows thin semiconductor layers to be built up with very precise thickness. The gate, the source and the drain are added later by conventional photolithographical techniques. The indium gallium arsenide layer is unnaturally compressed, leading to the name pseudomorphic h.e.m.t. The indium gallium arsenide forms the two dimensional electron gas channel instead of gallium arsenide. The m.e.s.f.e.t. is the main factor in achieving ultra-low noise figures, (where the gain is unity), was determined by extrapolating the measured gain at 60GHz (11.5dB), assuming the normal 6dB/octave roll off.

Sony’s h.e.m.t. devices are aimed not only at commercial applications such as 4 and 12GHz satellite signal reception, but also at communications and other applications at Ku band and above. The two models are available in both chip and packaged form.

The very high performance of discrete h.e.m.t. devices will eventually be incorporated into economical microwave modules, hybrid devices and monolithic microwave integrated circuits (m.m.i.c.s). As long ago as 1983, Fujitsu announced the integration of a few h.e.m.t.s into a single device and in early 1984 produced a 4K static RAM with access times only a small fraction of those of other gallium arsenide or silicon devices. In January 1986, a 256 bit Fujitsu h.e.m.t. memory containing 2072 h.e.m.t. devices became the first digital h.e.m.t. ic. to be marketed; it is designed for operation at -196°C, but has a 1.5ns access time. In 1985 this manufacturer announced that a four-stage 19GHz h.e.m.t. amplifier was operating at liquid nitrogen
Temperature in a Japanese satellite as part of a communications link.

The Japanese have had a national plan which aimed to produce a scientific supercomputer based on h.e.m.t. devices by 1989. It was predicted that it would out-perform even the projected Cray computers.

Monolithic Microwave i.c. (m.m.i.c.) devices using h.e.m.t.s are still in the laboratory stage, but progress is currently being reported on such devices as traveling wave m.m.i.c. amplifiers, especially for military applications. Workers at Varian in Santa Clara, USA report an improvement in microwave amplifier noise figures of about 1dB when h.e.m.t.s are used instead of m.es.f.e.t.s in m.m.i.c.s for the upper microwave frequency range of 12 to 20GHz with smaller improvements down to 2GHz. The greater gain available from h.e.m.t. devices also contributes to the overall performance of these m.m.i.c.s.

It has been suggested that the availability of the h.e.m.t. with switching times of less than 10 picoseconds has been largely responsible for the winding down of intensive research on superconducting computers using Josephson junctions. HEMT switching speeds at the temperature of liquid nitrogen can be greater than that of Josephson superconducting junctions at liquid helium temperatures. However, the new high temperature superconducting materials may eventually change this position.

**Conclusion**

The availability of h.e.m.t.s has enabled a comparable performance to be obtained at millimetre wavelengths to that previously obtainable at much lower GHz frequencies. Although Japanese and a few US companies have been prominent in the h.e.m.t. market, it seems the number of manufacturers of these specialised products will be quite small unless the market takes off in some unexpected way.

Only large companies, with extensive research facilities, and advanced semiconductor processing equipment can sensibly enter h.e.m.t. manufacture. The h.e.m.t. manufacturing technology can also be employed for creating lasers on an i.c. High frequency quantum-well devices which depend on tunnelling through thin barriers are expected to provide a challenge to the h.e.m.t.

**Integration of HEMTS**

HEMT devices are attractive for integration into m.m.i.c. devices (monolithic microwave i.c.s), since the resulting m.m.i.c.s may have reduced i.c. size, improved receiver performance and an extended frequency of operation even into the mm wave region.

It has been estimated that the advance of h.e.m.t. integration into operational systems is increasing by a factor of four each year. A number of monolithic circuits incorporating h.e.m.t. devices have been developed in the past few years which provide excellent gain and noise figure performance (see Table 1).

HEMTs are being used in military equipment (both hybrid and monolithic products). They are very suitable for electronic warfare application in the 2 to 40GHz frequency range, for phased array X-band radar applications, for 35GHz smart munitions, and also for the US Military satellite programme using a 20.7GHz downlink and a 44.5GHz uplink with a 60GHz satellite cross-link band.

There is intense interest in the development of more advanced m.m.i.c.s utilising h.e.m.t. devices. Improvement in the materials and in the process technologies (leading to shorter gate lengths and mushroom gate profiles) are resulting in work on the development of monolithic h.e.m.t. low noise amplifiers for frequencies up to 100GHz. Various manufacturers are also developing power i.c.s using h.e.m.t.s for the mm wave region of the spectrum; advanced material structures such as a pulse-doped h.e.m.t. device or multi-channelled h.e.m.t.s can be used in such products.

Digital applications are expected to greatly intensify the importance of h.e.m.t.s during the 1990s. Details of the first digital h.e.m.t. i.c. became available in January 1986 when Fujitsu released details of its 256-bit h.e.m.t. memory. It includes 2072 h.e.m.t. devices and provides an access time of 1.5nanoseconds at -196°C. The same company developed the fastest 1Kbit static RAM with an access time of 0.85nanosecond at -196°C (1.5 times faster than any silicon i.e. on the market).

It has been forecast that h.e.m.t. technology will gain most attraction from large digital systems, such as mainframes and supercomputer manufacturers. Another area for development is that of telecommunications where h.e.m.t.s may play a very important role in the future. The technology used for h.e.m.t. fabrication can be used to create lasers on the same i.c. Instead of installing more optical filters in fibre optic systems, lasers emitting different wavelengths could be fabricated on i.c.s to increase the number of circuits which can be carried by a fibre optic pair.

**Table 1: Monolithic i.c.s containing h.e.m.t. devices**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Frequency (GHz)</th>
<th>Noise Figure (dB)</th>
<th>Gain (dB)</th>
<th>IC Area (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen. Electric</td>
<td>7.5 - 12</td>
<td>2.4</td>
<td>12 - 18</td>
<td>1.7 x 2.54</td>
</tr>
<tr>
<td>Thomson-CSF</td>
<td>9.5</td>
<td>-</td>
<td>5</td>
<td>0.85 x 1.8</td>
</tr>
<tr>
<td>TRW</td>
<td>43 - 45</td>
<td>5</td>
<td>5.5</td>
<td>1.25 x 1</td>
</tr>
<tr>
<td>Varian</td>
<td>2 - 21</td>
<td>3</td>
<td>12</td>
<td>2.3 x 1.7</td>
</tr>
<tr>
<td>Varian</td>
<td>20 - 40</td>
<td>5</td>
<td>6</td>
<td>2.2 x 1.1</td>
</tr>
<tr>
<td>Varian</td>
<td>3 - 40</td>
<td>4</td>
<td>6</td>
<td>2.4 x 0.9</td>
</tr>
<tr>
<td>Varian</td>
<td>23 - 25</td>
<td>-</td>
<td>10</td>
<td>2.0 x 1.1</td>
</tr>
</tbody>
</table>
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The UK's favourite discone composed of traditional British quality engineering. The REVCONE works well without exaggerated advertising claims. It is designed to cover 50 to 500MHz, and thousands of satisfied users will testify to its efficiency. Unlike some manufacturers 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 discone. We do not want to give you the 'hard 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 coaxial feed, which is the case if the whip is mounted at the base of the feeder. On the other hand, the die-cast box version requires no special installation and is readily taken out of circuit. The masthead model is supplied with a special power unit which feeds the DC supply into the antenna feeder. No PSU is provided for the PA31 as this vertical whip is optional and is available separately. The PA31 finds application in instrument work, e.g. input to spectrum analysers, boosting the output from signal generators to give a low-power TX.

The standard version of the P31 has BNC sockets and is designated "PA31/N". It is supplied with coaxial feed. A special feature of the PA31 series is a high-pass filter in the input circuit. The PA31 is specified for use with 5-15V DC power supplies, and a low-pass filter is necessary to attenuate frequencies below 20MHz; high-power HF & MF broadcast stations can be very troublesome!

The P31 Masthead, with PSU: PL259 £29.95, N-type £35.95

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£199

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**PACKET RADIO FROM THE SPECIALISTS!**

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**ATARI ST R8232 lead...£9.95**
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**4 way R232 switchbox...£24.95**
**SPECTRUM 48K TNC interface...£14.95**
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Imagine coming into the shack in the morning and checking the Private Mail Box of your packet station to find mail from friends in the USA, Australia, South Africa or even from just across town. Used properly, it can be the outlet to the world for lots of amateurs with antenna restrictions for example, or for an amateur constantly moving around on business, the complete packet station can be contained in a brief-case. How does all this work? What do I need? How much does it all cost? Read on and find out.

The packet station can be split into three parts. First you possibly already have the radio equipment, a transceiver, tuned to 144.650MHz, the most common v.h.f. packet frequency. You probably also have an antenna to go with the transceiver. Secondly, a TNC, that's a Terminal Node Controller. This is the packet equipment which provides packet assembly and disassembly, together with modulation and demodulation functions. Thirdly the terminal equipment, a computer being the most common, using a terminal emulator program.

The terminal equipment can be a dedicated terminal, such as a v.d.u., a Video Display Unit, with a keyboard and RS232 interface. If it is used solely as a display unit, with basic input and output functions it is known as a dumb terminal. If it has other support functions, it is known as an intelligent terminal. However, most amateurs use a computer these days, with a program enabling them to "emulate" a terminal. There are numerous micro-computers available to suit most pockets and there is usually a communications program available to enable it to be used on packet.

The TNC has seen lots of major advances since the days of the old TNC1 from TAPR (Tucson Amateur Packet Radio-corporation). There are TNCs that are designed for v.h.f. (1200 baud) working, such as the Tiny 2. This unit also has its own personal mailbox. There are TNCs with modems suitable for either v.h.f. 1200 baud or h.f. 300 baud operation, such as the TNC200. Then there is the sophisticated all-mode Tiny 2. This unit also has its own personal mailbox. There are TNCs that are designed for v.h.f. (1200 baud) or h.f. 300 baud operation, such as the TNC200, baud rates are normal. The radio port baud rate is 1200 for v.h.f. and 300 for h.f. In the case of the TNC200, baud rates are selected by DIP switches. This MUST be done with the TNC switched OFF. If in doubt, always adopt the RTM technique (Read The Manual). Having set the baud rates correctly, you should have a sign-on message on the screen at switch-on. For example, the TNC2 sign-on message is in Fig. 2.

Parameters

Modern TNCs have well over 100 parameters, each of which has to be set correctly in order for the TNC to perform properly. Having said that, the default settings of a large percentage will be OK for a start. Parameters can be classified into several different groups:

- **Character commands** - These select the special alphanumeric characters used by the TNC for various functions.
- **Identification commands** - These determine how a packet radio station is identified.
- **Link commands** - These relate to functions and parameters used in communications with other stations.
- **Monitor commands** - These relate to the

Figs 1 & 2

**Computer RS232 connections.**

- **Pin 2 Transmit Data** - This line is the serially transmitted data from the terminal to the TNC.
- **Pin 3 Receive Data** - This line is the serially transmitted data from the TNC to the terminal.
- **Pin 4 Request To Send** - This line tells the TNC that the terminal is ready to receive data. An ON level tells the TNC it may send data while an OFF level tells it to stop sending data.
- **Pin 5 Clear To Send** - This line tells the terminal whether or not to send data to the TNC. An ON level tells the terminal it may send data while an OFF level tells it to stop sending data.
- **Pin 7 Ground connection.**
- **Pin 8 Data Carrier Detect** - This line is an input from the TNC indicating connect status of the unit.

The sign-on message from the TNC.

AX.25 Level 2 Version 2.0.
Release 1.1.4 11/13/86 - 32K RAM.
Checksum $21

Packet - the Mode for the Nineties.
Packet has been around for several years now, but there is always an influx of newcomers, sufficient to warrant another educational article. It seemed a suitable time, coincidental with the new format of Practical Wireless, for Roger J. Cooke G3LDI to produce such an article.

Audio and swamping takes place, the result is no copy. Padding networks may be necessary in stubborn cases. The RS232 connection is normally described in the TNC handbook. You should check this carefully also because the RS232 standard is not always "standard". However, normally only five connections are needed, given in Fig. 1.

**Switching On**

Having connected the equipment together and double-checked the wiring, it's time to switch on. However, don't expect everything to be fine after that. There may be incompatibility between the TNC and the terminal or the TNC and the rig, or at worst, all three! The first thing to check is the terminal, or serial port, baud rate. A data rate here of 4800 bauds is normal. The radio port baud rate is 1200 for v.h.f. and 300 for h.f. In the case of the TNC200, baud rates are selected by DIP switches. This MUST be done with the TNC switched OFF. If in doubt, always adopt the RTM technique (Read The Manual). Having set the baud rates correctly, you should have a sign-on message on the screen at switch-on. For example, the TNC2 sign-on message is in Fig. 2.
monitoring of packets and also the status of the TNC.

**Re-initialisation commands.** - Exactly what it says.

**Port commands.** - These configure the port connected to your computer.

**Timing commands.** - These adjust the various TNC timing parameters.

An immediate command instructs the TNC to perform an immediate task, such as connecting, disconnecting etc.

A configuration command sets the TNC parameters.

Configuration commands that have to be set from the start are as follows:

- **MyCall** - An obvious one, to be set to your callsign.
- **Frack** - This will have to be determined by experiment, normally between 1 and 4.
- **Maxframe** - Set it to 1.
- **Paclen** - On v.h.f., if you do not speed up, set it to 0 (256). On h.f., if you have a good link, 250 is about the maximum, although the vagaries of h.f. propagation can easily take their toll, so 60 is about average.
- **TXDelay** - Depends on your rig, determine by experiment.
- **Retry** - Normally about 10 to 15. Make sure you never leave it on 0 as it could be embarrassing!
- **Echo** - If you don’t see what you type, set it to “ON”.

If you see two of what you type, set it to “OFF”.

**Monitor** - There are several different levels of monitoring on most modern TNCs so read the manual to determine what suits you.

---

### Table of Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A(BORT)</td>
<td>Send during long list to stop</td>
</tr>
<tr>
<td>B(YE)</td>
<td>Use to sign off from the BBS</td>
</tr>
<tr>
<td>D(OWNLOAD)</td>
<td>Download a file in the file directory, e.g. D USER.DOC. See W to get list of files</td>
</tr>
<tr>
<td>H(ELP)</td>
<td>A brief help file</td>
</tr>
<tr>
<td>I(NFORMATION)</td>
<td>Information on the mailbox</td>
</tr>
<tr>
<td>J</td>
<td>Lists recently connected stations</td>
</tr>
<tr>
<td>K(ILL)</td>
<td>Kills messages. For example: KM = Kill mine. K XXXX = Kill number XXXX</td>
</tr>
<tr>
<td>L(IST)</td>
<td>Lists messages. For example: LM = List mine; L XXXX XXXX = List from XXXX to XXXX</td>
</tr>
<tr>
<td>L&gt;c/s</td>
<td>List to a callsign; L! text</td>
</tr>
<tr>
<td>L&gt;Text</td>
<td>Searches all subject areas for text string; L text</td>
</tr>
<tr>
<td>L(!)</td>
<td>List all since last time; L XXXX XXXX</td>
</tr>
<tr>
<td>R(EAD)</td>
<td>Reads Messages. For example: RM = Read mine; R XXXX = Read message XXXX</td>
</tr>
<tr>
<td>S(END)</td>
<td>Send a message. For example: SP G4GBA = Send a personal message to G4GBA; SP G4GBA @ GB7XM = Sends a message to G4GBA at GB7XM. BBS (works to all BBS worldwide!); SB ALL @ ENET $ = Sends a bulletin to all BBS in Eastern Anglia; SB ALL @ GBR $ = Sends a bulletin to every BBS in GB; So use sparingly!</td>
</tr>
<tr>
<td>T(ALK)</td>
<td>Talk to the Operator</td>
</tr>
<tr>
<td>U(LOAD)</td>
<td>Upload a file to the Files area</td>
</tr>
<tr>
<td>V(ERSION)</td>
<td>Gives version of BBS in use. If used with a message number gives read of all the headers etc. V XXXX</td>
</tr>
<tr>
<td>W(HAT) ?</td>
<td>List directory of the file area ? followed by first letter gives a detailed help message of the command e.g. W ? Please remember: Advertisements or For Sale notices are against your licence and mine. They will be deleted if I catch them. You may see others using them, but don’t be tempted.....</td>
</tr>
</tbody>
</table>

---

**Fig. 3**

---

**Operating**

Having put the basic station together, with the transceiver on 144.650MHz, you should see packets appearing on the screen. One way of announcing your presence to the packet world is to put out a beacon. This is easily done by setting two more parameters. First the beacon text. All that is needed is something like “G9ZZZ, Fred in Anytown”. Then set the beacon timing to something sensible. Refer to the manual again and make sure that you set the timing for AFTER 10 minutes, or whatever interval you choose. Less than 10 minutes is unnecessary and setting the beacon to EVERY instead of AFTER is unsociable. Using AFTER makes sure that the beacon is not transmitted until that interval has passed with no link activity. This ensures that no collisions take place.

**BBS and Node Use.**

Having connected the equipment successfully, watching the screen will identify your local BBS station. If there are several, pick the one that has the best signal and make that your “home BBS”, the place where you pick up your mail. If you can connect direct, fine, if not you may have to use the local repeater or node. To do this, simply issue a connect request to the repeater, C G8XXX, for example and then wait for the “Connected to G8XXX” message. Then issue another connect request, C GB7XXX, to connect to the BBS. You will then receive a sign on message which will invite you to give your name, so that you will be recognised in the future. Just type N Fred to tell it your name. You will need to become familiar with the command structure of the BBS, the different types are mostly compatible, so try typing H to get some help. This will point you in the direction of a help file which can be downloaded and printed out for reference. The complete documentation on BBS operation is about 28k long, so if you want this, make sure you download it in a quiet period! A help file is given in Fig. 3.

Some general rules to follow when using a BBS.

1. Always kill your mail after reading it, download it to your system if you want to keep it.
2. Never send an advertisement of any kind. Most sysops will kill it on sight as they contravene our Notice of Variation (BBS licence).
3. Don’t send frivolous, racist or contentious messages. They will likewise be killed.
4. Don’t use the BBS system as a soap-box, exchange and mart, or comic strip. If you have a bone to pick with anybody, do it on the land-line. The BBS is NOT a gossip column. ALL such messages are killed on sight on my BBS.

In other words, please use the system thoughtfully. Sysops spend a lot of time editing and maintaining their systems for your benefit. They have also spent vast sums of money on the equipment needed to run a busy BBS so they will not take kindly to abuse of any kind. So, before you issue a message such as SB ALL @ GBR, which means that all the BBS systems in the UK will receive it, ask yourself if that address is right, could it have been @ Local, or just a private message? Having said that, most sysops will help in any way they can, so don’t be afraid to ask if you are not sure how to address mail or use some of the many features of a BBS. There is a lot of information tucked away in the directories and the system exists for your enjoyment.

73 and happy packeting.
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£139
(N-Type £159)

ARA 30
£129

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

TECHNICAL SPECIFICATIONS
Noise Figure
1dB at 50-180MHz
1.5dB below 300MHz
2.0dB below 350MHz
2.7dB below 400MHz
3.0dB below 500MHz
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4.6dB below 1300MHz

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Intercept Point
3rd Order: +18dBm at Input
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ARA 30 ACTIVE ANTENNA
50MHz ... 400MHz 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 multi-receiving systems. £129. See Review in August 1985 issue p.35

£129

Both antennas come complete with 7 metres of cable, interface, power supply and brackets. Dressler preamps available.

Also a wide range of masthead pre-amps available for most V.H.F. and U.H.F. frequencies, including scanner pre-amps from £39.

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INCLUDING ARA 900(N) £399

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INCLUDING ARA 30 £99

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KENWOOD R5000 £799
VC5000 Converter £180
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TS340 inc Auto ATU inc. Microphone £1,150
TS240 inc Auto ATU £2,200
TS160 Dual Band £1,479
TM622 2m TX/RX £1,679
NEW TM 791 New Mobile Dual Band £1,759

FRG 9600 £475 FT747 GX £599
FRG 9600M £799 FT747 MKII £845
FRG 8800 £545 FT 240, 410, 4700, 875
FT7900 £119 + All YAESU Available

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153kHz-29.995MHz
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INC PSU, CARRY STRAP & EARPHONE

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Sony ICF 7600DS + FM Stereo £239
Sony ICF 7600DS FM Antenna £79
Sony ICF 7600DS + FM Stereo £299

SONY ICF 7600DS £159
SONY ICF 7600DS FM Antenna £79
SONY ICF 7600DS FM Stereo £239
SONY ICF 7600DS + FM Stereo £299

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C150 2 MTR £320
C528 DUAL BAND £379

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Practically Yours
Glen Ross G8MWR

Simple Answer

What is needed is a system where the average levels are brought up more closely to the peak levels, and the peaks are held below the level at which overdriving would occur. One of the easiest ways to do this is by using a clipper circuit in which the audio peaks are literally cut down to size. The problem with this type of unit is that the resulting waveform tends to be a square wave and this itself needs further treatment before it can be used to modulate the signal.

RF Clipper

In an r.f. clipper system, the audio from your microphone is used to modulate a transmitter in the processor box and the peaks of this r.f. signal are then clipped. The clipped signal is then demodulated and the recovered audio is used to modulate your rig. This has several advantages over the audio clipper system in that there is little distortion involved and the clipping level can be set to as much as twenty or thirty decibels with reasonably acceptable results. The big problem from the home constructors point of view is that it is expensive to build and none too easy to set up correctly without a lot of test gear.

A Solution

Is there a way round these difficulties? The answer is yes. The third way of controlling your audio is to use a system of automatic gain control. In this type of unit, the gain of a pre-amp stage is controlled by a voltage which is derived from the incoming audio signal. The higher the audio level, the greater is the control voltage which is fed back to the pre-amp and reduces the circuit gain. By this means it is possible to get a sensibly constant output from a input signal which varies over a 60dB (1000 000:1) range.

Tailoring

As well as getting more effective modulation levels, it would also be nice if we could adjust the frequency response of the modulation system to improve readability. Most of the information in the human voice is contained in the range 300 to 3000Hz, yet most modulation systems have a much wider bandwidth than this. Because the lower frequencies tend to contain most of the power, your signal is being heavily modulated with unwanted voice frequencies which add nothing to the readability. It is also true that a signal which is top heavy tends to cut through the QRM and gives you more punch.

The Answer

Is there a simple way of putting all these things together in a simple circuit? Again, the answer is yes. Plessey produce an i.c. known as the SL6270 which will give all the facilities we need and what is more it is very cheap. Referring to Fig. 1, the resistor R1 is used to provide a reasonable impedance match for the average microphone, the single ended input of the i.c. being around 150Ω. Resistor R6 allows the input level to the i.c. to be adjusted. A certain amount of low frequency roll-off is provided by the capacitor C1, but most of the audio tailoring is done by C4 and 5.

Roll Off

Capacitor C4 is in parallel with an internal resistor and increasing its value will decrease the h.f. roll-off point. Capacitor C5 is a coupling capacitor between two sections of the i.c. and reducing its value will raise the frequency of the low frequency roll-over point. As listed the components give roll-over points at about 300 and 3000Hz, but these components can easily be altered to suite your own requirements. The gain of the system can be adjusted over a wide range using R7 and the resistor R3 must be included to maintain the minimum allowable resistance between pins 2 and 8. The attack time and the decay rate of the system are set by C3 and R2, connected to pin 1.

Response Times

As shown, the attack time of the circuit is fairly fast at 20ms and the a.g.c. decay is set at 20dB per second. These values avoid the bumping effect which is obtained if the attack and, more especially, the decay times are too short. The settings can be changed over a wide range by suitable choice of these components, but those used in the circuit should suit most requirements. The final variable setting is R8, which is used to control the output from the unit to the rig.

Construction

There is nothing special about the construction except that, to avoid hum pick-up, the unit needs to be well screened. Veroboard and a die-cast box would fit the bill pretty well. The actual component layout is very much as shown on the circuit diagram. The power supply requirements are only a few milliamps at 6V. This could be obtained from a built-in battery or, as shown in the circuit diagram, by using a dropper resistor and a Zener diode from the station’s 12V supply.

Setting Up

The unit can be set up without the need for any test gear, you simply need someone to listen to your
signal at a few kilometres distance. Insert the unit into the microphone line and set R6 and R8 to about mid position, with R7 set to the maximum resistance point. First, adjust R6 until high ambient noise is reported to have gone. Now, whilst speaking into the microphone at your normal speech level, adjust R8 until distortion just sets in. When this happens reduce the value of R8 slightly to clear the distortion and the job is done. If these adjustments cannot be accomplished, try altering the setting of R7 and run through the whole procedure again until the desired results are obtained. Now you come to the interesting bit! Having obtained a selection of "on air" reports, you can decide if you want to modify the frequency response; just follow the points made earlier. The nice thing about this design is that it will keep you happily playing with it for hours until you get exactly what you want.

**Shopping List**

<table>
<thead>
<tr>
<th>Resistors</th>
<th>Capacitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.25W 5% Carbon film</td>
<td>Disc ceramic</td>
</tr>
<tr>
<td>220Ω</td>
<td>4.7nF</td>
</tr>
<tr>
<td>270Ω</td>
<td>10nF</td>
</tr>
<tr>
<td>390Ω</td>
<td>1nF</td>
</tr>
<tr>
<td>680Ω</td>
<td>12V Electrolytic</td>
</tr>
<tr>
<td></td>
<td>2.2µF</td>
</tr>
<tr>
<td>820Ω</td>
<td>68µF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Potentiometers</th>
<th>Semiconductors</th>
<th>Integrated Circuits</th>
</tr>
</thead>
<tbody>
<tr>
<td>R6</td>
<td>Diodes</td>
<td>SL6270</td>
</tr>
<tr>
<td>R8</td>
<td>C6V2</td>
<td>1</td>
</tr>
<tr>
<td>R7</td>
<td>1</td>
<td>IC1</td>
</tr>
</tbody>
</table>

Last time, I showed a 32 day, 160 hour, test of observing meteors by radio and recording the results on about 140m of pen recording chart. After this it was obvious, that another method of counting had to be found before my plan to run the system from 0800 to 2300 each day could be put into operation.

**Electronic Counter**

My problem was solved in August 1971, when I received a copy of RS Components' catalogue and found that they had added decade counter parts to their component range. These included the p.c.b., adder and driver chips and the Nixie tube, all ready to assemble. I immediately ordered enough parts to make 6 decade counters, a power unit and one of their metal cabinets to house the system. Total cost about £40 trade. Each p.c.b. was clearly marked for wiring, and component positions and arranged that the output of one was fed to the input of the next and so on until, in my case, the unit could total just one short of a million counts.

The counter worked a treat and the first real test was carried out on September 26, when 1072 meteor "pings" were counted between 0915 and 2300. So, the following day a major observation began, but, this meant that Joan or I had to read the counter every hour during each daily observation and although you may think us daft, we did it for about four years!

**Receiver**

Reference to Fig. 1, will show that meteor reflected signals from the Polish transmitter at Gdansk on 70.31MHz were collected on a 3-element beam and passed on a low-loss coaxial feeder to the 70MHz converter detailed in box A. The converter's output was fed by a short screened lead to the antenna socket of a communications receiver, box B, tuned to 2.31MHz. The rectified signal from the receiver's detector was tapped and sent to an integrated circuit (741) d.c. amplifier which in turn energised the coil of a sensitive relay which had a positive action and good quality contacts.

When the system was working, only the periodic 'pings' of speech or music from Gdansk could be heard above the fluctuating hiss of the receiver's background noise. The zero control on box C was adjusted so that each 'ping' operated the relay. However, before the input of my home-brew counter was connected to the system, it proved necessary to add a capacitor and resistor network across the relay contacts to prevent 'contact bounce'. In other words the electronic adder would total up the relay contact operations. Remember, this was 18 years ago, so different input techniques would be used today. Next time, I will tell you about the results.

Ron Ham takes a look into various aspects of propagation and how you can do experiments of your own.
Building your own equipment is one of the most enjoyable aspects of amateur radio. Our range of kits is designed to enable you to enjoy this pleasure with the minimum of trouble. We have receiver kits to suit the beginner, and transmitters for the licenced amateur, plus a full range of accessories.

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To make life easy for the newcomer we also stock "hardware" packages to go with our receiver kits. These include a case, dial, tuning capacitor(s), knobs, sockets, nuts and bolts, etc. — the mechanical bits and pieces to go with the basic kit (which contains the electronics). The total cost of a complete three band receiver package (DXR10 + hardware + P&P) comes to £39.90. Which is not bad for a radio that will receive almost as many stations on these bands as the most expensive set! A DcRx single band package works out at only £32.10.
Lots of things to report this month, lots of letters, so we'd better get on with it! First Though, it was nice to meet some of you, readers and contributors, when a last minute offer of a seat going to the Leicester exhibition came up. Particularly nice to hear the chats with G5KW and G2HKU.

**Events**

Thanks of course to DXONS, TDXI, the CARP Conv. Amateur, your letters, and a midwinter! The period October 16-22 was notable for a series of proton flare events on the sun; and I won't need to tell keen DXers what that caused! Andorra has suspended its licensing for some unspecified period. Initially the news was that all licences had been so treated, but the latest word is that all licences had expired for some unspecified period. Initially it was nice to hear the chats with JH2MAZ, KJ7O, XE3LPV, HB9AHA/J6L, KQ7W, JA4XGC, W6s, W7s, PY6BT, JX7DFA, JA1UQP, JA5RH, JR5JAQ, JA2DHG, JA2IVY, JA6PK, JA6DXS, JA6B1F, JA8A1P, JR6CSY, G3NOF, G3BDQ (Guestling) was away for a while, and his activity was reduced to raising VE1AGG and Y4ODDR on 3.5MHz and his improvised antenna, DL9EO. Next we turn to GM3JDR who was using Just 20 watts c.w. to the 18m band, while YL2RG, F3AT, DJ3GR and DJ6WQ were raised on one of John's grounded counterpoise. While this set-up produced mostly G stations, I notice that some thirteen contacts were two-way QRP. For the rest, the morning and evening operating stints yielded lots of Gs nicely covering the whole country, GM3TMK, DL1EXF, ON5AG, F2W2F, but, alas, a great GW! Next I turn to G3CCB, who uses c.w. for the most part, with two-way contacts booked against some of the period and when he got back found the bands none too good; however on 7MHz c.w. he made it across to VE7AHR, JASRH and J3H3RA.

**The 7MHz Band**

Nice to have so many different "lists" to interpret this month. Everyone's input is greatly welcomed. Some of the real dab hands is G4CCB (New Ollerton) recently had his KW trapped dipole down for repairs of the mast, so about 24m of wire was hung up, tuned through a KW a.t.u. and driven from the station FT-277. On 7MHz, this impromptu antenna and a Morse key yielded NM2E, NJ1H, UA9KCN, UA9WZ, UA9FOR, OH2NQX/8 on QRP, F6AESG again QRP and SBFBG. As Tony says, while the regular antenna may be more effective, he will never under-estimate the simple end-fed wire, nor another transmitter, Norall Simple, Stupid! technology.

One of the real dab hands is GM3JDR (Ukengwill) who offers as his c.w. picking on 7MHz the following: W7E, UB5MAL/UA1O, PY9DX, J5U2S, VK3OL, AU9M, PY8BG, JX7DFA, JA1UQP, JA5RH, EE4AA, UA9CGL, JA4MRL, 3C6JRV, VK3NC, VG6UO, VK2QM, RH813Q, JA4MRL, EA4GF, W9G, W8S, W5S, V81BB, JT0DX, VK3MR, VE7DBI, ZL1A1E, KNOE/KH3 and K60DC. Over now to ON7PQ (Kortrijk), who offers his c.w. with 4J3MAZ, JT0DX, ZL2AT, 5H2TW, V81BB, KU7O, XE3LPV, HB9AHA/J6L, VE7QW, PA0GAM/STO, ZM1AZ, VQ5SS and 4KOF.

**G0HGA (Stevengen)** was active with 10 to 20 watts c.w. to an end-fed 18m wire; with thus raised loads of Europeans, plus HB10/HB5NL, U9A9T, VE1FKRZ, KZG0, K1DBP and 2K2CN. Another one to stick to the key was G2HKU, although his activity was reduced by way of the KW Electronics move to Sandling on the one hand, and on other his attendance at Leicester. Nonetheless, he did manage to raise VK2RKH, XANMQ, W2EJFJ, DW3CAY and YU2WM who was on Palagruza Is.

**G3DBQ (Guestling)** was away for some of the period and when he got back the bands none too good; however on 7MHz c.w. he made it across to VE7AHR, JASRH and J3H3RA.

**The 5MHz Band**

Now here's a band you either love or hate! Another new hand to write in is GOKRT (Welling) who uses a Lake DTR54 GRP rig at 1.5 watts output, plus a Howes direct-conversion receiver to a 22m end-fed wire loaded against a quarter-wave counterpoise. While this set-up produced mostly G stations, I notice that some thirteen contacts were two-way QRP. For the rest, the morning and evening operating stints yielded lots of Gs nicely covering the whole country, GM3TMK, DL1EXF, ON5AG, F2W2F, but, alas, a great GW! Now to ON7PQ; Pat mentions his contacts on c.w. with HC6/ W7AGEA, 9S5DXD, JT0DX, ZLA1E, Y4S/DL, ZL2GQ, UG6GAW, U6FEFI, U6EDEK, U6P1BH, U6BAI/AU1C, H1AAW and DF8EF/V9. Turning to G0HGA, we find Angel using just 20 watts c.w. to the 18m end-fed and raising a galle of Europeans on the band, including G2FDF, GL3D, G3HJF, G0HUL, G3XNG, G4KLG, DL5SES, SM5LF, HM1LNO, ONS4, PASD10NN, Y4MHN, 12GZQ, SP5STK7, O1ZTKW and DL5EO. I turn to G3CCB tried a couple of times on 3.5MHz and his improvised antenna, to raise VE1AGG and Y40DDR on s.s.b. plus Y7SDP and UA9EVE on the key.

**The 1.8MHz Band**

I really do need some more news of this band than I am getting of late, so all you Top Band addicts please let me know what gives. Unfortunately, I am very deal on this band because of the site constraints - hint, hint!

G2HKU (Minster) mentions s.s.b. contacts with YS6S, ON7W, while YL2RG, F3AT, DJ3GR and KA9HYV were worked on the key. G3DBQ (Hastings) had a little slurrin' round the band but he did not make it, although his activity was reduced. As a result his log included c.w. with UT6UR, TF2FZ, 9Y4SD, ZL3GQ, UG6GAW, UF6FEI, U6EDEK, U6P1BH, U6BAI/AU1C, H1AAW and DF8EF/V9. Turning to G0HGA, we find Angel using just 20 watts c.w. to the 18m end-fed and raising a galle of Europeans on the band, including G2FDF, GL3D, G3HJF, G0HUL, G3XNG, G4KLG, DL5SES, SM5LF, HM1LNO, ONS4, PASD10NN, Y4MHN, 12GZQ, SP5STK7, O1ZTKW and DL5EO. I turn to G3CCB tried a couple of times on 3.5MHz and his improvised antenna, to raise VE1AGG and Y40DDR on s.s.b. plus Y7SDP and UA9EVE on the key.

**The 3.5MHz Band**

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TL4RM, CQ0LNI, VK6DZP, V66DL, H12LSX, L224FT, QY7MI, V59OH, VK0EG, HK9RO, ZP6XDW, SJO, and PY9AW. Finally, for this band we note that G2H4U made a foray on c.w. to raise K6V and N3CEU.

The 14MHz Band
G2H4U stuck to his key on this band and managed to SFL17, YZ0RC, K16FT/V9P, R5A3, K29KA (Johnston Is) and VK2BXL.

Not greatly enamoured of it! About sums up GM3D/JR’s view of this band, but he did key 2L2AGN, U6W6HZ/JW, S9BPUO, JW, VK7AAAQ, RA9LZ, JA9UK, and WA5K76.

G2H4U notes that he didn’t spend much time on 14MHz since conditions were so good elsewhere; however, he did have s.s.b. contacts with AH8MC, BZ4CH, and GM2IU. Yet another one to comment “not my favourite band these days” is G3NOF, who only worked JA7BE.

G2H4U introduces a new note in his report on the band: Phil worked 21.010MHz with his CN1 and DL1H, plus s.s.b. to VU2TTC, V47NNX, W1-2-3-4-8.

G2H4U managed to worked 11CC, ES5PA, G0LUA, G0N2, DL6ZBA and DL1BL.

Coming now to the list of ON7PQ, Pat spreads his activity out very evenly between the bands, and emphasises it by the very way he expresses it. His main QTHs were: FOM0GZ, JT0DX, ZY0RC, ZK1QO, OH4ML/H44, ZY0FA, CIOMDA, KX8DC, K7SS/P11, V9GVR, DF4TP/V9P, 4K0F, and GOM4/V9P.

The 21MHz Band
First, a very nice letter and photograph, sent in by Kevin SM2ZZ (Kuala Lumpur). This photo shows Kevin with some active locals a.w.s. Sharvanjit, Harry 9M6HF and Son Ali from Sabah, Rashid 9M2GZ and Zainal 9M2TA. Turning his band activity, Kevin is mainly active on 21MHz, 1500-1800Z, into the UK; among the stations heard by 9M2GZ we note G3N3Q, G3WGY, G4WDX, G0KON, G0RIP, G4WDF, G0E1N, G5PQG, G0F, G0K2J, and 4GAPDQ and others.

Now to GMDQG, who offers, on c.w., U1OCC, U0AMW, JA0AMM, RASSCIE, J1A7CD, VE2DXZ, W2LQF, JA9PO, J9HBR, JA9JOK, CM6DX, JA2GQX, VE2ABX, ZA6H, and 44D4U2X. Finally, for this band we note that G2H4U made a foray on c.w. to raise K6V and N3CEU.
Tom remarks that signals were loud very low level, giving much poorer activity was very high enabling at 121OUTC. No very long distance worked at this time. Auroral activity was observed from 2220UTC but on the 144MHz band he worked good place to start with when workable by stations, located mainly the auroral radio quality indices collapsed to a month and by consequence, the index, recorded at Meudon, reached the 110 units. The activity, in the sun's last week of the month had seen a dramatic change in the station. Ian McCabe GOFYD (LNH) HG1YA (JN87), OK1KQJ (JN69) and worked many 144MHz stations in the world including DC4OH (J052) and OZ/DG7LAB/P (J046). A report of the events on October 20/21, as heard in Belgium, comes from Johan Van De Velde ON1CAK. Activity was maintained on the 20th with only 20 stations worked on 144MHz in a 2 hour session. Among the contacts were EA5AV (1097), G4IUN (1074), G3JOC (1067), GM4ERB (1067), G4IZH (1051), F6HRP (1088) and G8BFL/P (1087). A number of stations concentrated on the 50MHz band during the recent period of auroras. Bill Billcliffe G6GNB (OFE) mentions that 6 new counties were worked in the event on October 21. Contacts were made with G4OPH, G0FVZ, G0MEGI, OM1FSA and many G stations. Signal strength of all signals was reported as very strong.

Paul Baker G0VZW (GWT) participated in the aurora on October 20 between 1423 to 1515UTC, working many G stations. The event on October 21 was first detected at 1200UTC. Paul going on to work 80s in 32 counties and 7 countries. New counties and countries worked included G3JOC (NOR), G4IUN (TWR), G6FPLP (W8GM), G40CY/G (LCZ), G4OPH (DWS), G6GGB (LDR), GIBYAZ (ATM). GIBYDZ (ATM), G0MECU (SCD), E15S (B351), F6HRP (B88) and PE1ILY (J031).

The 50MHz Band

In marked contrast to the previous month, October provided a good place to start with when workable by stations, located mainly the auroral radio quality indices collapsed to a month and by consequence, the index, recorded at Meudon, reached the 110 units. The activity, in the sun's last week of the month had seen a dramatic change in the station. Ian McCabe GOFYD (LNH) HG1YA (JN87), OK1KQJ (JN69) and worked many 144MHz stations in the world including DC4OH (J052) and OZ/DG7LAB/P (J046). A report of the events on October 20/21, as heard in Belgium, comes from Johan Van De Velde ON1CAK. Activity was maintained on the 20th with only 20 stations worked on 144MHz in a 2 hour session. Among the contacts were EA5AV (1097), G4IUN (1074), G3JOC (1067), GM4ERB (1067), G4IZH (1051), F6HRP (1088) and G8BFL/P (1087). A number of stations concentrated on the 50MHz band during the recent period of auroras. Bill Billcliffe G6GNB (OFE) mentions that 6 new counties were worked in the event on October 21. Contacts were made with G4OPH, G0FVZ, G0MEGI, OM1FSA and many G stations. Signal strength of all signals was reported as very strong.

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- **Output Power**: 100 watts
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  - Telephone: (0227) 369464.
  - Open: 9-5.30, Lunch 1-2pm. Mondays to Saturdays.
was worked twice, the second time
the band was in an even better state
and VE1YX were heard at good
distances. In the morning, between 0805 to 0835UTC,

The 70MHz Band

Without any sporadic-E to live
up the band being opened,
the only event to draw
operators' attention was new

conditions. During the first week of
October, the band opened up to the Far East during the

October 12, to see if the band would
prove to be excellent for v.h.f.
operations in the Central region once again after an

absence of a month. The new

location, on top of a hill, should
prove to be excellent for v.h.f.
operations, far better than the old

site in West Lothian.

From the Four Metre Newsletter,
G6HKM had a field day during
the period of extended propagation.

Bill Sterling GM4DGT has
announced the opening of a new
central region station from the

north of the border in Elgin Bailey GM6BBB.

He is active from Strathclyde and
assures readers that he will not
forget the old West Lothian

operators located up north. Elvin

will be operating from this site in

times other than contests.

From the poorly activated county
of Western Scotland, a new voice should
shortly be heard. John Chinn

GB0FH is currently converting some
old pre-war equipment and hopes to
be on the band in the near future.

The 144MHz Band

Tropospheric conditions were
very good during the first week of
October. The band was open,

at some time during the week, from
the Faroes, in the north, through
central Europe, right round to Spain.

John Chinn GB0FH starts his
month's report on September 30.

He managed to work G14KSO (DWN)
for a new county. On October 2, the
Fareham island club station, G0YFA,

was working for a new county and

locus square.

Mervyn Rodgers GM6GDL (CRN)
reports that conditions were
good on 144MHz, as reported by GM2ZV.

On September 30, he worked ED3GE (IO63), ED4Q
(O151), E16ARD/P (IO53) and G11BW (IO68).

A few days later, on October 3, propagation was very
good to the south, with E1A1CD.

E1A1RD and E1AB being worked.

Over on the Isle of Man, Dave

Brown GM1CZK (W) had a

great evening despite running 7 watts output.

First indication of the tropo opening,

on September 30, came when Dave

was trying to work G1RER (LDN)
on 430MHz via a 144MHz talkback.

At 1640UTC, F6I9MY broke in to say

that he was 59 in Holland on 144MHz.

The test was quickly

abandoned and the PA station
was worked to provide a new county for 144MHz. The
distances included ON1CAK and FC1MOZ
(JN29), DL1EJA was heard but

even at 7 watts didn't quite make it.

The band opened up and PA stations were worked but

nothing startling or new. Conditions
were not quite as good for the better on the 2nd
class stations with F6ANQ (IN94), FC1GXX (IN95),
FC1NIZK (IN96), FA1XME (JN90) and

other stations in JN15, JN16 and
JN17 between 1230 and 1500UTC.
The DXCC List (IN93) provided country
No.14, followed by EA1BCF, EA1DZ,
E1A1CQ, E1A1AM, E1A1EY, E1A1EY
and E1A1QJ.

Another station running low
power, 10 watts in this case, is
GB6N who made a number of

interesting tropo contacts. On
October 2, PC1ADT/P (UN15) and
PC1ADT/P (UN15) were worked but

Propagation had swung around to
Scandinavia by October 4, giving
a total of 19 counties on 144MHz.
This is not particularly true.

If conditions are right and polarisation
is correct, too good DX stations
running 100 watts into a single Yagi,

of reasonable boom length, are able to
work some of the larger e.m.e.

stations quite a bear in conditions

like this. John Hilton GM1ZVJ (LTH)
reports that conditions were

excellent to EI/G on September 30.

and worked for a new country and

locus square.

Gerry School GM1GRW (MCH) is
the only operator in England to report
work into JO5I and K02 squares.

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excellent to EI/G on September 30.

and worked for a new country and

locus square.

Mervyn Rodgers GM6GDL (CRN)
reports that conditions were
good on 144MHz, as reported by GM2ZV.

On September 30, he worked ED3GE (IO63), ED4Q
(O151), E16ARD/P (IO53) and G11BW (IO68).

A few days later, on October 3, propagation was very
good to the south, with E1A1CD.

E1A1RD and E1AB being worked.

Over on the Isle of Man, Dave

Brown GM1CZK (W) had a

great evening despite running 7 watts output.

First indication of the tropo opening,

on September 30, came when Dave

was trying to work G1RER (LDN)
on 430MHz via a 144MHz talkback.

At 1640UTC, F6I9MY broke in to say

that he was 59 in Holland on 144MHz.

The test was quickly

abandoned and the PA station
was worked to provide a new country for 144MHz. The
distances included ON1CAK and FC1MOZ
(JN29), DL1EJA was heard but

even at 7 watts didn't quite make it.

The band opened up and PA stations were worked but

nothing startling or new. Conditions
were not quite as good for the better on the 2nd
class stations with F6ANQ (IN94), FC1GXX (IN95),
FC1NIZK (IN96), FA1XME (JN90) and

other stations in JN15, JN16 and
JN17 between 1230 and 1500UTC.

The DXCC List (IN93) provided country
No.14, followed by EA1BCF, EA1DZ,
E1A1CQ, E1A1AM, E1A1EY, E1A1EY
and E1A1QJ.
I made mention in a previous column that I worked GW5GWH on DX, and have been proving interesting antenna consisting of an array of 16 phased dipoles. Using 10 watts from an FT-877 transmitter was possible at my QTH. In October, when the 432MHz band was bent over at an acute angle, breaking the rotator and wrapping the 50MHz antenna around the mast. Fortunately the 144MHz and 432MHz systems escaped without too much damage. At my QTH, I wasn’t too much force winds on October 28, topping a 2 tonne chimney through the roof of the garage, the radio room and losing the mast with the 70MHz and 430MHz antenna systems.

The 430MHz Band

Tropospheric conditions on this band were on a par with 144MHz but the lack of activity was very disappointing. The band was in good shape during the evening of September 30/ October 1 for Ela G6HRM. Two new calls were heard on the total when G0MCDL/P (1076) and G4ALVB (1075) were worked. Later in the day, contacts were made with F6HVE (JN36), G6EDQO/P and E1SFK. Tropo conditions were still good later in the evening when I worked GB3DLY on October 16 and G4MSIV (1065) on the 24th. During the 432MHz band, I was interfered by QJ4AT and 7 counties for the PW squares showed up this year on 2.3GHz. The 2.3GHz Band

The antenna is at 27m above the ground, fed with 20mm diameter RG58 Coaxial cable and 10 watts from an FT-797 contacts were made with F6HYE (JN36), GM4LBV (1075) were worked. Later in the month with HB9MIN/P being welcomed by the beacon keeper. Reports of reception, which will be answered, are 

Prior to setting up the world record 5.7GHz. The contact between XE2GQX/IXEQX, located in Mexico (CM049) and GB5CM (56) plus GB4LC/PL located in Reunion, on DL37, was over a path length of 2987km. Equipment used at both stations was an Icom IC-715 with a Maclen C0721C, 1.5dB noise figure receiver, 4W narrow band transmitters and 1.2m dishes. Contact was also made on 2304MHz in the North Atlantic area. Contact was also made with GW5GWH, and GB5CM, and their own QSL bureau operating independently from Box 88. You can now send cards to PO Box 56, 1716, Vilnius, Lithuania, USSR. In a similar vein, the Estonian authorities are changing their call signs, with the United Kingdom going from ES1 to ESQ, with the country being divided into 10 call areas, similar to that which existed before WW2. Not to be outdone, Latvian amateurs will be changing from UQ to YL.

Working on 50MHz now allowing worldwide communication, many operators have worked, or are very interested in working, all six continents required for the W.A.C. award. Applicants are advised that the qsl cards should be forwarded to the RSGB HfV Awards Manager GW4BKG and NOT to the HfV Awards Manager. Full details of the W.A.C. certificate and other awards can be found in the RSGB Amateur Radio Call Book.

Beacon and Repeater News

Damon G8PTF (DOR) worked most of what was going to be a 3 day period from September 29 to October 1. Many French and German stations were worked. Highlights were EA1BCB, EA1DDU, EA1NU and HB9FIPA/P (JN36), Ulrich HB9AMH/P (JN37), N9AQ0O (JN141), ON4NYU (J101) and others proving the performance of the most unusual antenna.

Back Scatter

Another old hand on the microwave bands is Gordon Emmerson GPPNN (NDL). New squares worked this year on 2.3GHz have included DLOUD, EA1NU, E6GAS, F6E72Z, HB9AMH/P, ON1ABO and FE1HCN. Dave says that anyone who wants GD on 430MHz should call him on 144MHz for a QSY.

Ray Harlow G4LRT (TSS) operates on all bands from 50MHz through to 1.3GHz. The period of extended propagation he put to very good use, particularly on 430MHz. On September 30, contacts were made with E6GAS (1065), GM0GMD/P (1077) and F4WPE/UI21. A new square, IN78, was obtained by working F0OUC on October 2. Later on in the month, RB40Z also worked. Scandinavians were the order of the day, on the 4th, with SM7FHI and SM7CJ, both in J065, and OZ7LX (J055), working on s.s.b.

Notification in Wimborne, Steve G8FPY worked a number of DX stations during the lift on October 2. The best of the bunch were HB9AMH/P (JN36) and FC1ADT/P (JN15).

The Microwave Bands

A report from Bob Atkins EA1GT (ex G8EBSW) tells of a new world record on 5.7GHz. The contact between XE2GQX/IXEQX, located in Mexico (CM049) and GB5CM (56) plus GB4LC/PL located in Reunion, on DL37, was over a path length of 2987km. Equipment used at both stations was an Icom IC-715 with a Maclen C0721C, 1.5dB noise figure receiver, 4W narrow band transmitters and 1.2m dishes. Contact was also made on 2304MHz in the North Atlantic area. Contact was also made with GW5GWH, and GB5CM, and their own QSL bureau operating independently from Box 88. You can now send cards to PO Box 56, 1716, Vilnius, Lithuania, USSR. In a similar vein, the Estonian authorities are changing their call signs, with the United Kingdom going from ES1 to ESQ, with the country being divided into 10 call areas, similar to that which existed before WW2. Not to be outdone, Latvian amateurs will be changing from UQ to YL.

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Beacon and Repeater News

News has recently been received that the Channel Island beacon, GB3JOQ on 50.065MHz, will shortly be given permission to start transmissions. Of very great interest is the fact that the DTT has allowed the beacon to run 10 dBW e.r.p. with an antenna which is vertically polarised. This move may hopefully herald the introduction of mobile operation at a later stage in the UK. New in Recently in the Finland. OH181X, became active on September 23. Located in KP11I, it was working towards GB3JOQ and GB4RPS on 432MHz. F4KDH, came into service during October. More information is available from Derek Stewart G4FRE if you can help.

The Bristol packet radio repeater, GB3FC, now has a port on 704/485MHz. Contact G4FRCW/ you want more details.

The Sussex Coast 144MHz repeater, GB3BL, on channel RB4, to which the beacon HAM623D, on channel RB4, will be off the air for several months due to a persistent building work taking place at its site.

The new Coventry u.h.f. repeater GCCBV, on channel RB4, became operational on November 6. The repeater is located at the GPT site at Stoke.

The Guildford u.h.f. repeater, GB3G7, was due to change channels, from RB13 to RB12, on October 17, to eliminate co-channel interference. A new Bedford u.h.f. repeater, GB3BN, was recently returned to service. Another u.h.f. taint, GB3HR, is also back on the air after the recent failure of the waveguide feeder. It is available from Derek Stewart G4FRE if you can help.

A new beacon. PI7DIJ, on 1063MHz was incorporated into the website. Further reporting of its coverage. Also from GB3SNV, comes news that the nearby beacon, GB3DD, on channel RB4, will be off the air for several months due to a persistent building work taking place at its site.

European VHF/UHF/SFH Contest Calendar

Operators interested in finding out what contests are running on any particular day during 1990, will be pleased to know that a publication by DH2NAF will give them such information. The new book, Frank will have a 120-page booklet given information in three sections, on more than 450 contests, from all over Europe. The first section gives contests on a calendar basis, the second section is a listing by country, and the third section gives contests on a country basis. All necessary addresses. In addition, there are various articles of interest to those interested in band jumping. The Contest Calendar is written in both English and German and can be obtained by sending £4 IRCs to 3 Ursula-Vorwerk-Weg, D-8078 Etchstatt, West Germany.

KEEP THE REPORTS COMING FOR YOUR ENTRY INTO THE TABLES
**Interference**

Regular readers will remember that I recently mentioned how Mr Innes solved his computer interference problems. I have now had a number of reports from AMTOR users who have worked out that if the AMTOR system is not connected up and ready to go, the first thing you will have to do is enter two separate exclusive codes, one for acknowledgement and one for repeats. The codes used are known as control 1 and control 2.

The heart of both systems is the code used to represent the transmitted characters. Those of you who have yet to encounter error correcting systems might wonder why you can detect an error in the received signal when you don’t have a copy of the original group. Although the AMTOR system is called error correcting, like many other error correcting systems, it can in fact only correct certain types of error. To help you understand this I’ll describe just how the error correcting system works.

There are two modes in AMTOR - Mode A and Mode B. Mode A is most commonly used for QSOs and refers to the automatic repeat request ARQ which is used to detect and correct errors. The system is designed to transmit the last three characters known as alpha and beta. The important point about the Morse code is that each character always contains four marks and three spaces. It’s just the combination that changes. The first part of any error correction system is to detect the error and this is where the characteristics of the Morse code are used to the full. As you pass every received character should contain four marks and three spaces which will help you to decode it. Also, any errors which corrupt the signal but still leave four marks and three spaces will be filtered out.

Having detected the error the next problem is to correct it. This is done in the same way as you or I would when in conversation, i.e. you ask for the corrupted information to be repeated. The AMTOR Mode A system works, automatically, hence the name, Automatic Repeat reQuest or ARQ.

Try and sort out the errors, the AMTOR system will split the message into more manageable groups of three characters. If some of the characters have been sent, the system waits for an acknowledgement from the distant station that they all arrived safely. If not, the last three characters are sent again. The system will continue in this way until the station has received all the characters correctly.

The use of acknowledgement codes in ARQ is rather ingenious so let’s take a look at them. As you can see, the use of ARQ means that if an error is encountered, the system sends the last three characters the station begins the process again.

The use of acknowledgement codes is vital. The AMTOR system only uses error correcting systems that are used in the ARQ system to the automatic repeat request ARQ. This is one of the most popular error correcting systems. The system is designed to detect and correct errors. The system is known as TOR and is described in CCIR recommendation 461. The AMTOR system is an implementation of SIOR (Simplex Teleprinter Over Radio) and is used to communicate for Telex communication. The AMTOR system has been designed to be as robust as possible and is the one chosen for this British Teleport in Portishead. The AMTOR system is designed to detect and correct errors in the received signal. The system waits for an acknowledgement from the distant station that the last three characters have been received correctly.

One very important point to note is that when using Mode B is that if the system sends a message all you have to do is sit and listen for the message. The message is then received by the receiving station and is fully understood. The system sends yet more idles at the end of the message.

If you are sending idles, and this only occurs when you are not actually receiving a message, the receiving station will note the absence of idles and this is known as an error. The system sends yet more idles at the beginning of the message. The system sends yet more idles at the end of the message.
Mode A and if the path is good your equipment should respond to his call and his initial message will print out on your screen. The QSO is then under way and can be continued using the / call combination at the end of your transmission. Of course as AMTOR is fully error correcting, there is no need whatsoever to repeat any message as the system does that for you. One plea I would make at this point is to include both call signs at the end of each exchange. Unfortunately it seems to be common practice among many AMTOR operators to only send call signs occasionally. This is very frustrating both for other amateurs and for short wave listeners as it can sometimes take ten minutes of listening before a station can be identified!

Let's now look at operation from the other point of view, i.e. after hearing a CQ call. The first thing to do is note the other stations SELCAL and enter it into your equipment as the station to be called. When he has finished his transmission, start a Mode A call to his SELCAL - if it is well your status indicators should show that you are idling in transmit mode. At this stage you can start the QSO using / at the end of your over.

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Amateur Satellites

By Geoff Roberts G3ENY

OCTOBER 1990

As predicted, OSCAR-9 (alias Usat-1) fell to earth in early October, after having been functioning in space for just over eight years despite it’s three year design lifetime. OSCAR-9 was launched from Vandenberg Air Force Base in California on 6 October 1981, in a 554km circular orbit. It had its teething problems, as, soon after launch in April 1982, 12 educators were reported as being commanded on simultaneously. The net result was that as one or the other of these bands needed to be free to uplink control commands to turn one or the other beacon off, the desensitising of both command receivers made switching off the satellite almost impossible. It finally went over on 20 September 1982, when the 145.025MHz beacon was finally silenced by beaming up a 12 Megawatt command signal, so perma-faultless faultless operation for the next seven years.

In the week prior to its demise, OSCAR-9 continued to make history with two sendable call signs in the same minute - an achievement dependant on a nearly perfect solar flux expanding strongly ionised F2 layer, the temperature had climbed from the normal just below zero to some plus 6 degrees Celsius. On October 10 it was down to +1, and the following day down to -6.3°C. It then went up again as it went through the F1, peaking at +5°C on the morning passes of October 12, but dropped to +4 by that evening. The findings, AOS, TCA, LOS, Doppler curves were compared with other observers G3ACG, G3DK, G3ENY, G4CUO, G4LWM and L4XC with 3.780MHz pass post net each day prior to the fall-out. As far as is yet known, the 220UTC October 12 TLM was the last recorded from the UK, although it was heard from 0343 to 0349UTC on October 13 by R9C1S who reported “…all TLM normal…”.

OSCAR-9 re-entered earth’s atmosphere on orbit 44761 at 0756UTC on Friday October 13, at around 48 degrees south 220 degrees east (140W), a remote part of the earth more than one thousand kilometres south of the 1740km Pitcairn Island, sadly outside of range of any known monitoring station. TLM of the last 9 hours is urgently required for study, even in it’s death throes, Usat-1 was still putting out all of its 60 channels of valuable data, which has told us much about the predictability of terminal decay and re-entry place and time.

U-9 Re-entry Contest

The winner of our OSCAR-9 satellite re-entry competition for the handsome space book prize was David Rowan G4CCD, who was only seven hours early of the precise re-entry date and time. David modestly claims that he picked October 12 as it was my XYL Margaret’s birthday…(if reliable sources in fact state that David had put much study and effort into his findings, and that many graphs and equations had been meticulously prepared to permit the forecast to be so close. The majority of entries had predicted, as I did, between October 4 and 8, with some relatively wide August and some as late as January 1990. Frankly, all entries were possible winners as the variables posed were many!

The AMSAT-UK contest was won by Geoff Roberts G3ENY, who by a lot of study of decay graphs relates to periodic solar flux expansion was also able to predict within a day. In all, both competitions attracted over 70 entries, though many arrived too late for the one month deadline required.

The need and use of the telemetry channel brought about by the OSCAR-9 findings brings us to the subject of the use of telemetry itself, as outlined in the AMSAT-Journal in an editorial entitled Telemetry - The Best Kept Secret. Joe points out how the TLM channel can be used to tell us a story of what is happening to the spacecraft and it’s environment, how valuable this is as a study, and yet how few seem to make use of it. He writes, “The number of individuals not associated with command stations who have decoded spacecraft telemetry and published their findings can be counted on the fingers of one hand. There’s a lot of computing power out there that has the potential to process telemetry and something new, but does not have access to the data. Perhaps the reason for the lack of use of the telemetry is that those who have the capability to receive it are not interested in it, and those that have the interest in it do not have the equipment to receive it”.

Joe points out that the average school science class has a computer, but not a satellite ground station, and that an AMSAT repository is obviously needed that could distribute the data on disk to those who want it.
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The question arises to the interested individual, who is far better able to contribute toward knowledge and education than merely making a few QSOs 'by satellite'. Have you contacted your local school, college or university to explore any need? You may know of them, but the chances are they do not know of you. The lack of TLM found when exploring for sources outside ones own horizons for OSCAR-10 is re-entry data has highlighted the separation, as some very valuable information is fully available but apparently not utilised.

New Launches

To publish a confirmed launch date in this column is to automatically invite the inability of a launch to occur after the stop press deadline! The problems encountered with the pyrotechnic initiators on the Ariane V-34, 35 and 36 launches and full electrical failure of the Spot-2 launch carrying UsSat-D 'and 'E' and the four new microsat launches is currently set at 0130UTC on 19 January 1990, giving a breathing space welcome by the AMSAT builders and testers.

The 1 watt 'S' band beacons are now ready for two of the microsats, and all four have passed their shake and vibration ordeals. UsSat-E has had its solar simulation, tip mass balance and antenna pattern tests completed, and the c.c.d. camera has been shown to give excellent picture quality of scenes outside the laboratory window.

Launch and monitoring nets are already organised with G3HWL/G5AIR planning to be on 3.780MHz from one hour prior to blast off. The ejected cluster of satellites will not be 'seen' in the UK until about 0900 the following morning, when a further informal 3.780MHz observer net will be activated to monitor progress. Each evening following orbital insertion will see 7pm update information nets on the same frequency.

JAS-1-b

Since December's news on the forthcoming JARL/JAMSAT satellite, progress and conformity testing of the coming JAS-1-b appears to be excellent. JARL report that full environmental testing has now taken place at the Yokohama factory of the NEC Corporation, and no defective equipment was found. The final and full tests, consisting of equipment adjustment, full electrical tests, thermal, vacuum, vibration, calibration, etc., was being completed in October, to ensure that no problems are encountered during the launch or later in orbit. The main differences as I have mentioned in previous issues between the new Fuji and its predecessor JAS-1 alias Fuji-OSCAR-12 are greater solar cell area and new antennas. These should prove to be a great improvement.

The launch time has not changed from that previously supplied, for example 23 January 1990, and past experience of Japanese planning and efficiency shows delay to be unlikely. Look out for nets covering the event and post launch capture which have yet to be arranged.

FUJI-OSCAR-12

The ailing OSCAR-12 continues to try to meet its JA pass time in range minimal commitments despite a very meagre and restricted schedule due to power insufficiency. Placed transponder 'on' times are:

November 18, from 0156 to 0349UTC on Mode JD digital.
November 25/26 from 2247 to 0449UTC, Mode JD digital.

December 5, from 1951 to 2132UTC, also Mode JD digital. At all other times the transponder will be kept off in order to attempt to ensure continuity of battery supply.

OSCAR-10 and 13

While OSCAR-10 has been unusable since September 1 due to eclipses (though due to be back with us for transponder use from 1 December 1989), OSCAR-13 has had its problems too. On the morning of October 9, following a huge solar flare, the system was found to be stuck on the default Mode B transponder energising the omni antenna, and the normally expected 145.812MHz TLM was but a plain carrier. The entire memory had been wiped from the whole system had crashed. At first attempt the re-set and re-load of software failed, but the command team eventually regained control. A similar event took place between 2145 and 2115 on October 28 between MA 245 and MA 109, and this further problem is currently being serviced. Whether these failures were due to a vital part of the 32K memory, or Van Allan radiation belt damage (despite the specially hardened chips and dual layer protective shielding), has yet to be determined, but it certainly looks as if we can lay the blame on the pre-press-active sun. It is to be hoped that the satellite can be used again by the time you read this. Following the previous stop press deadline! The problems encountered with the pyrotechnic initiators on the Ariane V-34, 35 and 36 launches have dictated a further postponement of the Spot-2 launch arrangement.

One of the microsats undergoing qualification tests - Jan King W3GEY

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A returns are common from northern passes. The robot can prove at such times a little hard to access when multipath propagation effects delay elongation the accurate dot/dash ratio desired for entry into the system. Gordon Covey G3DDG continues to experiment with the speeds acceptable under different path propagation conditions, and advises that on the provos good spacing is provided between characters, call acceptance and QSOs are normally possible with persistence.

Vadil Donchenko UL7CR, is regularly operating around a 29.463 - 470MHz downlink on passes to the UK north east, and has worked 80 countries so far. He needs QSOs with GW and GI if anyone out there can help by providing a suitable contact. At the five other UL7s are regularly active.

Ron Pearson GSCAG and Dave Rowan G4CUO are regular 'RS' users, and regularly report QSOs being made, but with little new DX apparent. Vin G4ULS reports hearing a good signal from the RS-10 and RS-11 satellites but sadly still not subhorizon, long after he had lost his uplink to the satellite.

One of the most active operators is Jim W3GJ. Fig. 4. It is a recent photograph of 67 years young Janos HAMAS (also HG5AM) in his satellite station. Fig. 4. He has had many QSOs with Janos on OSCARS 6, 7, 8, 10, 12 and 13, and on RS-1, 2, 5, 6, 7, 8 and 11. He is a mainstay of the Technical University of Budapest, and with Bandi Gahwindt is active in the design and building of many parts for past and future satellites.

RS-11 is being kept in mothballs as a standby for RS-10. The expected new RS-12/13 may well ascend with a new Cosmos Nvast in late March, but confirmation or denial of this earlier voiced possibility is still awaited.

Shuttle

WJANW, the club station of the Goddard Space Flight Centre at Greenbelt, Maryland transmitted throughout the latest Atlantis mission to launch the Galileo probe to Jupiter. They will similarly transmit future non-military missions, and are to be found on 3,860, 7,185, 14,295, 21,395 and 30,000MHz, as well as on 145MHz. Don't forget that Galileo is now upon us, the very latest information is needed. Under such circumstances, invariably being the case, a change in the orbital element is to be expected. Don't forget to write to the Editor of this newsletter to let him know about your findings.

AMSAT Nets

Whilst this column prides itself in topicality, invariably being the first with the written news, at times of high launch activity such as is now upon us, the very latest information is needed on a daily basis. Here follows a listing of AMSAT nets from which you will glean the instant updates detail.

<table>
<thead>
<tr>
<th>Net Name</th>
<th>Designation</th>
<th>Day/Time</th>
<th>Freq MHz</th>
<th>Net Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMSAT-Europe</td>
<td></td>
<td>Sat 1000 UTC</td>
<td>14.262</td>
<td>PA0DLO</td>
</tr>
<tr>
<td>AMSAT-USSR</td>
<td></td>
<td>Sat 1100</td>
<td>14.290</td>
<td>USQCR</td>
</tr>
<tr>
<td>AMSAT-S.Pacific</td>
<td></td>
<td>Sat 2000</td>
<td>14.262</td>
<td>ZS6AVK</td>
</tr>
<tr>
<td>AMSAT-S.Africa</td>
<td></td>
<td>Sun 0900</td>
<td>7.080</td>
<td>ZS6AVK</td>
</tr>
<tr>
<td>AMSAT-S.Africa</td>
<td></td>
<td>Sun 0900</td>
<td>14.280</td>
<td>ZS6AVK</td>
</tr>
<tr>
<td>AMSAT-S.Africa</td>
<td></td>
<td>Sun 0900</td>
<td>145.650</td>
<td>ZS6AVK</td>
</tr>
<tr>
<td>AMSAT-Australian</td>
<td></td>
<td>Sun 1000</td>
<td>3.685</td>
<td>VK5AGR</td>
</tr>
<tr>
<td>AMSAT-Australia</td>
<td></td>
<td>Sun 1015 local</td>
<td>3.780</td>
<td>GOAUK</td>
</tr>
<tr>
<td>AMSAT-Argentina</td>
<td></td>
<td>Sun 1100 local</td>
<td>3.737</td>
<td>LA4T</td>
</tr>
<tr>
<td>AMSAT-Internat</td>
<td></td>
<td>Sun 1900 UTC</td>
<td>14.282</td>
<td>WD0H8U</td>
</tr>
<tr>
<td>AMSAT-Internat</td>
<td></td>
<td>Sun 1900</td>
<td>21.280</td>
<td>WB8GQW</td>
</tr>
<tr>
<td>AMSAT-Internat</td>
<td></td>
<td>Sun 1900</td>
<td>28.460</td>
<td>WB2YGA</td>
</tr>
<tr>
<td>AMSAT-A.Sfrica</td>
<td></td>
<td>Mon 1730</td>
<td>145.650</td>
<td>ZS6AVK</td>
</tr>
<tr>
<td>AMSAT-UK</td>
<td></td>
<td>Mon 1900 local</td>
<td>3.780</td>
<td>GOAUK</td>
</tr>
<tr>
<td>AMSAT-NA East</td>
<td></td>
<td>Tue 2000</td>
<td>3.840</td>
<td>K4DUN</td>
</tr>
<tr>
<td>AMSAT-NA Mid</td>
<td></td>
<td>Tue 2100</td>
<td>3.840</td>
<td>W8PKB</td>
</tr>
<tr>
<td>AMSAT-NA West</td>
<td></td>
<td>Tue 2000</td>
<td>3.380</td>
<td>ZS6AVK</td>
</tr>
<tr>
<td>AMSAT-UK</td>
<td></td>
<td>Wed 1900</td>
<td>3.780</td>
<td>GOAUK</td>
</tr>
</tbody>
</table>

There are many more national nets on v.h.f., mainly 144MHz f.m. which will only be heard on a semi-local basis, but I will be pleased to publish these if requested. Those for the United Kingdom are as follows:

<table>
<thead>
<tr>
<th>Station</th>
<th>Local Time</th>
<th>Freq MHz</th>
<th>Net Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedford, Devon</td>
<td>Sun 1800</td>
<td>144.280</td>
<td>G0DLC</td>
</tr>
<tr>
<td>Brighton</td>
<td>Sun 1915</td>
<td>144.280</td>
<td>G6ZUJ</td>
</tr>
<tr>
<td>Lancashire</td>
<td>Tue 2100</td>
<td>144.280</td>
<td>G6JG</td>
</tr>
<tr>
<td>Birmingham</td>
<td>Thu 1900</td>
<td>144.280</td>
<td>G4ULS</td>
</tr>
<tr>
<td>Chichester</td>
<td>Thu 1900</td>
<td>145.275</td>
<td>G6SX</td>
</tr>
<tr>
<td>Trent Valley</td>
<td>Daily 1900</td>
<td>145.575</td>
<td>G4CUO</td>
</tr>
<tr>
<td>Paisley, Scotland</td>
<td>Daily 0900</td>
<td>144.625</td>
<td>GM1DXX</td>
</tr>
</tbody>
</table>

For those who like to track the various satellites by listening at the frequencies indicated in the above table, I would like to draw attention to the new RS-11/12/13. The new RS-11/12/13 may well be found on 145MHz f.m. looking for QSOs as the Soviet manned space station orbited the world, mainly during their 'free' time at week-ends. It will be noted that due to last minute rescheduling, the originally planned launch was moved to Friday via the new SOYUZ-TM-8 satellite on September 7 is now in operation, with confirmation or denial of this earlier voiced possibility is still awaited.
**Solar**

Ron Livesey (Edinburgh), using a 2.5m reflector and solar projecting system, identified 6 areas of activity on the sun on September 30, 7 on the 2nd and 18th, 8 on days 10, 16 and 17 and 10 on the 9th. From his observatory in Selsey, Selsey Moore sent the drawings that he made of the massive sunspot group on September 29 around 0930, the smaller group and scattered spots on October 17. Fig. 4, Ted Waring (Bristol), reported on October 3 and 22 respectively and in Plymouth, Ern Warwick heard variations in the background noise of 8 words receiver, at 140.15 MHz receiver, on September 30 and October 1, midday on the 13th, 1550 on the 15th, and 0930 on the 17th, midday on the 18th and 0915 on the 20th.

Neil Clarke GOCAS (Ferrybridge) reports that the mean solar flux for September was 225 units and as usual provided the daily figures on his computer printout in Fig. 1a. Cmdr Henry Hatfield (Sevenoaks) using his spectroheliograph during the period September 29 to October 31 observed the sunspot groups, filaments and quiescent prominences listed in Fig. 5. Henry also recorded individual bursts of solar radio noise at 136MHz on September 29 and October 8, 10, 15 and 19 and on 1297MHz on September 29 and October 19, 27 and 28. His recording charts run side by side so that direct comparison can easily be made between solar bursts at these widely differing frequencies. This proved valuable on October 19, Fig. 2, the day when Professor Alex Hall cubed the solar flare index peak at 64 to 70 on 1800 and 1100 on November 1.

**Auroral**

Around 2100 on September 26, Simon Hamer (New Radnor) sighted auroras and described their colour as a "predominantly orange with some white." This event was also reported to Ron Livesey (Newcastle) and Ron Gaskin (Farraday) and in London, John Levesley, Greg Hague, Vaclav Dosoudil, Henry Hatfield, John Levesley, Greg Hall, Fred Farrant, Fred Hall, and Mark Appleby also reported auroral activity. From his computer printout in Fig. 1a.

The Fluxgate magnetometers used by Karl Lewis (Saltash) and David Pettitt (Carlisle) and the "JAM-Jar" and Hall effect instruments operated by Ron Livesey and Doug Smith respectively, between them indicated stormy conditions on September 23, 5, 6, 8, 10, 11, 12, 15, 16, 18, 22, 25, 26, 27, 30 and September 29. "September was generally unsettled to active, but there were some quiet days and also some stormy days," said Neil Clarke, who noted the Ap Index peak at 64 on the 19th and recorded the daily levels for the month on his computer, Fig. 1a.

**Sporadic-E and P2**

Simon Hamer logged television pictures, via Sporadic-E, in Band 1, from stations in Poland and the USSR on September 21. Finland and Scandinavia on the 22nd, Spain on the 23rd and Czechoslovakia, Hungary, Poland, Scandinavia and the USSR on October 7. In addition he identified smeary pictures, received via the P2 region of the ionosphere on Ch. E2 (42.25MHz) from Dubai on October 8, Iran on the 9th and Zimbabwe on the 10th and 11th. He heard strong synchronising pulses and saw a multitude of unlookable pictures, typical P2, on Ch. R1 on (49.75MHz) early on the 16th and on Chs. E3 and E4, 0900 and 1100 on November 1.

**28MHz**

At midday on October 8, Igor Khristalev (UASJC, Toronto) called on his portable receiver from Ontario, operated from the Chalk Pits Museum (Amberley, Sussex) and soon contacted a pile-up of stations including a friend of his who was in Africa at that time. "On the 18th Oct. at 1800UTC I picked up a signal from Melbourne, Florida, -WA4BIR/BCN TESTING FOR PROPAGATION FROM THE EXHIBIT OF THE ROCKET," wrote Ted Waring and this was also heard by Mark Appleby G4XII (Scarborough), Greg Loveck G4023 (Shipston on Stour) and Ern Warwick who also reports hearing echoes on a number of signals around 1057 on the 2nd. Among the DX logged by John Levesley G3HJL (Bransgore) were signals from stations in Australia on September 30, Canada and/or the USA on the 30th and October 1, 2, 3, 4, 6, 14 and 15 and South America on days 2, 1 and 4.

**Propagation Beacons**

First, my thanks to Mark Appleby, Chris van den Berg (The Hague), Vaclav Dosoudil, Henry Hatfield, John Levesley, Greg Loveck, Ted Owen (Maldon), Fred Pallant G3RNM (Storrington), Ted Waring and Ern Warwick for their beacon logs from which I extracted the detailed information to compile this month's, longer than ever, 28MHz beacon chart, Fig. 2.

Vaclav Dosoudil received strong signals from the Spanish beacons EAJA and EAGBCD on his portable receiver while walking in the nearby barograph installed at his home in Sussex. It is interesting to compare the timing of the tropospheric openings with the timing of the tropospheric openings which occurred during the period. Although Simon Hamer found too much Band II DX to mention, he simply listed the countries that he heard which included Benelux, France, Germany and Scandinavia. This opening, like the one on October 3, extended to Band III IV, and the USA. He logged television captions, test cards and programmes from Britain, Belgium, Czechoslovakia, France, East and West Germany, Hungary, Holland, Ireland, Italy, Luxembourg, Poland, Scandinavia and Switzerland. I found at least 10 active voice and CW stations throughout Band II at 0845 on October 16 and early on the 17th and while travelling between

**Back-Scatter**

**Propagation**

Reports to

Ron Ham
Farraday
Greyfriars, Storrington, West Sussex R20 4HE

![Diagram of Back-Scatter propagation](image)

**19th October 1989**

**1273 MHz.**

**363 MHz.**

**101**

Practical Wireless, January 1990
Winchester and Poole at 0640 on the 17th. Editor, Rob Mansell G3KPD heard French, Italian and one Spanish station in Band II on his Panasonic car radio.

Although my Plustron 1VR5D with its own rod antenna, was on the back seat of my car and under trees, in East Sussex, I heard several foreign voices as Band II was gradually opening up around 1600 on October 24. When I checked from home at 0930 on the 25th, with my ex-military R216 fed by a dipole, I counted at least 18, mainly German, foreign stations between 87.5 and 102MHz plus BBC Radio Oxford which is unusual for me. In addition, between 0900 and 1030, I received pictures in Band III from Belgium between 0900 and 1030, I received pictures in Band III from Belgium, France and West Germany and similar conditions prevailed at 0900 on the 27th.

934MHz.

"Favourable tropospheric conditions were enjoyed during the evening of October 17 through to the morning of the 18th," wrote Terry Wyatt UK-845 (Walton on Thames) and adds, "Stations made contact from and between Leicestershire down to Devon in the west and Essex in the east." Although conditions were not so good for the UK club contest on the 15th, competitors enjoyed the event over a 80km radius and John Levesley UK-627 worked stations in the Channel Islands, around 160km, during the good conditions on September 27 and 30 and October 2. Also on the 2nd he heard a station in Bridgend at 135km.
broadcast round-up
Reports to Peter Shore

Radio Free Europe and Radio Liberty are expanding contacts with their Eastern Bloc target countries. The head of the recently visited the Hungarian news agency MTA and other visitors to the station's headquarters in Munich have been broading with the help of Soviet officials in recent weeks. The Public Affairs Director of RFE/RL, Robert Redlich, told me in late October that changes were taking place which just over two years ago would have been unthinkable, including the establishment of bureaux in Warsaw and Hungary, and correspondents in other major Eastern Bloc capitals. Improved transmission facilities would enable the station to improve coverage of the Soviet Asian Republics and the audience figures are on the increase.

In a continuing trend amongst Soviet Republics, Radio Minsk and Latvian Radio have both introduced new services for expatriates. Details are given in the European news section.

Radio Australia will have a new General Manager, Richard Broadhead, for the coming year. In a recent review of the station, its aims and potential has shown that short wave broadcasting will be important in the Asia-Pacific region until well into the 21st Century, and that Radio Australia should be playing its part. A new programme schedule is to be introduced in December which will represent the station's target priorities for that region. In the South Pacific, Latvian service for West Europe at 1730, also for thirty minutes, on the medium wave channel of 1.143MHz. Vancouver's shorter wave service while Moscow at other times is thought to be in Kaliningrad and be 500kW. Radio Vlastinos in Lithuania has English transmissions to Europe at 0930 on 6.10MHz and 666kHz, and from 1000 also on 15.455, 13.645, 11.79 and 9.40MHz.

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North American listeners can tune in at 2300 on 17.69, 17.665, 15.18, 11.675 & 9.61MHz. Radio Vlastinos has also started a Russian language DX programme called Hello DXers. It is heard on 17250kHz on Monday, Wednesday and Friday, and on 17290kHz on Tuesdays. Also a Russian language DX programme is broadcast on the medium wave channel of 1.143MHz.

For Moscow home services and World Service are audible at several times of the day. Try between 1700 and 2000 for broadcasts beamed to West Europe from 2000.

Radio Vlastinos in Lithuania has English transmissions to Europe at 0930 on 6.10MHz and 666kHz, and from 1000 also on 15.455, 13.645, 11.79 and 9.40MHz.

North Central & South American Stations

Radio Canadia is using 13.65MHz for broadcasts beamed to West Europe from 2000.

Radio Via International from Costa Rica opens at 1100 on 11.87 and 9.725MHz. Try the 9MHz channel between 2030 and 0100.

Radio Cultural in Guatemala has been heard in Europe on 3.30MHz from 0330 with gospel programming. Radio Vlastinos uses 5.98 MHz from 0000 until 0200.

Radio Havana Cuba currently transmits at: 1900-2100 on 15.34MHz.

WHSB at 2000 uses new 15.225MHz, replacing 15.39MHz for its European and North American service. To Australia at 0800, new frequency 13.76MHz is used.

Trans World Radio In Guam broadcasts in English to Africa at 1600 on 11.91MHz.

The other Guam religious broadcaster, Adventist World Radio, airs a DX programme on Saturday at 1630 on 11.98MHz and again at 2200 on 15.125MHz. On Sunday the show is at 0330 on 11.70MHz and Monday at 1030 on 13.72MHz.

Some details of All India Radio's use of short wave for domestic services: Radio Kashmir uses a new 10kW transmitter daily 1130-1630 on 4.76MHz, and at 0120-0300 on 3.33MHz.

At Port Blair, AIR uses another transmitter, 0700-0800 on 7.18, 1030-1630 on 4.76MHz.

Shillong, in the north-east of the country, has a 10kW transmitter which is heard 0125-0220 and 1225-1720 on 3.525MHz, and on 7.19MHz at 0225-1215. This channel is likely to be replaced by 4.79MHz before too long.

Tests for the new 50kW transmitter at SBIHOM, to replace the 2.5kW transmitter that has been in operation for many years, are being made on 17.85MHz. Details of the test transmissions are at 2300 on 17.84MHz, at 0900 on 10.525MHz, and at 1900 on 21.66MHz.

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I had a shock recently - strong winds had had an adverse effect on one of the trees in the garden and the trunk almost snapped. As soon as I saw it I went outside to check the antenna system... you know, make sure it’s still there, all sealed joints, no water getting in, no hot-nest proof and any guy wires are taut.

One TV I know has been hit by a freak storm - it's a wood panel type of TV - but the strong winds have actually caused a2 small metal tube of it to break. The local filling station is open 24 hours a day, and it was there that they found the broken part. After it was replaced, the service was back to normal.

Water always gets into unsealed UHF connectors and I've never heard of anyone using a1 special connector for that. The ones I use are pretty obvious, but there are some that are more difficult to spot. For example, I use a type of connector that is designed for use with water tanks.

It is important to make sure that all connectors are properly sealed, especially those that are exposed to the elements. This will help to prevent moisture from entering and causing damage to the equipment.

The Future of ATV

What does the next decade hold for amateur television? The future of ATV is uncertain, and there are many factors that could influence its development. One factor that is certain is that the technology of the future will be different from that of today.

Satellite technology is advancing rapidly, and this will have a significant impact on the future of ATV. Satellites are already being used to transmit television signals, and it is likely that this technology will become even more important in the future.

In addition, new technologies such as high-definition television (HDTV) and 3D television are also likely to have an impact on the future of ATV. These technologies are expected to be more widely available in the future, and they will likely lead to new and exciting developments in the field of ATV.

It is important to keep an open mind and to be prepared for changes in the future. The future of ATV is uncertain, but one thing is certain - it will be exciting and full of surprises.
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