

# Amateur **RADIO**

For all two-way radio enthusiasts

**Construction:**  
**A Trapped Dipole for the DX Bands**

**Frequency Synthesis:**  
**Understanding Frequency Synthesisers**



**Two User Reviews:**  
**The Pac-Comm Personal Message System and  
the Kenwood RC-10 Remote Controller**

**FOR THE BEST IN AMATEUR RADIO - SAVE MONEY AND CALL US NOW FOR OUR UNBEATABLE EXCLUSIVE PACKAGE DEALS**

**ICOM IC-761**



100W, 1.8-30MHz Ham band TX, GCRX, 32 mems, Internal ATU & PSU, DFM mixer, 105db dynamic range  
IC-761 ..... £2450.00

**ICOM IC-751A**



100W, 1.8-30MHz Ham band TX, GCRX, 32 mems, SSB/CW/AM/FM/RTTY, 12v operation, 40 wpm OSK keyer  
IC-751A ..... £1500.00

**ICOM IC-735**



100W, 1.8-30MHz Ham band TX, GCRX, an ideal contest or mobile rig, 12v operation, 12 mems, AM/SSB/CW/FM  
IC-735 ..... £920.00

**ICOM IC-725**



100W, 1.8-30MHz Ham band TX, GCRX, SSB/CW, AM/FM option, DDS low noise synthesizer system - package deal available!  
IC-725 ..... £750.00

**ICOM R7000**



25-1000MHz + 1.025-2GHz, keypad entry, 99 mems, AM/FM/SSB, comprehensive scanning system - package deal available!  
IC-R7000 ..... £900.00

**ICOM IC-R71E**



0.1-30MHz RX, 32 mems, keypad entry, SSB/AM/RTTY/CW (FM option), DFM system, a classic receiver  
IC-R71E ..... £950.00

**ICOM IC-3210E**



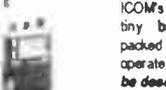
Dual band mobile, 144-146MHz and 430-440MHz, 20 double memories, 25/5W on both bands, duplex capability  
IC-3210E ..... £490.00

**ICOM IC-32E**



Dual band HT, 144-146MHz and 430-440MHz, 20 mems, SW on 2 and 70, duplex capacity, keypad entry  
IC-32E ..... £390.00

**ICOM IC-2SE/4SE**



ICOM's new babies, tiny but feature packed and easy to operate too! It can't be described in an ad, send SAE for info ahead now!  
IC-2SE/4SE from ..... £275.00

**YAESU FT-23R/FT-73R**



Yaesu's classic compact HT's, 144-146MHz or 430-440MHz, 10 mems, SW on 2/70, 0.25uV for 12db SINAD, many options  
FT-23R/FT-73R from ..... £200.00

**YAESU FRG-8800**



General coverage receiver, 0.15-30MHz all mode, 118-174MHz option, 12 mems, CAT system, keypad entry, 0.4uV sensitivity  
FRG-8800 ..... £640.00

**YAESU FT-767GX**



HF/VHF/UHF all mode 100W transceiver, 0.1-30MHz ham band TX, GCRX, 50/144/432 MHz option, built in ATU, digital SWR & power meter  
FT-767GX ..... £1500.00

**YAESU FT-736R**



VHF/UHF all mode transceiver, 144-146MHz and 430-440MHz (50MHz and 1.2GHz options), 115 mems, 60 watts, TV option  
FT-736R ..... £1350.00

**YAESU FT-747GX**



HF all mode 100W transceiver, 0.1-30MHz. Save money with the RAYCOM STARTER PACK with our MKII RX mod, 20A PSU and antenna.  
FT-747GX from ..... £650.00

**YAESU FRG-9600**



VUHF all mode RX, call for info on our exclusive mods, MK2 60-950MHz, MKS 100KHz-950MHz inc. free ROYAL discane and 75U  
FRG-9600 from ..... £490.00

**TEN-TEC PARAGON**



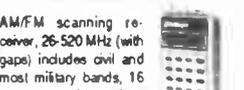
All mode 100W ham band TX, GCRX, dual VFO, RIT/XT, 62 mems, alpha display, OSK, five IF filters, PBT, speech proc, RF control  
TEN-TEC PARAGON ..... £1830.00

**NAVICO AMR1000/S**



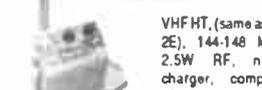
VHF 25W mobile, 144-146 MHz, 12.5/25 KHz steps, IARU channels, R0-R7, S0-S23, auto repeater shift/tone burst, digital S-meter  
NAVICO AMR1000/S from ..... £247.25

**CHALLENGER BJ200**



AM/FM scanning receiver, 26-520 MHz (with gaps) includes civil and most military bands, 16 mems, with free RAYCOM air band antenna (while stocks last)  
CHALLENGER BJ200 ..... £229.00

**CTE 1600**



VHF HT, (same as IC-2E), 144-148 MHz, 2.5W RF, nicad charger, complete with free 2m mag-mount antenna, while stocks last!  
CTE 1600 ..... £180.00

**AEA PK-232**



Multi-mode HF/VHF/TNC, CW, RTTY, ASCII, AMTOR, Packet, FAX, Navtex, great software for PC/CBM/BBC, come and try it now  
PK-232 ..... £270.95

**MOBILES**

- YAESU**  
FT-211RH 2m/45W ..... £300.00  
FT-212RH 2m/45W ..... £340.00  
FT-711RH 70cm/35W ..... £340.00  
FT-712RH 70cm/35W ..... £370.00  
FT-2311R 23cm/10W ..... £320.00  
FT-4700RH dual band 50/40W ..... £575.00

- ICOM**  
IC-228H 2m/45W ..... £380.00  
IC-448E 70cm/25W ..... £420.00  
IC-1200E 23cm/10W ..... £440.00  
IC-900 multi-band trvr ..... £480.00  
IC-UX19 10m band unit/10W ..... £240.00  
IC-UX59 6m band unit/10W ..... £240.00  
IC-UX29H 2m band unit/45W ..... £280.00  
IC-UX49 70cm band unit/25W ..... £280.00  
IC-UX129 23cm band unit/10W ..... £300.00  
IC-3210E 2m/70cm/25W ..... £400.00

- NAVICO**  
AMR 1000 2m/25W ..... £247.25  
AMR 1000S 2m/25W ..... £260.00

**HANDHELDS**

- ICOM**  
IC-2SE miniature HT ..... £220.00  
IC-MICRO 2 2m/1W ..... £240.00  
IC-02E 2m/2.5W ..... £220.00  
IC-2GE 2m/7W ..... £260.00  
IC-A20 airband trvr/NOR beacon ..... £400.00  
IC-A2 airband trvr ..... £420.00  
IC-04E 70cm/2.5W ..... £310.00  
IC-4GE 70cm/6W ..... £290.00  
IC-32E 70cm/2m/3-5W ..... £300.00

- YAESU**  
FT-23R 2m/W ..... £200.00  
FT-73R 70cm/5W ..... £220.00  
FT-411 2m/5W/keypad ..... £260.00  
FT-811 70cm/5W/keypad ..... £280.00  
FT-470 70cm/2m/5W/keypad ..... £380.00

- CTE**  
CTE 1600 2m/2.5W ..... £180.00

**CALL NOW FOR OUR FAMOUS USED LIST!**

**SCANNERS**

- Bearcat 200XLT ..... £250.99  
Bearcat 100XLT ..... £220.99  
Bearcat 100XL ..... £180.99  
Bearcat 70XLT ..... £160.99  
Bearcat 55XLT ..... £90.95  
Challenger BJ-200 ..... £220.00  
Sony AIR-7 ..... £220.95  
Sony PRO-80 ..... £290.95  
Sony SW1S short wave kit ..... £240.95  
Sony 2001D HF/Air Band ..... £290.95  
Sony ICF-7600DS ..... £150.95  
MARCII 0.15-950MHz ..... £380.00  
AOR AR2002 ..... £480.00

- FRG9600 Standard Pack ..... £400.00  
FRG9600 Mk2 60-950MHz ..... £560.00  
FRG9600 Mk5 0.1-950MHz ..... £720.00

all the FRG9600 packs include a free ROYAL 1300 discane worth £50.50 and a free mains PSU worth £25!

- ICOM ICR-7000E 25-1300MHz ..... £900.00  
including free ROYAL 1300 discane!

**RAYCOM NEWS BOX**

**FOND**  
We have always been fond of scanners at Raycom, starting way back when with what seem today like the most ordinary receivers, but no range has found a place in our hearts like the Uniden/Bearcat range when it comes to handhelds.

**CLOSE RELATIONS**  
Over the past years, we have built up a close working relationship with Uniden UK, and as a result of this continuing and flourishing relationship we are able to bring to our customers some special deals and very special benefits which underline our confidence in the Uniden range of products.

**SPECIALS**  
With effect from July 1st 1989 we are offering unbeatable deals on the following Uniden products. This is designed to clear out our stores for more of the current products and to make room for new and exciting products soon to come. Call us for super special deals on the following rigs:

- BC 50XL handheld scanner ..... £80.95  
BC 55XLT handheld scanner ..... £90.95  
BC 70XLT pocket scanner ..... £160.99  
BC 100XL handheld scanner ..... £180.99  
BC 175XL base scanner ..... £170.99

**NO QUIBBLE**  
As continuing proof of our faith in the product and to provide even better levels of service we make the following promise: we will exchange on the spot without quibble any unit failing within 1 year of purchase due to component failure or manufacturing defect (nicad/helical excluded) - with effect from July 1st 1989 - where will you find a better deal? 7/3 es 88!

**SCANNER SPECIAL! EXCLUSIVE TO RAYCOM - COBRA SR925!**  
16 channel programmable search, the COBRA scanner covers 29-54MHz for 10m & 6m Amateur bands, 118-136MHz Airband, 136-148MHz for 2m Amateur band, 162-174MHz for Land Mobile Radio and 406-512MHz for 70cm Amateur band and UHF 'T' band. With 16 memory channels, 2-speed search, high sensitivity (0.3 uV) and 1 watt of audio this scanner is ideal for beginner and enthusiast alike!

RAYCOM SPECIAL PACKAGE! includes the following:  
COBRA SR925 scanner including mains adapter £179.99  
FREE - RAYCOM scanner antenna worth £14.95 covering 60-90MHz, 108-136MHz, 136-174MHz and 380-525MHz  
FREE - antenna adapter, 10 metres of coax and PL259 sockets worth £15 - a ready-to-go special at only

only £179.99 (plus £10.00 post/packing)

**ICOM AT RAYCOM ICOM IC-R9000**



Magnificent is the only word for it! 100KHz-2Gigahertz continuous coverage, 1000 memories, multi-function CRT display and spectrum scope, send SAE for a fact sheet about this super new scanning receiver.  
ICOM IC-R9000 ..... £3900.00

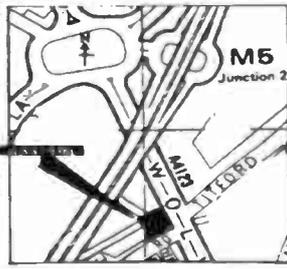
**Bearcat BC200xLT THE BEST HANDHELD SCANNER**

COVERS 29 TO 956 MHz (with some gaps). Covers all popular VHF/UHF/PMR Amateur/Air Band/Marine/Cellular and many other interesting frequencies. Features include:  
\* 200 memory channels \* helical antenna \* nicad pack and charger \* green backlight for display \* super fast search mode - 25 ch/sec \* selective delay \* auto lockout \* priority channel \* track tuning

only £229.99 (save £30)  
plus £10.00 post/packing/insurance

RAYCOM COMMUNICATIONS SYSTEMS LIMITED, INTERNATIONAL HOUSE, 963 WOLVERHAMPTON RD, OLDBURY, WEST MIDLANDS B69 4RJ. TEL 021-544-6767, Fax 021-544-7124, Telex 336483 IDENTI G.

**RAYCOM COMMUNICATIONS SYSTEMS LIMITED**



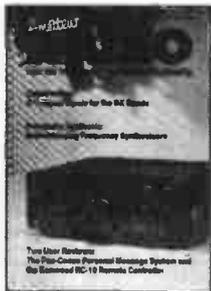
**RAYCOM gives you more BUYING POWER**  
ALL MAJOR CREDIT CARDS ACCEPTED, BC, ACCESS, DINERS, INSTANT CREDIT UP TO £1000 (SUBJECT TO STATUS) WITH RAYCOM CREDIT CARD (APR 29.5%). FREE CREDIT ON CERTAIN ITEMS AT MRP. CALL NOW FOR MORE DETAILS.

**ORDERING INFORMATION**  
WE STOCK ICOM, YAESU, BEARCAT, MFJ, BUTTERNUT, CUSHCRAFT, AEA, TONNA, NAVICO, TEN-TEC AND WELZ AMONG MANY OTHERS. CALL FOR FULL LIST.

**TEL: 021-544-6767**  
PHONE BEFORE 4PM FOR NEXT DAY DELIVERY BY COURIER (£15.00) - OR 2PM FOR DELIVERY BY POST (£10.00 P&P). PLEASE ALLOW TIME FOR CHEQUES TO CLEAR. MANY OTHER ITEMS IN STOCK. PLEASE CALL FOR MORE INFO AND FOR EXTRA SPECIAL DEALS!

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# Amateur RADIO



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You may have noticed that *Amateur Radio's* cover price has increased. This has been made necessary because of continually increasing paper and production costs.

As we are publishing a very specialised magazine, appealing to a dedicated band of readers, we are subject to higher unit production costs than other magazines of more general appeal.

Our research indicates that the magazine content is what you have asked for, so in order to continue publishing *Amateur Radio* for you, we need to charge an economic price.

I hope you continue to enjoy the magazine.

Best wishes

Peter Williams - Publisher



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AC127 0.20	BC107A 0.11	BC207B 0.25	BD132 0.42	B0534 0.45	BF272 0.26	BFY90 0.77	GEX542 9.50	R2010B 1.45	TIP146 2.75	25C496 0.80
AC128 0.28	BC107B 0.11	BC212 0.09	BD133 0.50	B0535 0.45	BF273 0.18	BLY48 1.75	MJ3000 1.98	R2322 0.58	TIP161 2.95	25C784 0.75
AC128K 0.32	BC108 0.10	BC213 0.09	BD135 0.30	B0575 0.95	BF335 0.35	BR100 0.45	MJE340 0.40	R3223 0.44	TIP2955 0.80	25C785 0.75
AC141 0.28	BC108B 0.12	BC214 0.09	BD136 0.30	B0587 0.95	BF336 0.34	BR101 0.49	MJE350 0.75	R2540 2.48	TIP3055 0.55	25C789 0.55
AC141K 0.34	BC109 0.10	BC214A 0.09	BD137 0.32	B0588 0.95	BF337 0.29	BR103 0.55	MJE520 0.48	RCA16029 0.85	TIS91 0.20	25C910 0.95
AC142K 0.45	BC109B 0.12	BC214L 0.09	BD138 0.30	B0701 1.25	BF355 0.37	BR303 0.95	MJE2955 0.95	RCA16039 0.85	TV106 1.50	25C937 1.95
AC176 0.22	BC114A 0.09	BC237B 0.15	BD139 0.32	B0702 1.25	BF362 0.38	BRY39 0.45	MPSA92 0.30	RCA16334 0.90	ZRF0112 16.50	25C1096 0.80
AC176K 0.31	BC115 0.55	BC258 0.15	BD140 0.30	B0703 0.90	BF363 0.65	BSW64 0.95	MRF237 4.95	RCA16335 0.85	2N1100 6.50	25C1098 2.50
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AC187K 0.28	BC117 0.19	BC259A 0.15	BD150 0.65	B0F115 0.35	BF394 0.19	BT100A/02 0.85	MRF453 17.50	S2600 0.95	2N1711 0.30	25C1162 0.95
AC188 0.25	BC119 0.24	BC252A 0.15	BD160 1.50	BF119 0.65	BF422 0.32	BT106 1.49	MRF454 26.50	SKESF 1.45	2N2219 0.28	25C1172 2.20
AC188K 0.37	BC125 0.25	BC258 0.25	BD166 0.50	BF127 0.39	BF423 0.25	BT116 1.20	MRF455 17.50	T6021V 0.45	2N2626 0.55	25C1173 1.15
AC17 1.15	BC140 0.31	BC258A 0.39	BD179 0.72	BF154 0.20	BF457 0.32	BT119 3.15	MRF475 2.95	T6027V 0.45	2N2905 0.40	25C1306 1.75
AD142 2.50	BC141 0.25	BC284 0.30	BD201 0.50	BF158 0.22	BF467 0.68	BU105 1.95	MRF477 14.95	T6036V 0.55	2N3054 0.59	25C1413A 2.50
AD149 1.50	BC142 0.21	BC300 0.30	BD202 0.50	BF173 0.22	BF493 0.35	NU108 1.69	MRF479 2.50	T9012V 0.55	2N3055 0.52	25C1449 0.50
AD161 0.50	BC143 0.24	BC301 0.30	BD203 0.50	BF177 0.38	BF499 0.25	BU125 1.25	OC23 9.50	T9015V 2.15	2N3703 0.12	25C1628 0.75
AD162 0.50	BC147B 0.12	BC303 0.26	BD204 0.70	BF178 0.26	BF499 0.25	BU126 1.50	OC26 1.50	T9034V 2.15	2N3704 0.12	25C1678 3.75
AF106 0.50	BC148A 0.09	BC307B 0.09	BD222 0.46	BF179 0.34	BF499 0.25	BU204 1.60	OC28 5.50	T9038V 3.95	2N3705 0.20	25C1953 0.95
AF114 2.50	BC149 0.09	BC327 0.10	BD223 0.59	BF180 0.29	BF499 0.25	BU205 1.30	OC29 4.50	THY15/85 2.25	2N3706 0.12	25C1957 0.80
AF115 1.95	BC153 0.30	BC328 0.10	BD225 0.48	BF181 0.29	BF499 0.25	BU208 0.95	OC32 5.50	THY15/85 2.25	2N3708 0.12	25C1969 2.95
AF116 2.50	BC157 0.12	BC337 0.10	BD232 0.35	BF182 0.29	BF499 0.25	BU208A 1.15	OC42 1.50	TIP29 0.40	2N3733 9.50	25C1985 1.50
AF117 2.50	BC159 0.09	BC338 0.09	BD233 0.35	BF183 0.29	BF499 0.25	BU208B 1.35	OC44 1.25	TIP29C 0.42	2N3773 2.75	25C2028 1.15
AF118 3.50	BC161 0.55	BC347A 0.13	BD236 0.49	BF184 0.35	BF499 0.25	BU208C 1.35	OC45 1.00	TIP30C 0.43	2N3792 1.35	25C2029 1.95
AF121 0.60	BC170B 0.15	BC347 0.13	BD242 0.65	BF185 0.28	BF499 0.25	BU209 1.00	OC47 0.75	TIP31C 0.55	2N4200 3.50	25C2077 1.45
AF124 0.65	BC171 0.09	BC478 0.20	BD246 0.65	BF195 0.11	BF499 0.25	BU407 1.24	OC71 0.75	TIP32C 0.42	2N4427 1.95	25C2091 0.85
AF125 0.65	BC172B 0.10	BC527 0.20	BD246 0.65	BF197 0.11	BF499 0.25	BU408 1.50	OC72 2.50	TIP33C 0.95	2N4444 1.15	25C2098 2.95
AF126 0.45	BC173B 0.10	BC547 0.10	BD246 0.65	BF199 0.14	BF499 0.25	BU426A 0.75	OC75 1.50	TIP34B 0.95	2N5294 0.42	25C2166 0.80
AF127 0.65	BC174 0.09	BC548 0.10	BD307 0.32	BF199 0.14	BF499 0.25	BU500 2.25	OCB1 1.00	TIP41A 0.45	2N5296 0.48	25C2314 0.80
AF139 0.40	BC177 0.15	BC549A 0.10	BD410 0.65	BF200 0.40	BF499 0.25	BU508A 1.95	OC84 1.50	TIP41C 0.45	2N5298 0.60	25C2317 0.95
AF150 0.60	BC178 0.15	BC550 0.14	BD434 0.65	BF240 0.20	BF499 0.25	BU526 1.90	OC139 12.50	TIP42C 0.47	2N5485 0.45	25C2370 0.95
AF178 1.95	BC182 0.10	BC557 0.08	BD436 0.60	BF241 0.15	BF499 0.25	BU807 2.25	OC171 4.50	TIP47 0.65	2N5496 0.95	25K19 0.55
AF239 0.42	BC182LB 0.10	BC558 0.10	BD437 0.60	BF245 0.30	BF499 0.25	BUY20 2.15	OC200 4.50	TIP48 0.65	2N5641 16.50	25K33 0.55
AS27 0.85	BC183 0.10	BC639/10 0.30	BD438 0.75	BF256C 0.35	BF499 0.25	BFY18 1.35	OC201 5.50	TIP50 0.65	2N5643 16.50	35K88 0.95
AS77 1.50	BC183L 0.09	BCY33A 19.50	BD510 0.95	BF257 0.28	BF499 0.25		OC205 10.00	TIP210 0.60	25A329 0.95	

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AN236 1.95	CA1325E 1.75	LA4420 3.50	MC1327Q 0.95	SN7413 1.10	STK0015 7.95	TA7631 2.50	TBA571 2.50	TOA1015 2.25	TOA2610 2.50	UPC1350C 2.95
AN240P 2.50	CA3086 0.46	LA4422 1.50	MC1351P 1.75	SN7413Q 1.10	STK0029 7.95	TA7632 2.50	TBA673 1.95	TOA1025 2.50	TOA2611A 1.95	UPC1353C 2.45
AN247 2.50	CA3132E 1.95	LA4461 3.95	MC1352P 1.00	SN7414 1.50	STK0039 7.95	TA7633 2.50	TBA675 1.95	TOA1037 1.95	TOA2640 3.50	UPC1360 2.95
AN260 2.95	CA3140M 2.50	LA4463 3.95	MC1357 2.35	SN7421 0.85	TA7061AP 1.50	TA7634 2.50	TBA750Q 2.65	TOA1044 2.15	TOA2655 4.50	UPC1363C 3.95
AN262 1.95	CA3145E 2.50	LA4463 3.95	MC1358 1.58	SN7421 0.85	TA7061AP 1.50	TA7635 2.50	TBA800 0.95	TOA1047 2.15	TOA2680A 2.75	UPC2002H 1.95
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC1496 1.75	SN76115N 1.25	TA7073 3.50	TA7636 2.50	TBA810AS 1.65	TOA1180 2.15	TOA2690 2.45	UPC2011ALC 2.50
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC1723 0.50	SN76115N 1.25	TA7108P 1.50	TA7637 2.50	TBA810P 1.65	TOA1270Q 3.95	TOA3310 2.95	555 0.35
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC3357 2.75	SN762260N 2.95	TA7120P 1.65	TA7638 2.50	TBA820M 0.75	TOA1327 1.70	TOA3310 3.50	556 0.60
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC3401L 2.50	SN762271N 1.05	TA7129P 2.50	TA7639 2.50	TBA820Q 1.45	TOA2002 1.95	TOA3560 3.95	723 0.50
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC14106P 2.95	SN762282N 2.95	TA7130P 1.50	TA7640 2.50	TBA890 2.50	TOA2003 1.95	TOA4050 2.95	747 0.50
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC14518CP 7.50	SN76533N 1.65	TA7137P 1.00	TA7641 1.50	TBA920 1.65	TOA2100 1.95	TOA4600 2.50	748 0.35
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12318 1.75	SN76650N 1.15	TA7146P 1.50	TA7642 1.50	TBA950/2X 1.50	TOA2020 2.95	TOA9053 3.15	7808 0.50
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7176AP 2.95	TA7643 2.95	TBA990 1.49	TOA2030 2.80	TEA1009 1.35	7805 0.50
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7193P 3.95	TA7644 2.95	TBA990 1.49	TOA2140 3.95	UPC41C 3.50	7812 0.50
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7203 2.95	TA7645 2.95	TBA990 1.49	TOA2150 2.50	UPC566H 1.95	7815 0.50
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7204 2.15	TA7646 2.95	TBA990 1.49	TOA2150 2.50	UPC575C2 1.50	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7205 2.15	TA7647 2.95	TBA990 1.49	TOA2150 2.50	UPC1001H 1.95	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7206 1.95	TA7648 2.95	TBA990 1.49	TOA2150 2.50	UPC1020H 2.95	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7207 1.95	TA7649 2.95	TBA990 1.49	TOA2150 2.50	UPC1024H 1.95	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7208 1.95	TA7650 2.95	TBA990 1.49	TOA2150 2.50	UPC1025H 1.95	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7209 1.95	TA7651 2.95	TBA990 1.49	TOA2150 2.50	UPC1028H 1.95	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7210 1.95	TA7652 2.95	TBA990 1.49	TOA2150 2.50	UPC1032H 0.95	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7211 1.95	TA7653 2.95	TBA990 1.49	TOA2150 2.50	UPC1158H 0.75	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7212 1.95	TA7654 2.95	TBA990 1.49	TOA2150 2.50	UPC1167C2 1.95	
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7213 1.95	TA7655 2.95	TBA990 1.49	TOA2150 2.50		
AN264 1.95	CA3145E 2.50	LA4463 3.95	MC12328 2.50	SN76650N 0.90	TA7214 1.95	TA7656 2.95	TBA990 1.49	TOA2150 2.50		
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DF91	1.50			ORP50	3.95
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DH63	0.90			PC88	0.75
DH77	0.90			PC97	1.10
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DL35	2.50			PCB85	0.55
DL63	1.00			PCB88	0.70
DL70	2.50			PCB89	0.70
DL73	2.50			PCC189	0.70
DL91	3.95			PCC805	0.70
DL92	1.50			PCC806	0.80
DL93	1.50			PCF82	0.60
DL94	1.50			PCF80	0.65
DL95	1.50			PCF82	0.60
DL96	1.50			PCF84	0.65
DL97	1.50			PCF87	1.20
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DL99	1.50			PCF201	1.80
DM160	6.50			PCF801	1.35
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E80C	19.50			PCF812	1.50
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E81CC	5.50			PCF819	1.50
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E88CC	3.95			PCF828	1.80
E88CC	3.95			PCF829	1.80
E88CC	3.95			PCF830	1.80
E88CC	3.95			PCF831	1.80
E88CC	3.95			PCF832	1.80
E88CC	3.95			PCF833	1.80
E88CC	3.95			PCF834	1.80
E88CC	3.95			PCF835	1.80
E88CC	3.95			PCF836	1.80
E88CC	3.95			PCF837	1.80
E88CC	3.95			PCF838	1.80
E88CC	3.95			PCF839	1.80
E88CC	3.95			PCF840	1.80
E88CC	3.95			PCF841	1.80
E88CC	3.95			PCF842	1.80
E88CC	3.95			PCF843	1.80
E88CC	3.95			PCF844	1.80
E88CC	3.95			PCF845	1.80
E88CC	3.95			PCF846	1.80
E88CC	3.95			PCF847	1.80
E88CC	3.95			PCF848	1.80
E88CC	3.95			PCF849	1.80
E88CC	3.95			PCF850	1.80
E88CC	3.95			PCF851	1.80
E88CC	3.95			PCF852	1.80
E88CC	3.95			PCF853	1.80
E88CC	3.95			PCF854	1.80
E88CC	3.95			PCF855	1.80
E88CC	3.95			PCF856	1.80
E88CC	3.95			PCF857	1.80
E88CC	3.95			PCF858	1.80
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E88CC	3.95			PCF860	1.80
E88CC	3.95			PCF861	1.80
E88CC	3.95			PCF862	1.80
E88CC	3.95			PCF863	1.80
E88CC	3.95			PCF864	1.80
E88CC	3.95			PCF865	1.80
E88CC	3.95			PCF866	1.80
E88CC	3.95			PCF867	1.80
E88CC	3.95			PCF868	1.80
E88CC	3.95			PCF869	1.80
E88CC	3.95			PCF870	1.80
E88CC	3.95			PCF871	1.80
E88CC	3.95			PCF872	1.80
E88CC	3.95			PCF873	1.80
E88CC	3.95			PCF874	1.80
E88CC	3.95			PCF875	1.80
E88CC	3.95			PCF876	1.80
E88CC	3.95			PCF877	1.80
E88CC	3.95			PCF878	1.80
E88CC	3.95			PCF879	1.80
E88CC	3.95			PCF880	1.80
E88CC	3.95			PCF881	1.80
E88CC	3.95			PCF882	1.80
E88CC	3.95			PCF883	1.80
E88CC	3.95			PCF884	1.80
E88CC	3.95			PCF885	1.80
E88CC	3.95			PCF886	1.80
E88CC	3.95			PCF887	1.80
E88CC	3.95			PCF888	1.80
E88CC	3.95			PCF889	1.80
E88CC	3.95			PCF890	1.80
E88CC	3.95			PCF891	1.80
E88CC	3.95			PCF892	1.80
E88CC	3.95			PCF893	1.80
E88CC	3.95			PCF894	1.80
E88CC	3.95			PCF895	1.80
E88CC	3.95			PCF896	1.80
E88CC	3.95			PCF897	1.80
E88CC	3.95			PCF898	1.80
E88CC	3.95			PCF899	1.80
E88CC	3.95			PCF900	1.80
E88CC	3.95			PCF901	1.80
E88CC	3.95			PCF902	1.80
E88CC	3.95			PCF903	1.80
E88CC	3.95			PCF904	1.80
E88CC	3.95			PCF905	1.80
E88CC	3.95			PCF906	1.80
E88CC	3.95			PCF907	1.80
E88CC	3.95			PCF908	1.80
E88CC	3.95			PCF909	1.80
E88CC	3.95			PCF910	1.80
E88CC	3.95			PCF911	1.80
E88CC	3.95			PCF912	1.80
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E88CC	3.95			PCF920	1.80
E88CC	3.95			PCF921	1.80
E88CC	3.95			PCF922	1.80
E88CC	3.95			PCF923	1.80
E88CC	3.95			PCF924	1.80
E88CC	3.95			PCF925	1.80
E88CC	3.95			PCF926	1.80
E88CC	3.95			PCF927	1.80
E88CC	3.95			PCF928	1.80
E88CC	3.95			PCF929	1.80
E88CC	3.95			PCF930	1.80
E88CC	3.95			PCF931	1.80
E88CC	3.95			PCF932	1.80
E88CC	3.95			PCF933	1.80
E88CC	3.95			PCF934	1.80
E88CC	3.95			PCF935	1.80
E88CC	3.95			PCF936	1.80
E88CC	3.95			PCF937	1.80
E88CC	3.95			PCF938	1.80
E88CC	3.95			PCF939	1.80
E88CC	3.95			PCF940	1.80
E88CC	3.95			PCF941	1.80
E88CC	3.95			PCF942	1.80
E88CC	3.95			PCF943	1.80
E88CC	3.95			PCF944	1.80
E88CC	3.95			PCF945	1.80
E88CC	3.95			PCF946	1.80
E88CC	3.95			PCF947	1.80
E88CC	3.95			PCF948	1.80
E88CC	3.95			PCF949	1.80
E88CC	3.95			PCF950	1.80
E88CC	3.95			PCF951	1.80
E88CC	3.95			PCF952	1.80
E88CC	3.95			PCF953	1.80
E88CC	3.95			PCF954	1.80
E88CC	3.95			PCF955	1.80
E88CC	3.95			PCF956	1.80
E88CC	3.95			PCF957	1.80
E88CC	3.95			PCF958	1.80
E88CC	3.95			PCF959	1.80
E88CC	3.95			PCF960	1.80
E88CC	3.95			PCF961	1.80
E88CC	3.95			PCF962	1.80
E88CC	3.95			PCF963	1.80
E88CC	3.95			PCF964	1.80
E88CC	3.95			PCF965	1.80
E88CC	3.95			PCF966	1.80
E88CC	3.95			PCF967	1.80
E88CC	3.95			PCF968	1.80
E88CC	3.95			PCF969	1.80
E88CC	3.95			PCF970	1.80
E88CC	3.95				

# STRAIGHT &

# LEVEL

## DP3T PIN-DIODE SWITCH

The WJ MSY2304-9CA is a double-pole, triple-throw, PIN-diode switch which interfaces with a dual-bandpass/band-reject, YIG-tuned filter, forming a switchable band-pass/band-reject/all-pass filter.

This dual switch covers the 2 to 6GHz frequency range, and provides a low insertion loss of less than 1.2dB. The VSWR is better than 1.8:1, and the isolation is greater than 80dB.

The DP3T switch is made of aluminium with hermetic feedthroughs and has a laser-welded cover, resulting in a lower component weight and improved reliability.

The RF interface incorporates both field-replaceable SMA connectors and female contact receptacles. The built-in female interfaces are flush-mounted on the bottom mounting surface, providing a simplified RF interconnection with its mating device. The switch operates from a +5V and -11 to -20V supply, and an integral driver provides TTL compatible control inputs.

For further information contact *Watkins-Johnson Int, Dedworth Road, Windsor, Berkshire SL4 4LH.*

## MICROTROL DIS 130

Roalan International have added to their range of interfaces and converters by introducing the Microtrol DIS 130.

The DIS 130 is an IEEE-488 to serial converter and provides both RS-232 and RS-422 signals. The baud rate can be set between 75 and 9600. Word length can also be set from 5 to 8 bits with odd, even or no parity. These variables can be changed via the DIP switches or by sending a software code over the IEEE-488 bus.

A typical application for the DIS 130 is to communicate to a serial plotter or printer from an IEEE-488 test system.

The DIS 130 has a standard 24 pin IEEE-488 connector and a 25 pin male 'D' connector.

For further information

contact *Roalan International, Gleneagles House, 31 Riverside Road, West Moors, Wimborne, Dorset BH22 0LG. Tel: (0202 86) 1512.*

## DIGITAL MULTIMETER

The MX50 hand-held digital multimeter, available from ITT Instruments, is a high-performance 5,000 count digital display instrument.

A unique safety feature is the battery compartment which is accessed from the front of the multimeter by disconnecting the measuring leads and then removing the safety cover. As a result, the operator is protected from receiving an electric shock. The sealed battery compartment, which also houses the fuses, is completely isolated from the rest of the instrument. This prevents any battery leakage from damaging the internal electronics.

The MX50 has a high-resolution bar-graph which operates in a number of different modes including centre-zero, zoom and 'live-trend'. A logic function is also provided to indicate circuit logic levels.

For further information contact *ITT Instruments, 344 Edinburgh Avenue, Slough, Berkshire SL1 4TU.*

## INTERFACE BOARD

New from STC Instrument Services is a new data acquisition and control interface board for the IBM PC/XT/AT and compatible computers.

The Keithley DAS-16(F) is a full-length board designed for direct installation into a PC expansion slot to turn it into a high-speed, high-precision, data acquisition and signal analysis instrument.

The DAS-16 has a standard AD674 successive approximation A/D converter, while the (F) version uses the faster AD774 12 bit converter, together with faster input circuitry.

Other features include: two channels of multiplying 12 bit D/A output; eight digital I/O lines (4 x 4); an adjustable

reference voltage output, and a three-channel programmable interval timer.

For further details contact *STC Instrument Services, Dewar House, Central Road, Harlow, Essex CM20 2TA. Tel: (0279) 641641.*

## HIGH-SPEED CISC

NEC Electronics Limited's new 32 bit Complex Instruction Set Computer (CISC), the V70, has now entered the preproduction phase.

This microprocessor operates at internal clock speeds of up to 45MHz and achieves an instruction processing capability of fifteen million instructions per second (MIPS), making it the fastest 32 bit CISC device currently available.

The V70 incorporates a virtual memory management unit with a virtual address space of 4 GBytes, a sixteen-entry translation look-aside buffer (TLB), and a four-level memory protection system.

High-speed operation is achieved by the use of a specially developed architecture incorporating an external 32 bit address and data buswidths, together with a six-stage pipelining structure enabling four instructions to be processed simultaneously.

The complete instruction set comprises 273 instructions of 119 types and is a superset of that used with the V20 and V50 microprocessors, enabling existing designs to be upgraded by emulation.

For further information contact *NEC Electronics (UK) Ltd, Cygnus House, Linford Wood Business Centre, Sunrise-Park Way, Linford Wood, Milton Keynes MK14 6NP. Tel: (0908) 691133.*

## TWO ACTIVE FILTERS

Cirkit Distribution have recently introduced two further additions to their Toko range of active filters for amateur radio and data communications equipment, as well as MCA and related communicators.

The THB277A hybrid inte-

# All the latest news, views, comment and developments on the amateur radio scene

grated circuit contains a bandpass filter for the 300Hz to 3kHz range and an operational amplifier, and measures 18.5 × 12 × 5mm (excluding pins). The maximum current consumption is 5.5mA and its attenuation is rated at 38dB (minimum) at 100Hz, and 12dB (minimum) at 6kHz. The maximum distortion is 0.5% at 1kHz, making the unit ideal for speakers or headphones between detector and expander.

For applications requiring both bandpass and lowpass filtering, the THB227 offers a combination filter which includes a 300Hz to 3kHz bandpass filter, a lowpass filter with cut off at 3kHz and an operational amplifier. This compact, nine-pin module, measuring 23 × 12 × 5.5mm, operates across a temperature range of -30°C to +70°C and may be stored between -40°C and +85°C. Its bandpass filter gives minimum attenuations of 18dB at 100Hz and 24dB at 6.8kHz, with maximum distortion of 0.2% at 1kHz. The lowpass filter's attenuation figures are 3dB (maximum) at 3kHz and 36dB (minimum) at 5.9kHz, with maximum distortion of 0.5%.

For further information contact *Circuit Distribution Ltd, Park Lane, Broxbourne, Hertfordshire EN10 7NQ. Tel: (0992) 444111.*

## CAD/CAM USER GROUP

Horseshoe Publishing have launched the first independent user group for users and potential users of PCB CAD/CAM systems throughout the UK. The CAD/CAM User Group (CCUG) offers its members support, training consultancy, and expert advice via a telephone helpline.

Under the editorship of Mark Jennings, former European Technical Director of Betronex, CCUG will mail a quarterly newsletter to all members containing hints, software and hardware reviews, letters and other topics of interest.

At first, CCUG will concentrate on EE Designer CAD/

CAM systems, but in due course will extend its scope to other products. CCUG is a totally independent body and offers an unbiased view on all products within its sphere of interest.

If you would like to become a member, or obtain any further information about CCUG, tel: (0763) 838885 or (0329) 661194.

## THE SPIRFLAME

Cobonic Limited have introduced the Spirflame self-contained gas production unit which produces gas (perfectly mixed hydrogen and oxygen) from the electrolysis of water and, hence, is suitable for applications such as soft soldering, brazing and welding, etc.

The Spirflame can produce a flame small enough to thread through the eye of a needle or large enough to cut 2mm steel. Running costs are only a few pence per hour.

Several work-stations can be supplied from one Spirflame and, with the launch of the second-generation of Spirflames, the gas supply to each work-station can be monitored. If one operator shuts down or changes the flame size setting on his torch, Spirflame automatically compensates by reducing or increasing the required gas output.

For further information, write to: *Cobonic Ltd, 32 Ludlow Road, Guildford, Surrey GU2 5NW.*

## PCB DESIGN

CADsoft Systems have introduced a PCB design package for the IBM PC or compatible computer.

The utility produces high-quality printouts of artwork on an Epson compatible dot matrix printer. Single or double-sided boards measuring up to 25×25in can be accommodated. Eight pad styles and five trackwidths are also provided which can be freely mixed.

Artwork can be enlarged to twice its full size; a high speed draft-mode is also pro-

vided. The design package costs £29.99.

For further details and a printout sample, contact *CADsoft Systems, 18 Ley Crescent, Astley, Tyldesley, Manchester M27 7BD* (please include an SAE). *Tel: (0942) 870376.*

## SIGNAL MULTIPLEXING

Klippon Micro-Systems have developed a signal multiplexing system called Miniplex. The unit includes a power supply unit, a control module, an input transmitter with an input conditioning module, and an output receiver with an output conditioning module.

Miniplex is capable of processing up to 128 digital or sixteen analogue signals via a twisted pair cable. The transmission system works in both directions, allowing the location of transmitters and receivers at any point on the cable.

A wide selection of input and output conditioning modules is available which support either eight digital signals or a single analogue signal. These include: I/O digital interfaces; I/O interface optocouplers; I/O semiconductor relays; I/O interface relays; and I/O interfaces for analogue signals.

For further information contact *Klippon Micro-Systems Limited, DPTS House, Cramptons Road, Sevenoaks, Kent TN14 5DZ. Tel: (0732) 460066*

## DS5000T SEMICONDUCTOR

The Dallas Semiconductor DS5000T microcontroller has an embedded clock/calendar and allows microcontroller systems to date and time stamp events, schedule activities and record the duration of operations.

Available from Dialogue Distribution Ltd, the device incorporates a lithium cell to preserve clock functions in the absence of power. Clock accuracy is better than two minutes a month at 25°C.

Time functions are accessed as though they were part

of the embedded non-volatile data memory, enabling the thirty-two input and output pins to be used.

Either 8 or 32K bytes of embedded non-volatile RAM are available for programs or data. The RAM incorporates a selectable partition between the data and program code.

For further information contact *Dialogue Distribution Ltd, Wicat House, 403 London Road, Camberley, Surrey GU15 3HL. Tel: (0276) 682001.*

## SIXTH VACATION SCHOOL

The Sixth Vacation School course 'Transmission for Telecommunications', organised by the Institution of Electrical Engineers (IEE), will be held at Aston University from 16 to 21 July 1989.

The purpose of the course is to provide a good appreciation of the overall strategies for the development, planning and implementation of the transmission aspects of national telecommunication networks.

The course is intended primarily for those already engaged in telecommunications engineering in either an operating or manufacturing organisation, and who have had a few years' experience in the industry.

Further information is available from *Miss F Sherwood, IEE, Savoy Place, London WC2R 0BL. Tel: 01-240 1871 ext 308.*

## WIRE STRIPPER

An automatic wire stripper for stripping insulation on cables from 0.2 to 8mm diameter in one simple action has been announced by Freertrade (TEP) Ltd. It can strip multicore signal cable, mains wiring and hook-up wires, while automatically adjusting its jaw separation. It includes a side cutter, and a strip length guide for accurate insulation removal which is graduated in inches and millimetres.

For further information contact *Freertrade (TEP) Ltd. Tel: 021-766 6142.*

# STRAIGHT AND LEVEL

## BARTG

The BARTG have recently published two more booklets to complement their *Beginner's Guide to Packet*: the *Beginner's Guide to RTTY*, and the *Beginner's Guide to AMTOR*, priced at £1.25 plus 20p p&p.

For further information contact *Peter Adams G6LZB*. Tel: (0923) 220774.

## SPECIAL EVENT

The Isle of Man Amateur Radio Society is setting up a station on the Calf of Man from 7 to 9 July.

The callsigns for this DXpedition are GD0IOM and GD3FLH on HF, with GD4IOM on VHF.

The bands to be used are: on HF, 20m SSB, 14.250; 15m SSB, 21.250; 10m SSB, 28.525 ±QRM; and on VHF, 2m, 70cm, and possibly 4m, 6m and 23cm.

All contacts made during the Calf of Man DXpedition will count towards the Golf Delta award.

For further information, tel: (0624) 834257.

## NEW NAVICO DEALER

Navico have appointed a new dealer to cover the south of England. ADITI Communications, of Hurstpierpoint, Sussex, have been awarded the contract.

The AMR1000 and AMR1000S 2m mobiles are stocked by ADITI and retail at £247.00 and £299.00 respectively; optional telephone handsets are also available.

For further information contact *Alec Parsons at ADITI*. Tel: (0273) 833311.

## ATLANTIC CROSSING

The Royal Air Force Finningley Amateur Radio Club are planning their own transatlantic challenge between 16 and 27 July from the Mull of Kintyre.

Their aim is to cross the Atlantic with radio signals via the Aurora Borealis. To mark the occasion the club will be using a special event callsign, GB2TAC.

The intended operational frequencies are as follows:

**2m Main Station:** a) 144.010,

A1A (CW); b) 144.225, J3E (SSB).

**4m Station:** 70.144, A1A and J3E.

**6m Station:** frequency TBN.

**HF Control Station:** a) 20m, 14.440 J3E; b) 15m, 21.330 J3E; c) 80m, 3.760 J3E.

During slow periods they will be operating on the WAB net on 80m and 20m, as the Mull of Kintyre is believed to be a rare square.

For further information contact *Corporal Nigel Fenton, Search and Rescue, RAF Finningley, Doncaster, South Yorkshire*.

## RALLIES

The Burnham, Beeches and Maidenhead and District Amateur Radio Club is holding its sixth McMichael Rally at the Haymill Centre, Burnham, near Slough, on Sunday 23 July.

Attractions will include an ATV group, packet station and an HF station, GB4MR.

Refreshments will be available all day and the car parking is free. The entrance

fee is £1.00 and car boot pitches cost £5.00 each.

For further information contact *Bob Hearn G0BTY QTHR*. Tel: (0494) 29868.

The Hilderstone Radio Society Mobile Rally takes place on 30 July at Hilderstone College, St Peter's Road, Broadstairs, Kent. Doors open at 10.00am.

There will be a talk-in and special event station, as well as the usual trade stands, etc.

For further information contact *Alan*. Tel: (0843) 593072.

The first North Cheshire Radio Club Mini-Rally and car boot sale will be held on 23 July from 11.00am at the Morley Green Social Club, Moberley Road, Morley Green, near Wilmslow, Cheshire.

Car boot pitches cost £5.00 in advance or £6.00 on arrival. There will also be a talk-in on S22 from G1NCR.

For further information contact *Peter G4WCE*. Tel: (092 575) 5959.

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# THE PAC-COMM PERSONAL MESSAGE SYSTEM

By Steven Goodier G4KUB and John Goodier G4KUC

In the December 1988 issue of *Amateur Radio* we reviewed the Pac-Comm TNC-220. At the time of writing the unit was being supplied with the 1.1.5 operating system, and the review stated that the TNC could be updated at any time as better and more efficient versions of the ROM were released onto the market. This has now happened, with the release of the new 1.1.6 software which now includes a Personal Message System (PMS).

If you are a regular user of packet radio, then you will be familiar with the larger mailbox systems that are used to forward and receive mail on a daily basis. Many mailboxes also contain a tremendous amount of useful information in their sub-directory areas for you to download and keep. These systems are of great value if you wish to forward a general bulletin around the country, or to a specific station at a known mailbox many miles away.

Valuable mailbox time can be wasted if you only wish to send a personal note to a friend a few miles away. A far better idea would be to have your own personal mailbox system, whereby you or other stations could leave short messages to be read at any convenient time. The introduction of the PMS ROM now enables the TNC-200 series of Terminal Node Controllers (TNCs) to operate such a useful facility. The new ROM will also upgrade the TAPR TNC-2, AEA PK-80 and MFJ 1270/1274 packet controllers.

## Facilities and features

Adding the new ROM to your system turns your TNC into a personal mailbox which can be accessed at any time, allowing messages to be stored for later retrieval. The TNC must be fitted with 32k of battery backed-up RAM, of which approximately 15k is allocated for messages. All information is retained even when the power is turned off. The system is transparent in operation and allows all normal packet working to be retained, while simultaneously allowing messages to be entered or read over the air by a second user who has connected to your mailbox callsign.

The system now includes a CW identification option which will send your callsign out in Morse code at regular intervals; usually every thirty minutes. Many of the new commands are specifically intended to control the PMS side of the software, and these include all the common commands such as SEND, READ and KILL, which should make first time users feel at home.

Once the new software has been fitted



Close-up of the PMS ROM

and checked for errors, you can arrange with your local BBS system operator (SYSOP) to forward all your usual mail directly to your personal mailbox. The idea is to leave your TNC on overnight and mail is forwarded to your PMS while you are asleep. This will save you having to log on to the main area mailbox, leaving it free for other users. You will only need to access it occasionally to check for bulletins and new information files etc.

## Fitting the new ROM

Before starting it is important to make a back-up of the TNC's parameters, as this will save you time later on. Making a back-up is simple; first open your receive buffer and then type DISPLAY. The operating parameters will be downloaded into the receive buffer. When this is complete save the buffer to disc. The saved information can then be uploaded later if wished.

The new ROM is easily fitted to your TNC by removing the main PCB and locating the old operating system, which is usually identified by a label that should inform you of the make of the TNC and the software version number. In the case of the TNC-220 the ROM is located towards the front of the board and close to the front panel LEDs. Make sure that you insert the new chip the right way round, and before starting make careful note of the orientation of the old one to ensure correct insertion. When satisfied, reassemble your TNC, and run your packet software.

Switching on your TNC should produce the sign-on message shown in Fig 1. You are now advised to purge the old parameters by sending the command RESET. Once issued this will reset the processor using the supplied parameters. You are now ready to make use of the new operating system. To save time you can now upload the parameters previously saved to disc; this is done by loading them into your transfer buffer and sending them to your TNC, just as if you were transmitting a file over the air. Of course, do not turn your rig on during this process.

## Setting up the PMS

If you decide to use the CW ident, then you are advised to use it with care. Not only does it send the text contained within the CWIDTEXT, but it borrows a section of code from the BEACONTEXT; therefore a portion text contained in that buffer may also be sent. The PMS overview advises you to leave the beacon text blank, and set the beacon to off. The CW beacon is sent at around 20wpm, and you are advised to transmit it every thirty minutes to avoid unnecessary QRM to other packet stations.

The Personal Message System is very simple to use, but there are a number of options to initialise before it can be put into service. The supplied handbook details all the new commands and Siskin Electronics supply a very useful 'PMS Overview', which explains about the CWID and other important commands.

Firstly, you must enter the callsign which the mailbox will be known as; this is usually your own call with a '-2' tagged on to the end. The command for doing this is MYPCALL, so for example entering MYPCALL G8VHF-2 from your computer terminal will name your PMS G8VHF-2. You now have the choice of allowing third party mail; this is set with the command 3RDPARTY, and it can either be on or off. Leaving the command on allows your system to store messages to and from other stations, whilst selecting off only allows messages to be addressed to or from your own callsign.

## Uploading messages

Now that your system is up and running you will probably want to upload a number of messages for people to read when they connect. I decided to dedicate part of my PMS to the ATARI ST computer, therefore I uploaded a couple of information files which I thought may be of interest to Atari users. Files can either be typed directly from the keyboard, or alternatively be prepared in a word processor and then saved in ASCII format for uploading later.

Fig 1

```
Pac-Comm TNC-220 packet
controller
AX.25 Level 2 Version 2.0
Features:
  PERSONAL MESSAGE SYSTEM
  CWID.
Release 1.1.6 10/18/88 - 32K RAM
Copyright U.K. by SISKIN ELEC-
TRONICS
Checksum $27
cmd:
```

# PAC-COMM PMS

Uploading is very simple. First prepare your text, load it into the transfer buffer and issue the command SEND followed by a callsign. Since my first message was a general bulletin to all users I used the command SEND ALL. The PMS will ask for the subject title which has to be less than twenty-eight characters. It's then just a matter of sending the message and ending it with a CTRL-Z or /EX. Once sent, typing 'L' will display a catalogue of messages stored on the system along with the message number, month and day they were entered, who the message is to and from and the subject title.

Since you are now a system operator (SYSOP), it is to your advantage to occasionally do some housekeeping in the form of deleting old or unwanted messages. Because there is only approximately 15k of memory for message store, the system can sometimes become full of messages you or other users have forgotten to delete. Any mail or file can be killed by issuing the command KILL followed by a message number. A much more powerful command, and one to use with great care, is KILL O, which will delete the ten oldest messages on the system.

Note that commands like KILL and KILL O will not be acted upon if the message is not to, or from, the user's callsign. This safeguards any other private mail and stops people abusing the system.

## The system in use

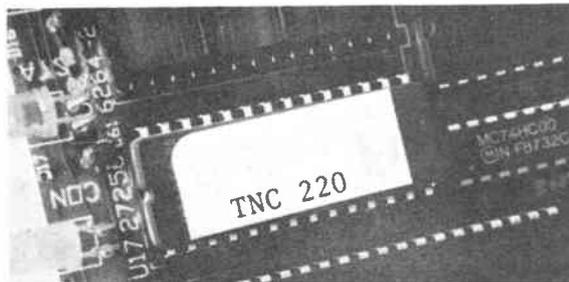
Anybody can connect to the mailbox by issuing the command C G8VHF-2 (the PMS callsign). If you are a regular user and know the SYSOP, there is a possibility that mail is waiting. If there is you are told at the time of logging on, and you will see the message 'You have mail waiting'. You are now in a position to use the command 'M', which will list all messages to your callsign. Any new mail will be listed here and can be read with the command 'R' followed by the message number.

Fig 2 shows the type of layout that you can expect to see once you have connected and used the command 'L' to list all messages. As you can see, messages are easily identifiable, but only the ones addressed to your callsign or to *all* may be read. The system also includes a fairly comprehensive help page, which the user can call up with the command 'H'; this is shown in Fig 3.

A very useful feature of the PMS is its ability to inform you of any new messages that have been entered in the mailbox. It does this by using the STA LED on the front of the TNC, which flashes slowly to draw your attention to the fact that a message is waiting. If the system operator reads any PMS message (not necessarily the newly entered one) the STA LED will stop blinking.

## Keeping a record

The PMS uses Stream K even if USERS is set to 1, so anybody connecting to the mailbox will not register on the green



The ROM installed on the TNC printed circuit board

CON LED located on the front panel of the TNC. If you suspect that a station is connected to your system, sending the command 'CS' will list all Streams and who is connected. This is worth doing before you close the TNC down, just in case somebody is using the PMS.

If you wish to monitor the activity on your mailbox, and keep a simple record of stations that have connected and messages read, switch to Stream K. Any station that connects now will register on the green CON LED, and activity will be stored in the TNC's remaining RAM area. Next time you run your packet software, open the receive buffer and hit the RETURN key on the computer. This will cause the TNC to empty the contents of its RAM into your receive buffer, and you can then study any activity that has taken place while you have been away.

Another good idea is to turn the time-stamp command on, and set the TNC's

internal clock by using the command DAY. All connections and disconnections will now be time-stamped, allowing you to build up a picture of how long a station has connected for and what messages were read. Don't forget to turn the MONITOR off before engaging the above process, or the remaining RAM will be filled with data from other traffic on channel.

## Third party mail

As my system stands at the moment it will accept third party mail because the command 3RDPARTY is on. The reason for this was so we could include informative files regarding the Atari ST computer. I think it would be a good idea for similar non-profit-making groups, such as RAYNET or local radio clubs, to set up a PMS to inform local amateurs of forthcoming activities.

If people start to use your information

```
***CONNECTED to G8VHF-2
Logged on to G8VHF's Personal Message System

CMD (K/L/LM/M/R/S/B/H/?)>
L
10      11/23  G4XHT      >  G8VHF      Xfer buffer info
9       11/23  G8VHF      >  G4XHT      THANKS FOR YOUR HELP
8       11/23  G8VHF      >  ALL        ASTUR ST Radio Group
6       11/22  G8VHF      >  G4PDX      THANKS FOR THE MESSAGE
2       11/22  G8VHF      >  ALL        ATARI SUB-DIRECTORIES
1       11/22  G8VHF      >  ALL        ATARI ST HAM SOFTWARE

7053 Bytes free
Next message Number 11
```

Fig 2

Fig 3

```
*** CONNECTED to G8VHF-2
Logged on to G8VHF's Personal Message System

CMD (K/L/LM/M/R/S/B/H/?)>
H
H(elp)   H [CR] or ? [CR] displays this help file.
L(ist)   L [CR] lists the 10 latest messages.
M(ine)   M [CR] lists the 10 latest messages to/from your callsign.
R(ead)   R n [CR] reads message number n.
K(ill)   K n [CR] deletes message number n (only to/from your callsign).
S(end)   S (callsign) [CR] begins a message addressed to (callsign).
          Subject: max 28 characters ending with [CR].
          Text: End each line with [CR]. End message by typing [CR]. [CR] /ex
          [CR] or CTRL-Z [CR] at the beginning of a new line.
B(bye)   B [CR] disconnects you from PMS.

CMD (K/L/LM/M/R/S/B/H/?)>
B
- Logged off
```

# PAC-COMM PMS

system to carry third party mail, I would advise you to delete such messages as soon as possible and warn other users not to engage in similar activities. It is now against licence regulations for a private mailbox to carry third party mail, and it is unlikely that any PMS would be licensed with a GB7 callsign. If you wish to keep your system completely private then you should set 3RDPARTY to off; any attempt to send mail to any callsign apart from the callsign of the mailbox will be met with the message 'No third party mail allowed'.

## Conclusion

The introduction of the Pac-Comm Personal Mailbox ROM has brought some very powerful, yet easy to use, commands to many users of the TNC-200 range of terminal node controllers. The system is both simple to fit and user friendly.

Without doubt, being able to leave the system switched on, and return hours later to find messages waiting is a great advantage. Another good point is having your own national mail automatically forwarded to you in the early hours of the morning.

All in all, the upgrade is well worth considering even if you do not intend to use the PMS system on a regular basis.

The Pac-Comm PMS ROM is available

from Siskin Electronics who also own the UK copyright. The price is £12.50 which includes post and packing or £7.50 if you trade in your old operating system. Incidentally, Siskin are now supplying all the Pac-Comm range of TNCs fitted with the new PMS as standard. They can also supply a complete range of AEA and

Kantronics TNCs, connecting leads, computer software and, of course, excellent advice.

For more information contact Siskin Electronics, Southampton Road, Hythe, Southampton, Hants SO4 6WQ. Tel: (0703) 849962 (24hr). If you are writing, a large SAE would be appreciated.

## PERSONAL MESSAGE SYSTEM – FACT FILE

- Product:** The Pac-Comm Personal Message System (PMS)
- Price:** £12.50 or £7.50 if you trade in your old ROM
- Supplier:** Siskin Electronics. Tel: (0703) 849962 (24hr)
- Features:**
- \* Twenty-seven new TNC commands
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  - \* Totally transparent in operation
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  - \* Approximately 15k of RAM available for message store
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  - \* Regional mailboxes can forward mail to your personal PMS on request
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# The Final Courtesy

by Trevor Morgan GW40XB

Amateurs often quote that the 'final courtesy' of a QSO is a QSL. But what is the QSL and, what is more important, why is it used?

The QSL card is a written verification of a contact made between two stations. It has no intrinsic value and, frequently, no technical value. Basically, it is no more than a 'thank you' card, but this should not really be the case. The problem is that it has become more of a tradition than a technical aid. So, what is the real value of a verification card and what should it convey?

To be of any use to the recipient, a verification card should give as much information about the sender's working set up as possible. It should also give full details of the weather and propagation conditions at the time of the contact, and comparative signal reports of stations in the same area as the recipient.

Any station, whether amateur or professional, has a good idea where his signals are being received and, from reports, how well they are being received in those areas. So a card stating the obvious is, literally, a waste of time.

Most QSL cards have the standard date, time, frequency, mode and report-type of layout. This is all right as far as it goes, but few amateurs or listeners take the time to give any other information.

So, what does a station need to make his report worthwhile? Really, a double-sided card is necessary. The usual pictorial or graphic design and standard report should be on one side, while the other side should contain as much technical information as possible. How this is set out is up to the individual, but here are a few guidelines.

**Comparative Reports.** It is useful for a station to know how his signals compare with other stations from the same area. He should also be aware of the equipment used by the other station so that he can assess his own results.

**Local Conditions.** Your locality can

play a part in how well his signals are received.

**Local Weather.** This can also play a part in reception, and details will help in his assessment.

**Timescale Reports.** A series of reports over, say, twenty-four hours will give an idea of changing propagation. Daily reports over a week at similar times will also give an idea of changing conditions.

**Your Equipment.** Give as much information as you can without getting too 'involved'. The receiver, aerial and any filtering used should be detailed.

Your report on the station's actual transmission should be as accurate as possible. A simple report of 5/7 with QSB (or a SINPO report of 54433) doesn't tell the station much. What sort of interference was there? How fast or deep was the fading? Was his audio excellent, average or distorted in some way? He'll never change his lousy mic unless someone tells him about it! Was he using too much compression or did the signal sound as if it was tailored, even if it wasn't? Watch out for harmonics, too, because a station might not be aware of them getting out. Also, a note on his bandspread may be useful. Anything that could be useful to the station should be noted. He may very well be aware of a problem, but you could help save a lot of embarrassment.

**Broadcast Stations.** The professionals are more keen to know if you have actually listened to their transmission so, naturally, they would like some 'proof'. A few comments about the programme you heard (they do not have to be complimentary!) will show that you did listen. Ask a few questions about the station, programmes or even staff. Most importantly, show some interest!

The final courtesy of a QSO is a QSL, but it's no good if the report isn't as accurate as possible. If a station receives a number of reports on his signals, all stating that he has some problem, it will

help him. If they all give 5/9+10 reports, he will carry on transmitting blissfully unaware that his rig is about to bite the dust!

**QSO Direct or via the Bureau.** For most amateur stations, the bureau represents a saving in time and money. Most stations have set times to send a batch of cards to the bureau. This may be weekly, monthly or even quarterly, depending on activity. If you send your report via the bureau, be prepared for a long wait for a reply. The cards you send are sorted by your bureau into destination bureaux and, when there are enough cards to make it worthwhile, these are posted off. The receiving bureau then sorts his pile into areas and these are posted to area managers. The area manager has the individual envelopes for the stations and will post these when they reach the weight for the postage paid.

Depending on how active a station is, the circuit can take a month, a year or even longer, and that's only in one direction!

Sending reports direct is not always possible or advisable but, if you think the report is important, perhaps due to a transmission fault, or something you think the station should know about, then do so. Always send sufficient postage for a reply.

Many stations do not respond to direct reports, either as a matter of policy or because they don't send verifications, so they have no cards anyway. Some stations use a QSL manager who deals with all of their cards.

Special event or DXpedition stations have a massive response. The majority of such stations write their cards while the contacts are being made and usually send them in one parcel to the bureau. These stations will receive thousands of cards which will be, mainly, from those contacts. Unfortunately, many special stations file all the cards they have received at the same time with hardly a glance at them unless they are unusual, so it is a good bet that a listener's report will be missed and filed with the rest.

The important point about verifications or reports is that they should be *detailed, informative and interesting* to the receiving station, otherwise QSL cards are a waste of time, money and effort. The final courtesy of a QSO is a useful report!

International  
Listeners'  
Association

SWL  
REPORT

15UXJ

I am pleased to report reception of your transmissions as detailed below

date	time	freq	mode	report	qso with
14 JAN 89	1725	14234	SSTV	5 7 9	GW40XB

If this report is correct by your records, your verification would be much appreciated

PLEASE QSL VIA  
RSGS BUREAU

RS88763/008

--- OR DIRECT

## DETAILED REPORT

INTERFERENCE: ADJACENT SSB SIGS FROM DLB  
 PROPAGATION: SLIGHT QSB ABOUT 1/2 POINTS  
 COMPARATIVE SIGNALS: I2ORX LOGGED AT 1745 5/9  
GOOD SIGNALS FROM ITALY  
 SPECIAL NOTES: VERY GOOD PICTURE OF YL RECEIVED.  
(COPY ENCLOSED)  
 RECEIVING STATION: TRIO R2000 WITH 130ft ENDFED  
AT 30ft AGL E-W. SPECTRUM/RX4. NO FILTER  
 LOCAL CONDITIONS: WX. DRY/CLOUDY 8/10 : 10°C  
GOOD WKG. COND. TO EUROPE  
 73 and Thanks: FRED SMYTH, 18 KING ST., FORAM, FOHAE

# The World of D | A | T | A

## BY DON FIELD G3XTT

This month I want to take a look at what traditional RTTY (Radio Teleprinter) has to offer, on the basis that many packet TNCs also support the RTTY mode.

Apart from CW itself, Baudot RTTY is the oldest data mode in use by amateurs (strictly, all the modes I refer to in this column are forms of RTTY, but by RTTY most amateurs mean five-bit Baudot). Early RTTY operators used mechanical teleprinter (telex) machines, obtained as surplus stock from military and commercial sources. Many UK amateurs, for example, started with the Creed 7B machine which became available at reasonable prices when the GPO (as it then was) introduced a new generation of teleprinters.

Mechanical teleprinters used a five-bit code to represent the characters to be sent. This is unlike CW, of course, where characters can be anything from one to five bits long (and more in the case of special characters like punctuation). The advantage of always using five bits in RTTY is that the receiving terminal knows when a character is complete; machines not being as intelligent as the human ear plus brain! On the other hand, a five-bit code only has two to the power five, or thirty-two different combinations. As there are twenty-six letters of the alphabet, you can see immediately that there is a problem in handling figures. This is solved by using the codes twice. Instead of upper and lower case as with a typewriter, RTTY uses a 'letters' and a 'figures' case. This provides for the twenty-six letters, ten numerals, some common punctuation marks, plus some control characters such as carriage return, line-feed, space and the letters and figures' shifts.

The complete RTTY character set is known as International Telegraph Alphabet Number 2 (ITA2), sometimes referred to as the Baudot Code (USA) or the Murray Code (UK). There are slight differences between the US and UK versions, but not enough to worry about.

You may have spotted from the above that RTTY doesn't distinguish between capital and lower case letters. Neither does it include the full range of computer keyboard symbols and codes. Having said this, the RTTY character set is perfectly adequate for straightforward communications.

You will come across RTTY on all the

HF amateur bands as well as some of the VHF and UHF bands. As well as being used for 'real-time' two-way QSOs, you may also run across RTTY mailboxes, where messages can be left for other amateurs to collect later. The IARU bandplans (see Table) include allocations for RTTY operation.

In fact, RTTY is so well established in the amateur world that there are many RTTY awards available including an RTTY version of the popular DXCC award, and regular RTTY contests.

Another fascinating aspect of RTTY is that it is still used for many commercial purposes on the HF bands. If you have a general-coverage receiver and the ability to decode RTTY signals then you will be able to copy press information, weather data, some ship to shore traffic, news bulletins and much else. Your terminal unit may also provide an ASCII mode. ASCII is similar to Baudot RTTY, but uses a seven-bit code, which allows for a bigger character set including the special characters needed by computer systems. Amateurs don't make much use of ASCII RTTY, but you may well run across it if you tune to the commercial RTTY frequencies.

### Getting Involved in RTTY

So, how do you get involved in RTTY? As with packet radio, the first thing is to get your station set up with the appropriate connections but, in practice, you will already have done that when connecting it up for packet operation. You will need to read the TNC manual to discover what commands are necessary to put it into the RTTY mode, and to operate it once in that mode.

The only parameter you should need to set is the baud rate which, for most amateur activity, is forty-five bauds. Set the mode switch of your radio to USB (or AFSK if this mode is provided) and tune to one of the RTTY bands (the majority of RTTY activity takes place on 20m, and as well as two-way QSOs you will also find several RTTY mailboxes active there).

You should quickly be able to tune in some RTTY signals. If you are having problems, check the speed and the polarity (you can change polarity by changing mode to LSB, or some TNCs permit it to be changed via a keyboard command). If you missed receiving a Shift character, perhaps because of

QRM, you can sometimes end up receiving a string of numbers when, in actual fact, letters are being sent, or vice versa. Again, from the keyboard, you can usually force the reception to Letters if this has happened. Some common received sequences will give you a clue as to what is going on. For example:

**:1 :1 :1:** really CQ CQ CQ, but with the Letter Shift missing

**646464:** really RYRYRY (the tuning signal), again with the Letter Shift missing

**SYSYSY:** probably RYRYRY being received with inverted tones.

In the days of mechanical teleprinters, operators would usually send a string of 'RYRYRYRY' at the beginning of each transmission as a tuning signal. This still happens quite a lot, although it really isn't necessary most of the time and simply generates unnecessary QRM. If you reply to, say, a CQ call, always start your transmission with a carriage return (so that it starts to appear on a new line at the distant end) followed by his call sign a couple of times and yours a couple of times, much as you would do on CW. In fact, most RTTY operators make extensive use of the CW 'Q' codes and procedure signals such as 'KN' and 'AR'. End every transmission with a carriage return.

One point to bear in mind is that no line of text should be more than sixty-nine characters long, as this is the most that mechanical teleprinters can handle. Most TNCs will insert a carriage return automatically at this point when in RTTY mode if you forget to do so.

You will soon discover that RTTY has one major disadvantage: it cannot handle errors. If an interfering signal comes up, that's it. The AMTOR or packet systems would ask for a retransmission but RTTY being an old and simple mode, can't cope. One way to minimise the problem is to keep the receive bandwidth as narrow as possible, by making good use of the adjustable filters in your receiver. A directional antenna is also invaluable, of course, for nulling out interference and maximising the signal you want to copy. Having said that, RTTY is far from being an ideal mode for DX operation, but can be a lot of fun when signals are strong and copy is good.

RTTY also gives you access to the regular news bulletins put out by BARTG

in the UK and ARRL in the USA, as well as to the various mailboxes I referred to earlier. The BARTG bulletins go out under the GB2ATG callsign on the first and third Sundays of each month on 80, 20 and 2m. The ARRL broadcasts, under the call W1AW, go out daily on all bands, and are best received in the UK on 14095 and 21095kHz. They are specifically beamed to Europe on Monday, Wednesday and Friday each week. The best times to check are 1600 and 2300GMT.

A word of warning before I complete this discussion of RTTY. RTTY is a 100% duty-cycle mode. In other words, while in transmit you are putting out a continuous carrier. SSB transmitters are normally rated for intermittent operation because voice is very peaky, so running them at full power for minutes on end can hasten

their demise. If in doubt, reduce the power on RTTY to something like a quarter to one-third of normal peak SSB power output. If a fan is an option with your rig (as with, for example, the FT101), ensure that you have one fitted.

#### A leap ahead?

The American *QST* magazine recently carried an interview with packet radio pioneer Doug Lockhart VE7APU. In it, Doug made some interesting observations about the adoption of packet radio by amateurs, and how he would like to see it develop. In the datacomms area, amateurs had traditionally used ex-commercial teleprinters, so were always one step behind the professionals. Doug comments: 'If amateur radio persists in just using tossed-out technology from

commercial users, we're never going to be able to hold our heads up high in the world'. Packet radio developments enabled amateurs to make a quantum leap in their capabilities.

Fortuitously, I saw a press report recently that Racal and Cable and Wireless have embarked on a joint venture to exploit the possibilities of transferring data via radio links. The new company, Merrac, will use newly-released frequencies in the 160MHz range. Another recent press item mentioned that Pace Communications of Southampton has launched a range of packet modems which can operate at speeds of up to 9,600bps and with an operational range on VHF or UHF of up to thirty miles. The company envisages applications in areas such as electronic

## Data Communications Bandplanning

<b>160 metres:</b>	RTTY allocation 1838-1842kHz
<b>80 metres:</b>	RTTY allocation 3580-3620kHz. Packet usually found on 3597, 3607kHz. AMTOR calling channels 3588 and 3637.5kHz
<b>40 metres:</b>	RTTY allocation 7035-7045kHz. Packet usually found on 7093kHz, though this is not an IARU-approved frequency. 7035kHz may be used in Europe. AMTOR calling frequencies 7045 and 7075kHz
<b>30 metres:</b>	RTTY allocation 10140-10150kHz. Packet found on 10147kHz, though the IARU currently recommends no packet operation on 10MHz. AMTOR calling frequency 10143kHz
<b>20 metres:</b>	RTTY allocation 14070-14099kHz. The ARRL recommends 14103, 14105, 14107 and 14109 for bulletin board services, and frequencies below 14100 for point-to-point packet contacts. 14100 is the International Beacon Chain frequency and should be avoided. AMTOR calling frequency 14075kHz
<b>17 metres:</b>	RTTY allocation 18100-18110kHz
<b>15 metres:</b>	RTTY allocation 21080-21120kHz. Packet tends to be found on 21103, 21105, 21107, 21109kHz. AMTOR calling frequencies 21075, 21100, 21115kHz.
<b>12 metres:</b>	RTTY allocation 24920-24930kHz
<b>10 metres:</b>	RTTY allocation 28050-28150kHz. Packet likely to be found on 28103, 28105, 28107, 28109kHz. AMTOR calling frequency 28075kHz. Some packet operation in the FM segment
<b>6 metres:</b>	50.6-50.7MHz recommended for packet by RSGB
<b>4 metres:</b>	RTTY calling frequency 70.3MHz. 70.4875MHz recommended by RSGB for formal packet links, 70.26-70.34 for informal, with 70.325 at the preferred channel
<b>2 metres:</b>	RTTY calling frequency 144.6MHz. 144.625-144.675 for packet as follows: 144.625 – all data modes including 'Cambridge' and TCP/IP 144.650 – AX25 including mailboxes 144.675 – AX25 other than mailboxes Some use of 144.585-144.590, 300 baud, USB, for packet DXing
<b>70cm:</b>	RTTY calling frequency 432.6MHz. Packet on 432.675, 433.625, 433.650, 433.675
<b>23cm and above:</b>	Allocations still under discussion

#### Notes:

1. There is no mandatory bandplanning in the UK, but voluntary adherence to the IARU recommendations is in everyone's best interest.
2. Where calling channels are specified, this implies that stations should move to a nearby clear frequency once a QSO is established.
3. Traditionally, and for commercial purposes too, HF data communications use LSB. On VHF, FM is frequently used for data communications. 25kHz channels are used on 2m and 70cm for packet transmission at 1200 baud (compared with 300 baud on HF). On the higher bands it is likely that wider channels will be used to accommodate higher speeds.
4. The method of specifying frequencies above is the traditional method, based on the notional carrier frequency. However, this assumes the modulating tones to be used. As these may vary, the method increasingly being adopted is to specify frequency by the centre of power of a data transmission. For most purposes this means the mid-point between the modulating tones. Thus 14105kHz (for example) would be referred to as 14104.3kHz.

point of sale, process control and various mobile data capture activities. As well as offering flexibility, the radio link saves on normal telephony network charges.

Undoubtedly these commercial users will build on developments already made in the amateur world, of which we can feel proud. However, amateur packet radio started ten years ago, and VE7APU sounds a word of warning when he says that 'It hasn't gone as far or as fast as I'd like it to go'. I have heard these sentiments echoed recently in the UK. Many packet users are happy to dabble with the local mailbox, and fail to see the enormous potential of packet radio which could be realised with improved software and more efficient networking.

Technically all this is possible, though cheap radio gear for linking on 23cm seems to be a long time coming, but the will and the sense of direction seem to have been lost. Although a lot of work is going on, it is largely unco-ordinated. Now that powerful PCs are becoming more affordable, mailboxes could offer much more sophisticated facilities, already available on commercial, non-radio systems. Better networking software, along with high-speed links, could open up real-time access to remote databases and directories; could permit multi-way conferencing; could allow documents to include graphics, image, and digitised voice; and so on. Perhaps what we need in the UK is for the innovators to form themselves into a

group, similar to the Tucson Amateur Packet Radio group in the US, to help push such developments through.

One of the papers presented at the last ARRL Computer Networking Conference particularly impressed me as a way that amateurs and professionals can work together for the common good. Dave Hughes, not himself an amateur, has worked with amateurs in Montana to set up an extensive packet radio network for schools, giving students in that very rural part of the USA real-time access to UNIX computing facilities. To provide dedicated telephone lines would have been prohibitively expensive. Local farmers, businessmen etc, are also encouraged to get in the act, giving them access to a wide range of data available on the network, and allowing them to share views and ideas. Dave believes that packet radio could completely transform communications in much the same way that micros have transformed the world of computing and made it available to 'everyman'. The biggest obstacle, and it would doubtless be the same here, is getting suitable frequencies released by the authorities.

#### HF mailboxes

The RSGB has now received authorisation from the DTI for the first HF packet and AMTOR mailboxes. GB7PLX, run by G3PLX, the father of AMTOR, is licensed for operation on 7, 10 and 14MHz. Packet mailbox GB7LDI, run by G3LDI, will

operate on 14 and 21MHz. GB7BNI in Northern Ireland and GB7GUR in Guernsey will operate on 14MHz. The rationale behind each of these HF stations is that they will be used for the forwarding of packet mail between the UK and overseas. Their success, or otherwise, will be monitored by the RSGB HF Committee and Packet Working Group, particularly to see whether packet or AMTOR is preferable for such links.

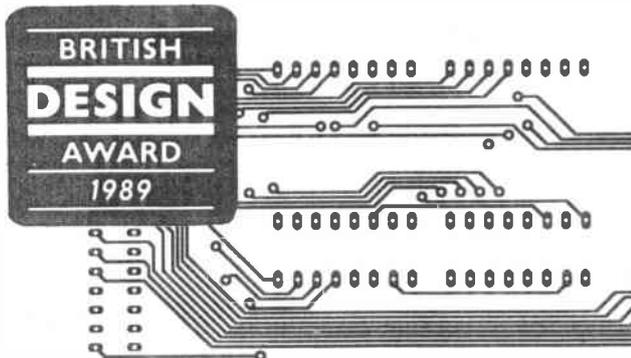
#### Digicom

Although I have said previously that packet radio is normally handled by a dedicated TNC, this is not always the case. There is a handful of software packages around which will allow the computer itself to do most of the work (though an external modem is still required). One example is Digicom, which works on the Commodore C64 and C128. The Digicom software is a shareware package, and is available from Jim Mahoney G6FCL, 89 Tynfields, Pitsea, Basildon, Essex SS13 1JA, by sending him a blank disc plus return postage and a disc mailer. You need to tell him whether it is for a C64 or C128. The matching modem is based on the AM7910 'World Modem' chip, and connects via the computer's cassette port, leaving the user port free to drive a printer. A suitable PCB is available for £5.00 from Ron Sadler G1SFK, 7 Newton Road, Stratford, London E15 1LR. Please enclose an SAE (about 3 x 4in).

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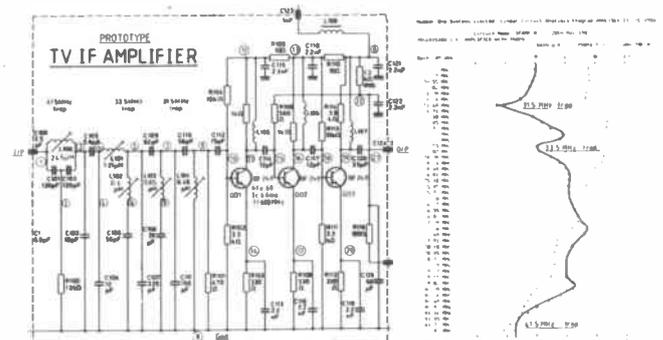
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# PROJECT BOOK

by Martin Williams

In the April edition we looked at the gain of beam arrays and how this depended on the length of the boom and the optimum number of elements for that length. We found that you cannot get more gain by simply piling on extra elements to an existing boom length. The best way to achieve extra gain is to stack more than one aerial.

## Multiband

There are two main areas involved: stacking arrays for the same band, or mounting, say, arrays for 144 and 432MHz on the same pole. We will assume that the aerials are set for horizontal polarisation and that they are stacked vertically rather than bayed horizontally. Although reference is made to VHF and UHF arrays the arguments are just as valid on other bands.

## Spacing

Let us start with the problem of mounting a 2m and 70cm aerial on the same mast; what should the spacing be? The simple answer is to put them as far apart as possible. Provided you can get them several metres apart this is good advice, although it does bypass some technical points that should really be taken into account. The real difficulty comes when you have only a short stub mast available; what then? As a general point it can be taken that, if the aerials to be stacked are both on the same band, the minimum spacing between them should be half the length of the boom. For aerials on different bands, set the spacing at half the boom length of the higher frequency aerial.

## Ground plane

There is rather more to it than the above simple rule of thumb would

indicate. In a stack for two bands the lower frequency array will appear to the higher frequency unit as a ground or earth plane. Theory tells us that the impedance of an aerial, and hence the correct matching, varies with the height above ground. In fact it passes through its free space value at a quarter-wave above ground and at all multiples of quarter-wave. Mounting the smaller array at some multiple of quarter-wave above the larger array will at least keep the SWR right.

## Angles

We are not yet out of the woods. When an aerial is mounted at *odd* multiples of a quarter-wave above ground, the ground acts as a reflector and causes a lot of your hard won RF to be sent out at high radiation angles. This is not what we want. This effect is minimised when the spacing is at *even* multiples of quarter-wavelengths where the impedance is once again at the free space value. The effects of spacing on the larger array are usually negligible and, if narrow spacings have to be used, watch out for detuning of the smaller aerial.

## One band

When stacking aerials for one band, the required spacing depends on the gain of the single yagi. Up to five elements the spacing should not be less than a half-wavelength and five-eighths is to be preferred. At ten elements the minimum spacing goes up to two wavelengths. If you are going to use two ten-element yagis on 2m, the minimum spacing would be four metres and four and a half would be better.

## Bays

Sometimes it is convenient to mount

the aerials side by side or bayed. This will give the same gain as vertical stacking but at the expense of narrower horizontal beamwidth than is obtained from vertical stacking. The important point in horizontal baying is the space between the ends of the elements on the two aerials. To obtain the best gain the end spacing should be at least five-eighths of a wavelength; on 2m this means about 2.4 metres between ends.

Putting all this together leads us on to stacking four aerials in a box array. If you are stacking four eight-element aerials for 2m, you would need a horizontal boom spacing of 3.6 metres and a vertical boom spacing of 4.5 metres to obtain maximum gain from the array.

## Lobes

If the bay spacing is increased, the main lobe gets tighter and the gain increases. Unfortunately, there is also an increase in the side-lobe content which can result in some very misleading directivity patterns. Two five-element yagis spaced a half-wave horizontally will show a beautiful clean pattern with virtually no side lobes. This can give the impression that you are getting a lot of gain. In fact, the gain from this baying distance is very small; it simply happens to be the optimum distance to minimise the side lobes.

## What now?

It is obvious from the above that large gain means a lot of metal and a lot of airspace. It also means a hefty rotator to handle it. Remember two things about aerial arrays: firstly, they are like Canadian lettuce, the bigger the better; secondly, if they did not blow over in the winter gales they were still much too small!



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# SECOND-HAND

by HUGH ALLISON G3XSE

## 'RCA' televisions

I've met quite a few disappointed people who have bought 5in diagonal, 'RCA' branded, black and white TVs. Well, at £20.00 brand new, boxed and working, with medium and VHF radio built in, wouldn't you? They are made in Suwon, Korea and are models BWT052E. They are freely available at rallies.

What's the catch? Well, there isn't one, provided you live in America. The TV is for NTSC, the US TV standard. Funnily enough, there is no problem with the picture; the line lock is happy to whizz away at our speed, and boy, are they sensitive. The problem is the sound; or rather the lack of it. This is due to the fact that the US sound video spacing is 4.5MHz; ours is 6MHz.

Right. To change one over. Rip the bottom off the set and locate the inter-carrier filter; it's a tiny three-legged thing called X101. Haul it out. It's got 4.5M stamped on it, hasn't it? Now do you believe me? The good news is that quite a few traders at rallies flog UK 6MHz filters at, literally, 10p each, or, if you cannot get to a rally, try a trader in **Practical Television**.

Wop it in. Still doesn't work, does it? That's 'cos the discriminator coil, T106, is still tuned to 4.5MHz. It's got a square drive hole in it, so be careful how you get the core out; a filed down matchstick should do it. With the core out, the coil only tunes to 5MHz. Sounds horrible, doesn't it? Really, you need a new coil. However, find a brass screw of the same thread and wind it in until it sounds right (brass raises the frequency). Works a treat, but what a bodge. I'm ashamed of myself, really I am. Now for the mega-good news. These sets also cover VHF Lo and VHF Hi (channels 2 → 6 and 7 → 13), so they are smashing for DX TV use. I'm sure you don't need telling that the mains input is 120V, so run the set on the 12V socket or the internal batteries.

All in all, an excellent little set at a very good price indeed, but you are going to have to work on it. As usual, let me remind you that, even though running on 12V, there are very high voltages present within this, or any, telly. Take care, and, if you don't know what you are doing, **don't do it**.

## Flogging it

The other end of buying a bargain is selling it. Whatever it is, you may have grown tired of it, it's been superseded or your interests have changed. Although there are many ways of selling your gear – adverts in this, your favourite amateur radio magazine, adverts on the wall at the radio club, word of mouth etc – one of the best ways of disposing of it is, of course, the bring and buy at your local rally.

Question. Why does some gear sell as

soon as it touches the shelf and some not move all day? I believe there are two factors: condition and price. Dealing first with condition; some of the disfiguring marks on the thing may have to be accepted. If it's fairly modern gear you might consider investing a fiver or so for a totally new front panel, case or what have you. These are often available from the importing emporium. A now regretted modification that involved gouging a hole somewhere, can often be removed in this fashion. However, the thing to enhance any sale is to make sure the gear is *clean*.

A total clean-up is the cheapest thing you can do. It may take you an hour or so but can repay dividends on sale day. When you have removed the knobs and the front panel etc, a bowl of warm, soapy water and a nail brush, plus a little enthusiasm, can equal amazing results. Remember, electricity and water are not friends; unplug first! Whilst the knobs are off, a gentle go over the cabinet with a damp cloth is on the cards. Beware what you use; soapy water is probably the safest (but go easy on the soap). Chemicals, even some spray polishes, can take off markings, melt plastic etc. Now, before we put the knobs back on, should we have white lines, pointers or dots on the knob that have worn off? These are nearly always recessed and the trick here is to blob 'TippEx' into the recess. Fill up the general area and give it five minutes to dry. Now chip off the excess with a finger nail and they look splendid, don't they?

Black leather carrying handles, protective cases etc, can often come up a treat after a going over with shoe polish of the appropriate colour – AVO handles especially. Clean off the excess after a few minutes, as normal, then remove any surplus the next day.

Scratches on black cases, front panels

etc, can often be disguised by going over them with a felt-tip pen. It's then a case of making sure the rig has got a full set of four feet and that all screws that show are present and correct.

Price. Study all the examples being offered for sale in magazines. Go to your chosen rally and have a look round first. Ask a few dealers what they will offer you – I've often been very, very pleasantly surprised at their offers, even for straight cash in the hand, never mind a trade-in.

You should have arrived at the rally equipped with a pen, a bit of card and some sticky tape. List on the card any special features of your wonderbox – accessories, Ni-Cads, handbook, aerials, mounting trays etc. I've often received favourable comments from purchasers when I have marked down how the thing is powered – 240V ac or 12V at 3A for example. Put the price on in bold figures and enter it in the sale. Bold figures? Well, due to security considerations (ie, to prevent stuff being nicked) equipment is normally displayed behind a roped-off area. It ends up so far away that it becomes an eyesight test for the punters. Let them know what a bargain you are offering! To sum up: a clean bit of kit, realistically priced and clearly labelled should equal a quick sale.

## Wythal rally

I just don't know how I've missed this rally in years gone by. Apparently it has been running for four years now but the organisers haven't promoted it too much owing to a lack of car parking space. This is due to change as a car park for hundreds of vehicles is to be built this year, so look out for this 'bash' in 1990. When I contacted the organiser, he called it a small rally. He did himself a disservice.

Visitors this year had a stiff walk of about a mile from car to site, but it was

The Trio JR500S receiver



unanimously agreed that this was well worthwhile. There was a couple of traders dealing in new black boxes, but the vast majority comprised amateurs having a clear out; thus there were excellent bargains to be had, albeit after some fierce haggling. I had to resist buying a Tektronics transistor curve tracer at the unbelievable bargain price of a fiver, because both the Cortina boot and back seat were full of other goodies. Next year I'm taking the van.

There was also a guest comedy spot. I snapped up nearly a thousand assorted 'D' type connectors; well wouldn't you at £2.00? Halfway back to the car, the bottom fell out of the box. You wouldn't believe how much ground a thousand connectors can cover. The event was much enjoyed by everyone present, with one exception: me.

### Trio JR500S

Good sets. Maybe even great sets. Amateur bands only; 80-10m plus WWV and an aux position. They work well and are fairly sensitive. They run out of steam a touch on 10m, but that's nothing to worry about. In use they are excellent. A slight moan about the preselector; flick from 80 to, say, 20m and the band sounds dead until you twiddle the preselect knob to the appropriate position. However, you quickly learn where it wants to be and thereafter, no hassel. Problems? Yes, one seems to be emerging now. The built-in, factory fitted 'S' meter goes open circuit. It's in with the tuning-gubbins view hole and replacements don't seem to be available. I've seen some real craftsmen graft in an ex-CB set meter and make a good job of it, but it isn't easy.

The solution often adopted is to fit another meter elsewhere - it will just about fit in next to the AF and RF gain controls. The photo shows a fairly typical 'stuffed in' variant, and it doesn't look too bad. It is essential to cover the variable capacitors before cutting the mounting holes, and clean out carefully before plugging the rig back in.

Prices. Well, I've seen one sell at £45.00, an absolute bargain. £75.00 is a bit too steep; most that I've seen sell in the last year have gone for £60.00 to £65.00. About a third of those sold seemed to have had replacement meters fitted.

Incidentally, these sets seem to hold their prices well.

### 'Eagle' valve receivers

Here we have a single conversion 465kHz IF receiver. It covers up to 30MHz and, given the low IF and lack of RF stage, you are in for a bit of second channel (image) reception - the ubiquitous 'tunes stuff in twice' problem. It's no worse, nor better, than a lot of other three or four-valve receivers of twenty years ago. Given that there's a built-in 'S' meter, a BFO and bandspread, of sorts, it may be slightly better than average.

The excitement here? The thing is 120V or 240V powered, selectable by a switch on the back. Totally unprotected and easy to knock over when carrying it about, you wouldn't believe how bright it all lights up when plugged into 240 with the switch in the 120V position. **Take care.** If you turn it off quickly enough you can get away with it.

There doesn't appear to be a model number on these sets, but as they have a fairly distinctive front panel, the attached photo should help you identify them. £25.00 to £35.00 seems to be the going rate and you shouldn't lose out; receivers like these are slowly gaining price at a pound or so a year.

### Sandown Park RSGB VHF Convention

Right. It's got to be admitted that the RSGB is a great thing to throw stones at, and their 'never publish any criticism' policy has angered many, but credit where credit is due. The VHF Convention used to run a bring and buy, and I remember with affection some of the

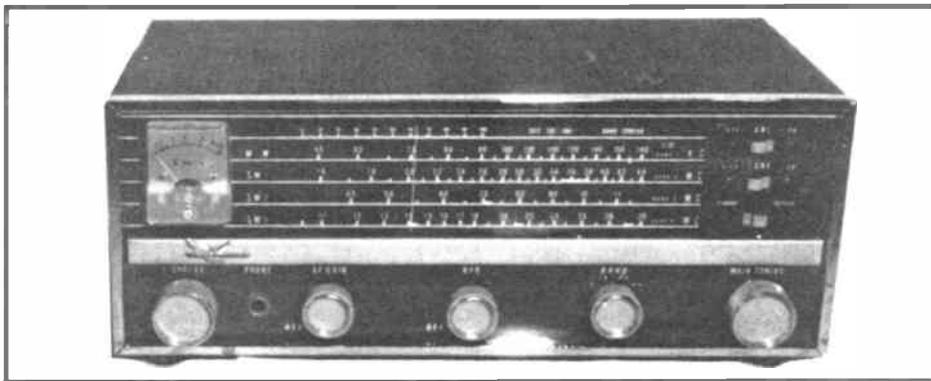
rubbish I bought there in years gone by. Disaster struck five years ago when an expensive bit of kit belonging to one amateur was stolen, and another amateur purchased some faulty gear. Both were reimbursed by the organisers, but given that this comes off the total profit of the convention, you will quickly see why the bring and buy ground to a halt.

Further disaster. The 'Teleprinter mob' (I know they call themselves Data nowadays) organise another bash at Sandown too. This has an excellent flea market. Thus, in your average amateur's mind is the equation Sandown = flea market; always. Amateurs rolled up at last year's VHF Convention with junk to sell. Some hero on the talk-in said that there was a bring and buy (there wasn't), so there were hoards of people wandering round the hall lugging junk, aimlessly looking for a non-existent stand. The comments of an amateur who had lugged a very heavy network analyser half a mile through the car park, then up some stairs were unprintable. Impromptu 'stalls' then set up all over the place and chaos reigned.

### Problem solved

The Convention's solution? Members' mart tables. A whole room of them. Not cheap - they were priced, according to the cost of traders' tables - but plenty of them. The advantages to the organisers are obvious - it's not their problem if gear is stolen and they have no involvement at all. An excellent compromise, and popular too. Well done, RSGB (I never thought I'd say that!)

The Eagle valve receiver



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# THE QUAGI

by Maurice Webb G1AMR

My interest in amateur radio started at the age of twelve, thanks to my father and the famous R1155 receiver. Since then, I have constructed many types of equipment and tried out many different antennas. For myself – and, of course, to many others – an effective antenna is one of the main priorities of a good station.

After obtaining my licence in September 1983, I decided to construct an inexpensive antenna. I started by building a two-element quad. The main reason for choosing this approach was that the two-element quad has slightly more gain than a two-element yagi at the same height above ground.

The antenna was erected to a height of about 20ft. Many long-distance stations were worked using this antenna, and the best QSO was with a station at Farringdon, Oxfordshire using a power output of 1W. Later I received the QSL confirmation of the contact.

Keeping the higher gain of the quad in mind, I decided to add three directors. Owing to experiments into the effect of quad-shaped directors, carried out a few years ago, I adopted the yagi principle and decided to feed the driven-element into one corner rather than use the conventional method (see Fig 1).

The antennas were constructed using 1/8in aluminium wire. I now had a five-element quagi which was fed with straight 50 ohm coaxial cable. Because only FM transceive operation was available, I mounted the quagi (vertically polarised) to about 25ft. Signal reports showed a definite increase, and the front-to-back ratio was very reasonable. I used this antenna for about two months.

## Testing

I was then loaned a multimode transceiver, TS700, to help me with antenna tests. So, I took down the mast and mounted the antenna horizontally. Tests

were carried out to evaluate the front-to-back ratio and the side lobes. Distance contacts were tested against a fellow station, GW3IWJ, who was running 100W to an eight-element, balanced fed yagi. Shortly afterwards, I extended the boom to 14ft and spent more time adapting a better feed method. I increased the boom length, netting approximately 3dB, and mounted the antenna to 25ft again.

With the help of GW3IWJ I carried out similar tests as before, though this time, because the length of the boom came close to the roof, some peculiar results were obtained. One side of the antenna had a greater null than the other. As a result of these problems I decided to increase the height of the antenna to 30ft to clear the roof of the house. As before, signal tests showed a definite increase

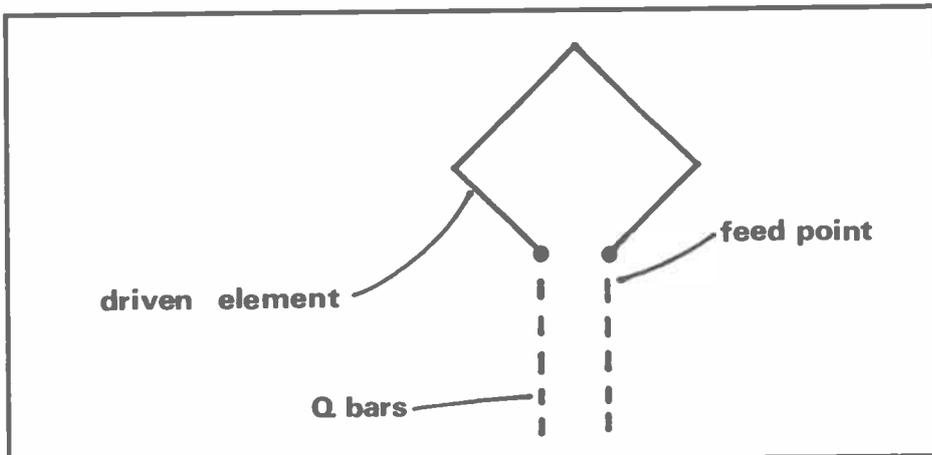


Fig 1

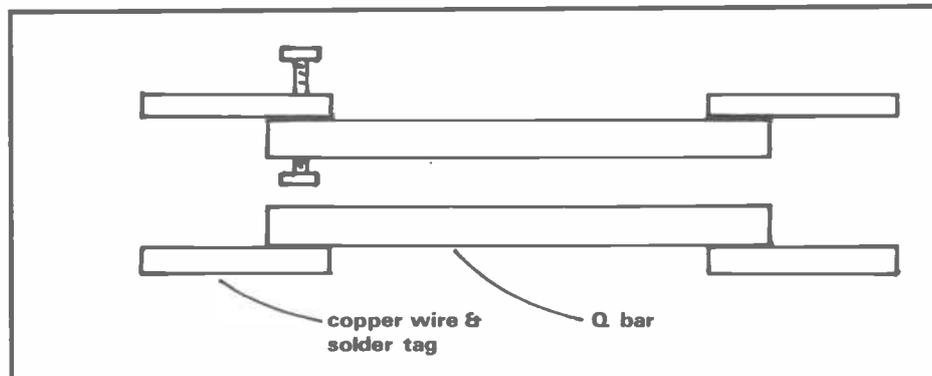
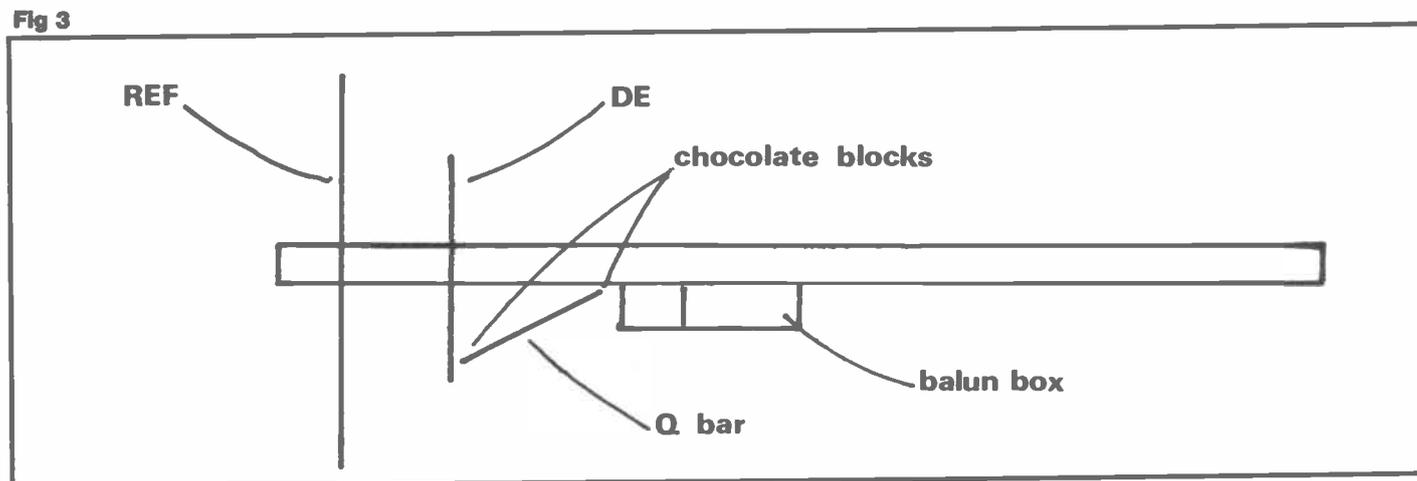


Fig 2



# THE QUAGI

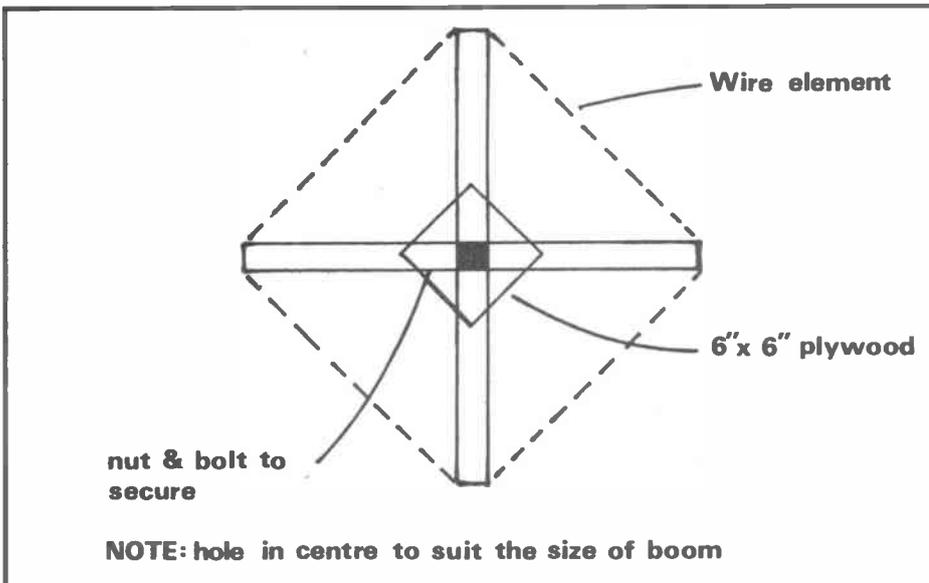


Fig 4

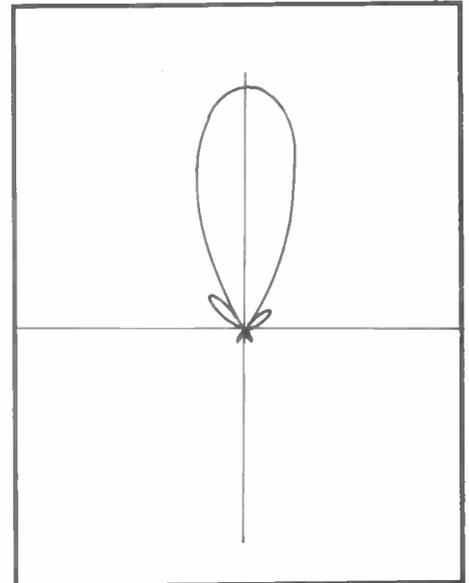


Fig 5

in the signal strength. After three months of evaluating the antenna's performance, the antenna's mast-to-boom clamp snapped during a storm with 100mph winds. On inspection, the only damage to the antenna was that the director wire had been bent. However, the advantage of using 1/8in aluminium wire is that I was able to simply bend the elements back into shape. Not being disheartened by this setback, I concentrated more thought on developing a better type of feed method.

A lot of people take a great deal of time calculating and constructing a good antenna, only to waste their efforts by feeding the antenna inefficiently. The quad/quagi antenna system is a balanced antenna and therefore should be fed with a balanced line to obtain the greatest efficiency.

## Q-bar system

After many hours of thought and discussions with other stations regarding a suitable method of feed, the Q-bar system was adopted for use with my antenna. As some people may be aware, the Q-bar system has a slight disadvantage in the way I have used it, because the distance between the Q-bars has to be varied. This was dealt with by mounting two pieces of stiff copper-wire to the end of each Q-bar. Then, as the bars are rotated, the distance between them increases or decreases in order to

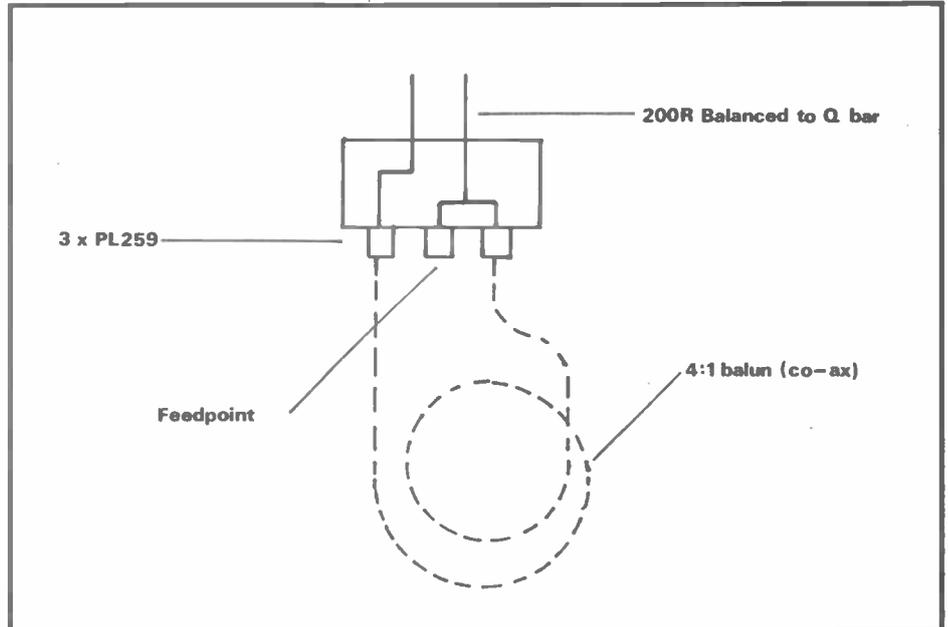


Fig 6

produce a good match (see Fig 2). I used 1/4in aluminium tubes with a piece of stiff copper-wire and a solder tag. I then drilled a hole in the end of each Q-bar and placed a nut and bolt through them to hold the solder tag in place. I then covered the joints with glue to protect them against the weather. The Q-bars were mounted at an angle of approx-

imately 45° on to the boom and placed in a plastic box (see Fig 3).

## The driven assembly

Some people may have a problem mounting the driven element/reflector assembly of the quad/quagi type of array. In the prototype, I used the method shown in Fig 4. Though not perfect, it was a quick method of construction which, of course, could be improved. To mount the reflector and driven assembly to the boom, I used four small 'L'-shaped brackets mounted at the bottom of each spider. Eight brackets are needed altogether to hold the elements securely in place on the boom. As stated earlier, a balanced feed is essential to preserve symmetrical lobe direction (see the polar diagram in Fig 5). The balun was mounted in a plastic box on the boom, as shown in Figs 3 and 6. Formulae for the balun measurements can be found in any antenna handbook.

## Antenna Dimension Measurements

Reflector	16 5/16in loop
D element	82in loop
Director 1	35 15/16in
Director 2	35 1/2in
Director 3	35 5/16in
Director 4	35 5/16in
Director 5	35 5/16in
Director 6	35in

## Antenna Spacings

Ref	to	D element	21in
D/E	to	D1	15 3/4in
D1	to	D2	33in
D2	to	D3	17 1/2in
D3	to	D4	26in
D4	to	D5	26in
D5	to	D6	26in

Boom used was 14ft in length and 34mm square

# THE QUAGI

After initially testing the antenna it was raised to 30ft again and, as before, there was an increase in signal strength. Numerous tests were carried out and the antenna's performance proved to be well above the expectations of myself and other stations.

## Conclusion

I have used the eight-element antenna for about two years now, with only one

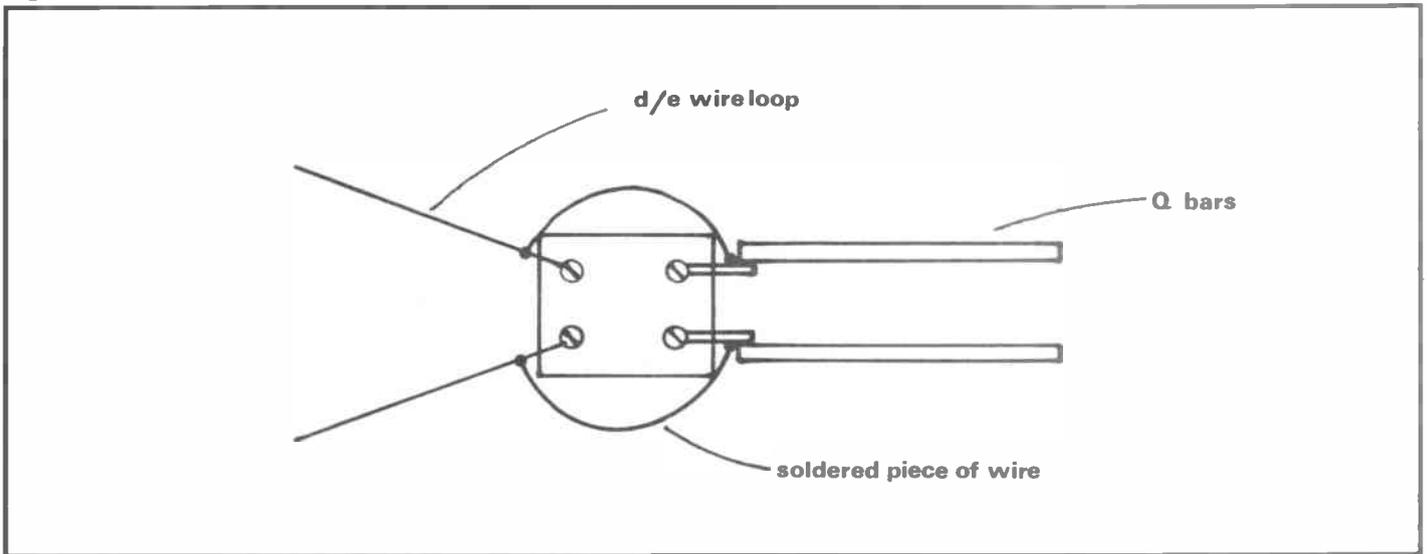
problem. The SWR kept rising very high and displaying an intermittent fault. The antenna was taken down and the fault was found to be at the end of the Q-bar assembly at the point where it joins the driven element. The aluminium wire was not secured properly by the chocolate block method I had used and had become corroded. I strongly recommend that the driven element assembly is made out of copper-wire and that the Q-

bar system is constructed out of copper tubing. All the joints can then be soldered to ensure a satisfactory performance (see Fig 7).

## Acknowledgements

The author would like to thank GW3IWJ for helping with the tests, and G3PKW whose assistance and encouragement made it possible to bring the project to fruition.

Fig 7



# C. M. HOWES COMMUNICATIONS

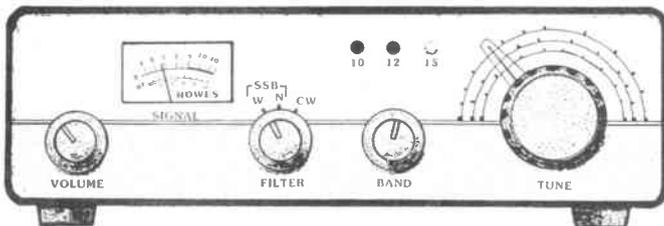


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# MORSE REPORT



## Tony Smith G4FAI takes his bimonthly look at the world of dots and dashes

### High Speed Championships

The second IARU Region 1 High Speed Telegraphy Championships will be held in Hannover on 10-12 November 1989. Apart from national team entries, there will also be an open class competition for all comers.

The following is an extract from the rules of the Championships. 'Straight keys or electronic keys (single or double paddle) are allowed. Electronic keys shall produce dots and dashes in the proportion 1:3. Electronic keys with additional adjustments or with memory systems, capable of transmitting messages automatically or semi-automatically, or keyboards, may not be used.'

The rules are rather lengthy and in some cases, because of translation problems, require clarification. For receiving in the team events it appears that contestants must use pen or pencil although they can use symbols or special writing systems if they wish, rewriting the received text afterwards in capitals on an official form. By contrast, in the open competition it appears that a typewriter may be used.

As I mentioned in the November 1988 issue, some quite respectable results were recorded at the 1983 Moscow Championships. All are capable of being beaten however, and it will be interesting to see what happens.

The Regional Championships are intended to alternate with IARU World Championships and potentially these could be bigger and better than anything ever held in the past. The question is, will there be sufficient interest outside the Eastern bloc countries to revive this great telegraphy tradition? We lesser mortals can often hear what appears to be super high-speed sending on the bands, but are those operators capable of similar performance under Championship conditions? Let us hope they are and that the UK can send a good team to Hannover.

Anyone interested in taking part in the Championships should contact Colin Turner G3VTT, 'Hurley', Weaving

Street, Maidstone, Kent ME14 5JJ, as quickly as possible.

### Copying behind

In the Winter 1988 issue of *Morsum Magnificat*, Wm G Pierpont N0HFF described the old Candler system of Morse learning which successfully trained both amateur and professional telegraphers from 1911 until the 1940s.

Walter Candler laid great stress on 'copying behind', as the following extract from N0HFF's article shows. 'Copying letter by letter is a vicious practice that stops advancement... Get in the habit... of carrying the letters in your mind, forming them subconsciously into words and sentences without copying anything down...'

From the beginning Candler put strong emphasis on learning to read the 100 most common words as words. 'Practice...' he said, 'until you can send and receive them without having to think how they are spelled... concentrating on the sounds of the words, with no thought of dits and dahs or spelling, until they are easy and natural.'

Following up his earlier article, Bill Pierpont sets out a list of 100 common words in the form of 'Drills to build skill in copying behind', in the Summer 1989 issue of *MM*. These words are in two columns and the idea is to start by writing down a word in one column, at the same time spelling out loud a word of similar length in the second column.

The next step is to key the words in the first column, again spelling the second column out loud. As the mind becomes capable of handling these two different activities at the same time, the student progresses to listening to text being sent, keeping a uniform two words behind with the aim of getting four to five words or even a whole clause behind.

N0HFF stresses that beginners should not work for very long at a time with these drills. 'Five to ten minutes at first is plenty, until it becomes easy.'

N0HFF's article is in *MM* issue No 12, price £1.75, post paid. The annual

subscription for four issues is £7.00. For more information write to me, QTHR.

### End of an era

Bob Hearn G0BTY comments on my report in the March issue about the decision to reduce Morse training in the NATO navies. He says, 'I am a regular operator of GB2RN, **HMS Belfast**, and I have the opportunity to go on board many ships, both MN and RN. I have yet to see a Morse key. One or two Radio Officers say they don't know CW. If a ship is sending CW it usually means the RO is an amateur.'

'Ships are going digital and of course satellite is the thing now. Within the next ten years HF radio at sea will cease as we know it. The only ROs will be the new solid-state whizz-kids who will remain on the big ships as maintenance men. So the end of another era.'

### The younger set

I have suggested before that the end of maritime Morse in 1999 could signal the end of the international requirement for an amateur Morse test - and that national societies seem to have little interest in supporting CW as a mode.

It was interesting, therefore, to read an editorial in the January 1989 issue of *QST*, the journal of ARRL, written jointly by the League's President and Executive Vice-President, no less, headed 'Why Morse Code?'

Commenting that the planned demise of maritime Morse has nothing directly to do with amateur radio, they go on nevertheless to ask if we will soon see the end of the Morse code in amateur radio. They answer themselves by declaring that the future of the code is assured because present-day practitioners enjoy using it. They refer to thirteen letters in that issue of *QST*, representative of dozens received, responding indignantly to an earlier letter entitled 'CW - Obsolete?', and comment, 'They say it better than we can'.

As for ARRL's position in the matter, they say it will always be determined by its elected board of directors which 'has shown itself to be very responsive to members' desires'. The real point of this article is reached halfway through when the question is raised, 'whether there isn't some place in American amateur radio for a no-code licence'.

These top ARRL officers also comment, 'Interestingly our pro-code correspondents average just thirty-eight years old - about ten years younger than the 'average' American radio amateur!'

### Best way to deal with them?

'The Northcote and District Section of the Wireless Institute of Australia wishes to warn the pirate who is operating a spark set in this district that every member will do his best to locate him and notify the authorities. One of the members has offered his car, and a loop aerial will be used to find this nuisance. This club will do its utmost to eliminate these pirates.' (From 'The Listener In', 12 September 1925, and reprinted in *Amateur Radio*, journal of the WIA, February 1986.)

# DX DIARY

News for HF operators compiled by Don Field G3XTT

T33JS on Banaba Island was the major DX operation during May. In the event it proved quite a hard one to work. 10m was in poor shape, but 15m did open up quite well in the evenings, with the T33JS signal occasionally hitting S9. They were also quite a good signal on SSB, though the behaviour of European stations on their frequency was, at times, absolutely appalling. Jim Smith VK9NS and his wife Kirsty have an invitation to make a return visit to Banaba later in the year, so we may all get another chance at this one.

OH2BH has been busy again. After returning from Revilla Gigedo, he travelled to the Western Sahara with OH3UU to give a boost to activity from there before taking part in the Malyj, Vysotskij Island operation. Somewhere along the line, at one of the US conventions, he was inducted into the CQ Contest Hall of Fame.

Glasnost has brought Lloyd and Iris Colvin closer to their goal of operating from all DXCC countries. During May they started a round of all the Russian Republics, turning up with big signals from some of the major club stations.

## DX news

I recently heard one of the operators at Y11BGD (Baghdad) saying that a number of the operators there will shortly receive their own personal calls. Y11AB and Y11XX were among those who were mentioned.

New Zealand stations are allowed to use the ZM prefix in place of the usual ZL from 1 June for eighteen months. This is in connection with both the Commonwealth Games, to be held in Auckland next January and February, and New Zealand's 150th Anniversary celebrations. The special event station ZM14CG will be active for the Games, and the New Zealand Radio Society is sponsoring an award to promote the event. To qualify, work five ZM1 stations, one each of ZM2, ZM3 and ZM4, plus one Commonwealth country in each of the three ITU regions—eleven contacts in all. In line with NZART's 'Honour System', no QSLs are required. Send a log extract, certified by two other amateurs, to the Awards Manager, Mrs A Johnston ZL1ALE, 63 Red Hill Road, Papakura, New Zealand.

A group of amateurs from the Heathkit Corporation in the USA, were due to operate from Taiwan, from 25 June until 8 July. I have no information about their callsigns.

Dave K8MN, who has been extremely active on all bands as J52US, will transfer

to Sierra Leone (9L) in December. Also from Africa, DX News Sheet carried a report that two French amateurs would be active from Chad for four months from late May. A station signing TT8CW appeared around the time of writing, so this may be them. JA1SGU/JD1 hopes to operate, mainly CW, from Ogasawara, from 14-17 July.

## Islands

A large group of Italian amateurs will appear with IMO callsigns from Rossa di Teulada Island over the weekend of 7-9 July. This counts only as Sardinia for IOTA, but separately for the Italian Islands award.

Another group of Italians will sign /IJ7 from Sant'Andrea Island from 30 June until 9 July. QSLs go to I7PXV. This is EU91 for the IOTA awards.

WAGVNR and his wife N6RLE will sign ZF2AH and ZF2JT throughout July from the Cayman Islands. Check 10kHz up from the bandedges on CW.

## Prefixes

As always, it is the Canadians who lead the way with novel prefixes. Ontario amateurs were to be allowed to use the CH3 prefix until 7 July to commemorate the fiftieth anniversary of the Queen Elizabeth Highway between Ford Erie and Toronto. And the Prince Edward Island Amateur Radio Association will air CJ1PEI during July to publicise the International Scout Jamboree.

## Rotuma Island

I was pleased recently to receive an attractive QSL card from last year's DXpedition to Rotuma Island. The card carried a lot of interesting information which, in case you haven't seen it, I thought I would summarise here.

The DXpedition took place from 22 October to 5 November 1988 with Eric K3NA, Kip W6SZN, Toni KN3T and Eddie VK8XX. Three stations were operated on 160 through 6m, making 34,688 QSOs with 173 DXCC countries. 3D2XX also entered the CQ World-wide Phone Contest in the multi-multi category, making 5,810 QSOs with 143 band-zones and 339 band-countries, for a total score of eight million points.

The Rotuma Island group contains one large volcanic island of about 10 x 3km with a population of 3,500, and is surrounded by eight small islets. British sailors discovered the group in 1791 while searching for the Bounty mutineers, and named it Grenville

Island. During the next eighty years, the island was a favourite hiding spot for convicts who had escaped from the penal colonies of Australia.

During the mid-nineteenth century, the influence of Methodist and Roman Catholic missionaries on the Polynesian natives led to a series of religious wars which ended only when Rotuma was annexed into the eight-year-old British Crown Colony of Fiji in 1881. Strong religious beliefs continue today, with a strict observance of the Sunday Sabbath. Even the current name of 'Rotuma' means 'belief in church' in the local language.

Rotuma has a comfortable tropical climate, abundant rainfall and beautiful vegetation. Extended family groups live in small villages scattered among the bases of volcano cones, growing their own food, fishing on the reefs, and occasionally selling copra in order to buy imported items. Small generators and solar cells provide intermittent electricity to schools, the government settlement and some homes. Tourists are not encouraged; there are no hotels, no postcards, no soft drinks – just ten pick-up trucks and some motorbikes. The outside world can be reached by a weekly aeroplane, the occasional inter-island freighter, and an unreliable HF radio-phone link to Fiji. The operators were sad to leave the beauty, the people and the DX pile-ups of Rotuma – but not the bugs!

## New countries?

As well as the various remote islands that may count as new countries under the current interpretation of the DXCC rules (and Rotuma was, of course, just such an island), there are several other possibilities on the horizon. At the time of writing, the ARRL is reconsidering 4U1VIC in Vienna and the Council of Europe station TP2CE, as well as an application relating to the Basilica Del Santo, an outpost of the Vatican. Walvis Bay, an enclave of South Africa but enclosed by the now independent Namibia, could also qualify. North Korea has been totally independent of South Korea for many years, and it would seem all that is needed to add this to the list of new countries is a properly documented operation. UB5JRR was hoping to be there from 1-7 July, so fingers crossed that he gets a licence.

The American **DX Magazine** also mentions some other possibilities. Firstly, if the Palestinians manage to gain

some legitimacy for their claims to a land of their own, this could be added to the list in the same way as the Western Sahara. Secondly, it has been suggested that recent constitutional changes in Belgium will divide the country in three relatively autonomous regions within ten years: Flanders, Wallonia and Brussels. Finally, there is still a number of Caribbean islands which may go it alone. For example, if Antigua and Barbuda were to continue to disagree on a whole range of issues they may decide to split, and create a new sovereign state in the process. All in all, it looks as though DXers will have to look to their laurels over the next few years if they are not to lose their place on the ladder. Mind you, if you think all this is getting out of hand, it could be even worse. Under the current wording of the DXCC rules, which refer to 'separation by water' rather than 'separation by sea', it has been suggested that some of the islands in the Great Lakes of North America would qualify!

### 30 metre award

Firstly, a correction. The **DX Magazine** 30 Metre award, which I mentioned in the May issue, starts on 1 January 1989, not 1988. The error was theirs, not mine!

### Canadian Islands award

The Canadian Islands award is issued by an old friend of mine, Garry Hammond VE3XN (his previous call sign was VE3GCO). The award recognises some twenty-nine groups of Canadian islands, including inshore islands such as Montreal Island. There are four classes of award: Class IV requires a confirmed contact with five islands, Class III with ten, Class II with fifteen and Class I with twenty. The cost is \$2.00 or seven IRCs, and Garry's address is 5 McLaren Avenue, Listowel, Ontario, Canada N4W 3K1. I will provide a full list of the islands which qualify if you write to me enclosing an SAE via the editorial department.

### Lists

Much has been written about the value of lists and nets as an aid to HF DXing. For some they are a benefit, but too often they are abused, with call signs and signal reports being passed by the net control to speed things along. Another

danger, though, is that they create a breed of ignorant DXers. Tom WB8ZRL, writing in **DX Magazine**, relates a tale of listening to a 20m net when a W6 station called in asking for information about 4WOPA, which he needed as the last one to get on to the honour roll. The net control asked the W6 when he had the best propagation to the Yemen, to which the W6 started discussing his various contacts with 3W8DX (Vietnam). When told that Vietnam wasn't actually all that close to the Yemen, the W6 then asked whether 3D2XX (Rotuma Island, in Fiji) might be closer! Finally he settled on 3A (Monaco) as a possibility. At this point, the exasperated net control told him to go away. Surely when DXers get to the point of total dependence on lists, with no feeling for who they are working and where, and whose total knowledge of DX is the frequency and start times of the major nets, then all the magic of the chase is lost? The fun should come from detective work, understanding propagation, knowing what time of day it is at the remote end, being prepared to learn a little of someone else's language in order to encourage him to reply, and so on. Otherwise there would seem to be just as much point in making a spot on the honour roll available on payment of the appropriate fee.

### NCDXF

It's quite some time since I mentioned the Northern California DX Foundation, which supports many major DXpeditions, as well as running the world-wide chain of beacons on 14.1MHz. The Foundation is unable to overcome political obstacles to get rare countries on the air, but provides an excellent service in helping DXpeditions overcome the logistical problems of getting to remote spots. The classic example of this was the \$30,000 (US) the Foundation committed on a speculative basis to make the Peter First Island operation possible. In fact, the Foundation sees the support of such major operations as being more important than providing smaller amounts of money for a large number of operations from less rare spots. More recently, in pursuance of this policy, the Foundation gave \$2,500 towards supporting the 3D2XX Rotuma operation, and is likely to be heavily involved in other operations

from the crop of 'new' countries unleashed by the ARRL's reinterpretation of the DXCC rules, especially as most of these places are off the beaten track and inaccessible by regular transport. The Foundation believes that operations such as these inject much-needed excitement and interest into the DXCC programme. To become a member of the NCDXF, the recommended subscription is \$25.00 (US) (larger sums are welcome!). Their address is NCDXF, PO Box 2368, Stanford, CA 94305, USA.

### Chiltern DX Club

Nearer to home, the Chiltern DX Club recently held its Annual Review Meeting. G4LJF was elected Chairman, G4JVG Vice-Chairman, G4GED Treasurer, G3LQP Secretary, G3HTA President, and yours truly, Newsletter Editor. CDXC was founded during the last sunspot maximum as an informal group of DXers in the Thames Valley to help each other out with information on HF DX, and putting out DX 'alerts' on 144.525MHz. Since then CDXC has become nationwide, with eighty members, a regular newsletter and occasional social events. It was also agreed at the Annual Meeting to sponsor trophies for the leading UK single-operator entrants in the CQ World-wide SSB and CW Contests, and to be prepared to offer financial help with QSL cards for UK amateurs undertaking DXpeditions.

CDXC membership is open to those who have at least 100 countries worked and confirmed, are in sympathy with the aims of the group, and are sponsored by two existing members. Further details can be obtained from the secretary.

### Contests

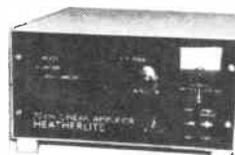
Finally, let's have a look at the contest programme for July. The main event is the IARU Radiosport Contest on 8-9 July (administered by the ARRL) which includes both SSB and CW. One feature of this contest is that you get additional multiplier credit for working the headquarter stations of the various IARU member societies. The other major event is the SEAnet (South East Asia) CW Contest which, like the IARU event, runs for a full forty-eight hours. This is a good opportunity to work some rare ones in the Far East.

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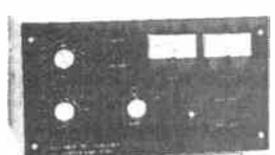
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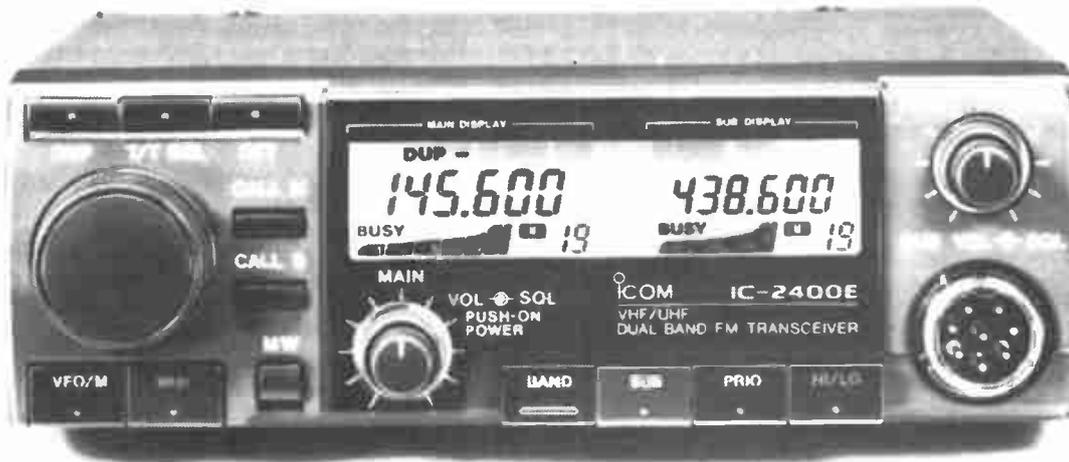
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# UNDERSTANDING FREQUENCY SYNTHESISERS

by Ian Poole G3YWX

Frequency synthesisers are used in almost every amateur receiver or transmitter made today. They offer many advantages in terms of performance, flexibility and ease of operation, compared with the 'crystal mixer VFO' arrangement which was popular during the '60s and '70s. Yet, despite their current popularity, comparatively few people understand how they operate, even though the basic concept is relatively simple. Understanding the principles of frequency synthesis makes it possible to see their disadvantages as well as their advantages. Then it can be understood why traditional approaches may be more suitable in some instances, whereas synthesisers will be better in others.

Although a signal can be synthesised in several ways, one method has gained universal acceptance. This method is often termed indirect synthesis and is based around a phase-locked loop.

This method of synthesis is popular because it only uses a minimum number of costly coils and filters to produce the required signal. However, against this, more circuitry is required; but with the advances in integrated circuit technology, this is not a problem.

## The basic loop

The basic operation of a phase-locked loop is fairly straightforward. Fig 1 shows a simple block diagram of a PLL which consists of three blocks: a voltage-controlled oscillator (VCO), a phase-locked detector, and a filter.

The voltage-controlled oscillator is a variable frequency oscillator which is tuned by using a variable voltage, instead of a mechanical variable capacitor or inductor. Generally, varicap or varactor diodes are used to charge the variable voltage to change the capacitance and tune the oscillator.

The phase-detector detects a difference in phase between the two signals at its inputs. If there is a steady-state phase difference with no frequency difference, or a changing phase difference corresponding to a frequency difference, the phase-detector will have a voltage which is proportional to the difference.

Finally, the low pass filter is used to remove high frequencies. However, its design governs many characteristics of the loop and is therefore particularly important.

In order to see how the loop operates, let us consider how it works when it is out of lock. A steady reference signal enters one of the phase-detector inputs. Usually, this signal is generated by a crystal oscillator which may even be in an

oven for additional stability. The other signal to the phase-detector comes from the voltage-controlled oscillator. The phase-detector generates an error voltage which corresponds to the phase difference between the two signals; this is passed through the low pass filter back to the control terminal on the RCO. The sense of this voltage is such that the loop reduces the phase (or frequency) difference between the two signals. Eventually the loop stabilises and there is a steady phase difference between the two signals. As the phase difference between the two signals is constant, the frequency of the VCO will be *exactly* the same as the reference signal.

## Low pass filter

The low pass filter between the phase-detector and the VCO performs several functions, and is designed to have a cut-off frequency well below the operating frequency of the phase-detector. This prevents any of the comparison frequency signals being applied to the VCO and causing the generation of spurious signals. The filter also governs the loop's stability, and affects the phase-noise footprint of the synthesiser. As a result, the design of the filter is paramount, since the importance of one parameter must be balanced against another to produce the best overall performance.

## Adding a divider

For a phase-locked loop to be used as a synthesiser it must be able to generate frequencies apart from that of the reference itself.

This can be done in a number of ways, and one of the most common is achieved digitally by using a divider, as shown in Fig 2. To see how this works, imagine the loop with the divider set to two. The loop will compare the two signals at the input of the phase-detector and reduce the error between them. When the loop is locked, the two signals entering the phase-detector will have the same frequency. But since the VCO signal has been divided by two, this means that it must be running at twice the reference frequency. If the divider is set to three, then by the same reasoning the VCO will run at three times the reference frequency, and so on.

So, the VCO will change frequency in steps equal to the reference frequency each time the division ratio alters. So, the channel spacing is equal to the reference frequency. In order to change frequency a programmable or variable divider is used (see Fig 3). This can be controlled by a simple switch or, alternatively, a microprocessor. If a microprocessor is used, then it is relatively easy to provide the system with several VFOs; thus offering all the

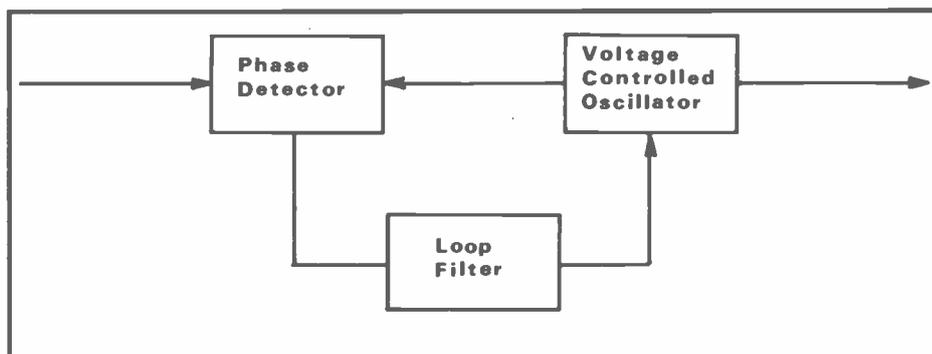
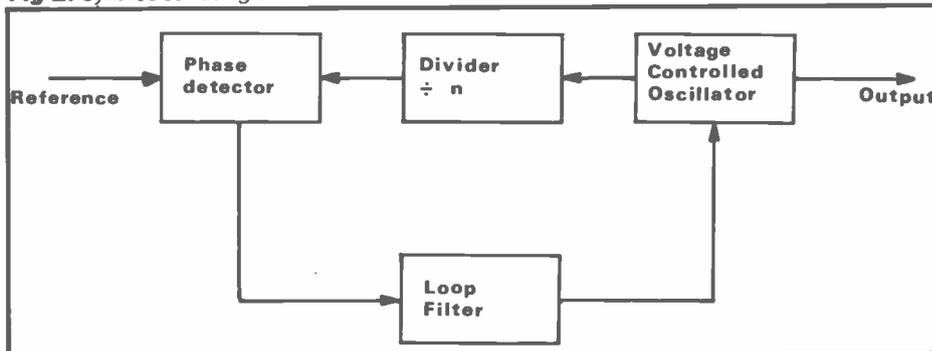


Fig 1: Basic diagram of a phase-locked loop

Fig 2: Synthesiser using a divider



flexibility of today's modern rigs.

The channel spacing of modern rigs can be fairly small, for example, a 2m FM transceiver will have a channel spacing of 25kHz. In order to produce a stable reference signal at this frequency, it is usual to use a crystal oscillator operating at 1MHz, or more. Its output is taken and divided down to the required frequency. The signal is produced in this way because it is not as easy or as economical to generate a 25kHz signal directly.

The variable or programmable dividers used in the loop can be quite long. If the output of a 2m rig is between 145 and 146MHz, the divider will need to vary between 5800 and 5840. Although this may seem to be a very large division ratio, it is not uncommon in synthesiser applications. Accordingly, there is a range of ICs available that enable dividers of this length to be easily made.

**Analogue synthesis**

Using a digital divider in the loop is not the only means of enabling a synthesiser to generate a range of frequencies. By including a mixer (see Fig 4) it is possible to inject an offset into the loop.

The way the loop copes with this is very similar to that of the divider. When the loop is in lock the two signals at the input to the phase-detector have exactly the same frequency. However, by tracing the signal back it is possible to determine the frequency at which the VCO is operating. For instance, the phase-detector is operating at 1MHz and the external signal is 5MHz. This means that the phase-detector will recognise a 1MHz signal when the VCO is operating at 4MHz or 6MHz. As it is more usual to mix a signal down in frequency, it is more likely that the VCO is operating at 6MHz.

When using a mixer in the loop it is necessary to ensure that the VCO cannot shift to 4MHz instead of 6MHz. Once the loop is locked this does not happen, but it is possible at switch-on or when the loop conditions are changed. The problem can generally be avoided by limiting the VCO range.

The simplest way of doing this is to design the oscillator so that it cannot reach 4MHz. This approach is likely to be unsatisfactory if the 5MHz signal varies a

little. In this case, a process known as 'steering' is used. This is accomplished in several ways, but it usually involves using a coarse and fine tune on the VCO. The coarse tune line has a voltage applied to it according to the frequency band required. The fine tune is connected to the loop-tune voltage from the phase-detector and loop filter. In this way the VCO is steered to the right frequency range using the coarse steer, and the loop is brought into lock using the fine tune. The coarse tune will only vary when large frequency changes are made, and will always be set to a voltage that will restrict the VCO range so that only the correct mix product will be obtained.

Analogue synthesis has a number of very useful applications. For example, it can be used as a 'transfer loop' to convert

a low frequency VFO to a specific frequency, or as part of a multiloop synthesiser.

Synthesisers containing several loops are often found in expensive communications receivers and signal generators. They offer better performance in terms of step size, lock time and phase-noise, compared with that of a single loop with a large divider.

There are many ways multiloop synthesisers can be designed, depending on the requirements. Generally, they involve loops which include both mixers and dividers. One type of design for a multiloop synthesiser is shown in Fig 5; it operates between 11.0 and 21.9MHz.

The operation of the first loop is straightforward. It has a comparison frequency of 1MHz, and with the divider range of 10 to 19, the output can be

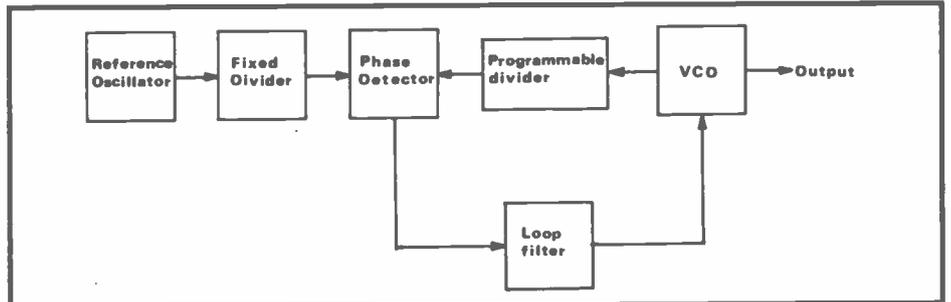


Fig 3: Synthesiser using a fixed divider to give a low comparison frequency

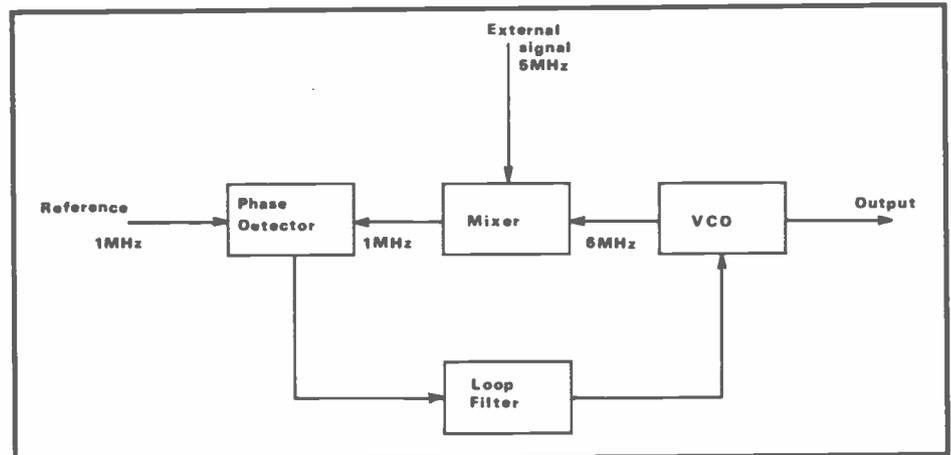
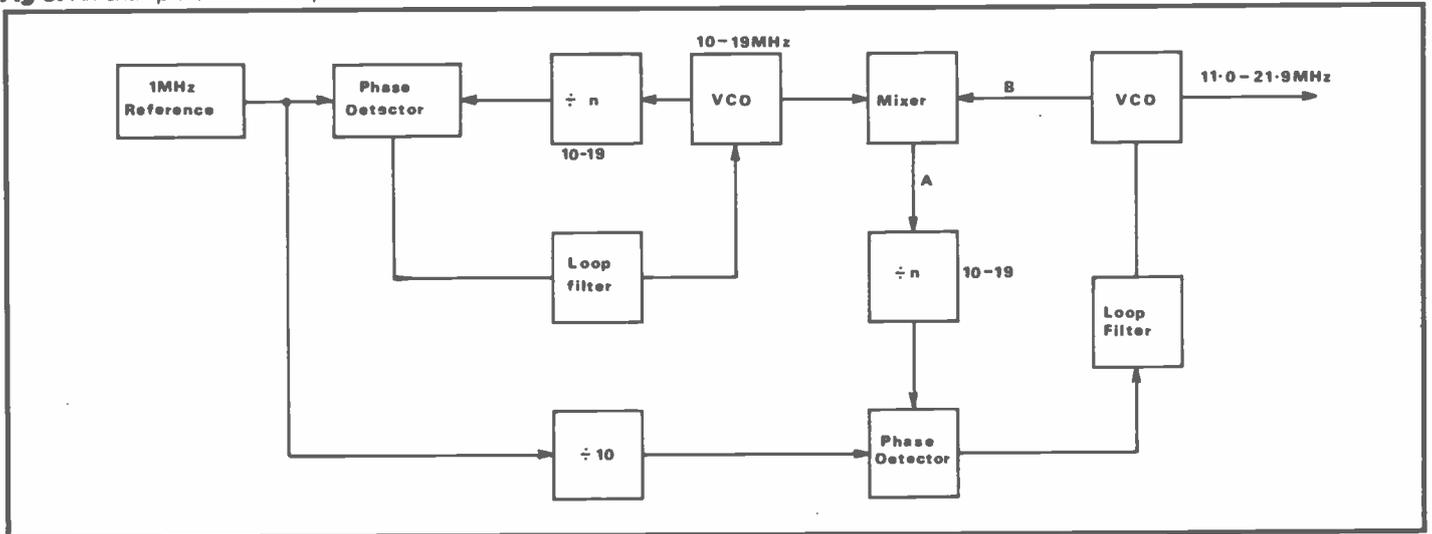


Fig 4: Synthesiser using analogue techniques

Fig 5: An example of a multiloop antenna



programmed between 10 and 19MHz in 1MHz steps. The output from this loop is applied to the mixer in the second loop.

In the second loop the divider can also operate between 10 and 19, but this time the comparison frequency is 100kHz. To understand its operation, take the example where the first loop divider is set to 10, giving an output of 10MHz and the second loop divider is also set to 10. The comparison frequency of 100kHz means that the frequency at 'A' must be 1MHz, and the frequency before the mixer at 'B' must be  $10 + 1\text{MHz}$ ; ie, the VCO frequency is 11MHz. If the divider in the second loop is set to 11, the frequency at A becomes 1.1MHz. By manipulating the values of both dividers it is possible to set the frequency anywhere between 11MHz and 21.9MHz in 100kHz steps.

If the number of loops is extended it is possible to have smaller and smaller step sizes while still keeping the divider ratios within reasonable limits. Unfortunately, adding extra loops greatly increases the cost as well as the possibility of finding spurious signals.

### Phase-noise

Phase-noise is one of the most talked about problems associated with synthesisers. It is particularly apparent at higher frequencies where it can result in transmitters splattering up and down the band, or receivers finding that weak stations can be masked out in the presence of strong off-channel signals.

Before analysing the phase-noise performance of a synthesiser, it is worth noting that any signal source will produce phase-noise. The phase-noise spectrum will look something like the outline shown in Fig 6. This spectrum will vary for a number of reasons, but oscillators with high Q resonators are much better than those with low Q ones. Not surprisingly, crystal oscillators possess a very good phase-noise performance, whereas voltage-controlled oscillators are very poor by comparison.

Returning to the synthesiser loop, the phase-noise is generated in three main areas. The voltage-controlled oscillator is a major cause, but the reference oscillator and phase-detector can introduce significant quantities of noise in some instances. Not all of these blocks affect the loop in the same way, and it is necessary to look at the operation of the synthesiser to see exactly what happens.

First of all, take the case of the reference signal. With the loop in lock a steady error signal is generated by the phase-detector which passes through the loop filter and is applied to the VCO control terminal. Phase-noise from the reference, together with any wideband noise from the phase-detector, appear on the tune line and pass through the loop filter. Filtering removes any high frequency 'components' of the noise, leaving only those within the loop bandwidth. Accordingly, they are applied to the VCO and it is found that the synthesiser output contains phase-noise inside the loop bandwidth which originates from the phase-detector and reference. At first sight this may appear to be very low. Unfortunately this is not always

so, because the level of noise from the reference and phase-detector is multiplied by the division ratio in the loop. This means that the higher the division ratio, the worse the in-band noise becomes.

Noise generated by the VCO has a different effect. Noise from the oscillator in the loop bandwidth appears at the output of the phase-detector, passes through the filter on to the VCO control terminal and tends to be cancelled out. Conversely, VCO noise outside the loop bandwidth cannot pass through the filter and is not corrected. This means that noise caused by the VCO only appears outside the loop bandwidth.

When the major components of noise are added together, the final output from the synthesiser is similar to the outline shown in Fig 7. Fortunately, it is possible to produce very low noise synthesisers, but they usually use several loops and can be very expensive.

### Reciprocal mixing

The result of a poor phase-noise performance on a transmitter is fairly obvious. The signal is 'wide' and splatters up and down the band.

With a receiver, the result is slightly different and rather more subtle. The synthesiser is generally used as the local

oscillator; mixing with the incoming signal to convert it down to the intermediate frequency. If this station is strong, all is well while it is tuned in and on channel. If the receiver is tuned off channel, the signal will fall outside the receiver passband and mix with the phase-noise from the synthesiser. This will produce noise which can fall inside the receiver passband and mask a wanted but weak signal. This process is called reciprocal mixing and is the downfall of many modern synthesised receivers.

### Final thoughts

For the most part, synthesisers fulfil their role very well, but like most things they have their drawbacks. Unfortunately, designers of many new rigs place more importance on having umpteen memories and computer control, which very few people use. All of this is at the expense of the basic performance of the synthesiser. Perhaps it is time to evaluate the role of synthesisers, to remove the unwanted gimmicks and invest in improving the basic performance of the equipment. Alternatively, a good old-fashioned crystal-mixer-type of VFO could be used. If so, there would be less splatter on the bands and receiver performances could be improved.

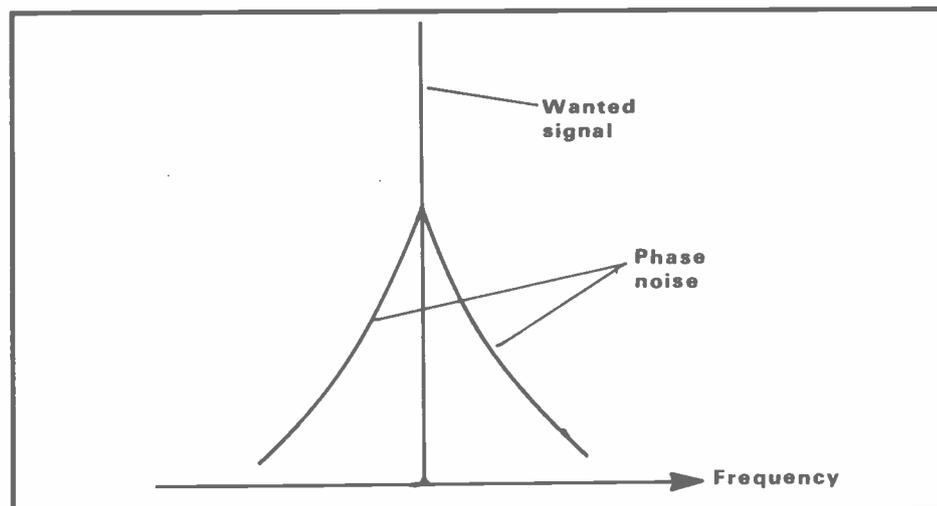
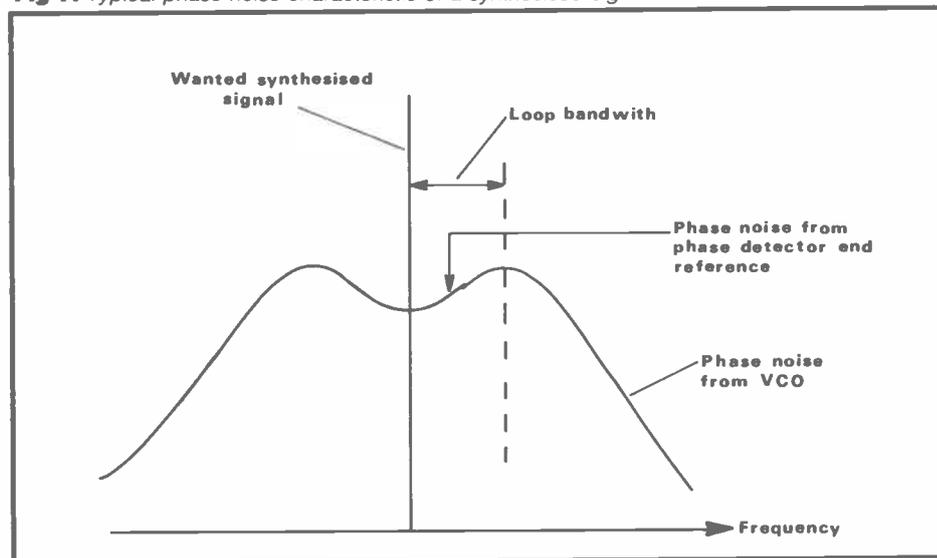


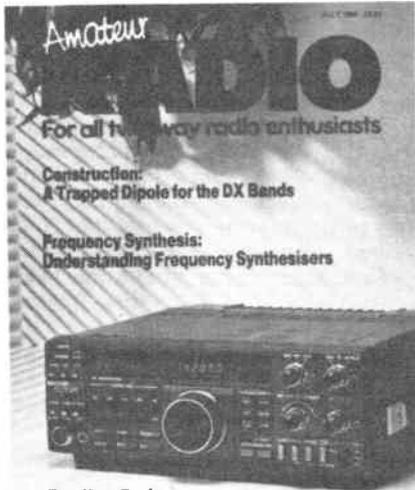
Fig 6: Typical phase-noise characteristic of an oscillator

Fig 7: Typical phase-noise characteristic of a synthesised signal



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# SHORT WAVE LISTENER

TREVOR MORGAN GW40XB

At the time of writing this piece, we are enjoying the warmest May week for years and, if it wasn't for that ex-computer extractor fan that I bought on impulse at a rally for a quid, the shack/office would be unbearable. Yes, the plaintive cries on 80m about having to 'do something with the garden', have changed to 'sorry I'm late on the net, lads, I've been busy transplanting the seedlings'.

This is not the time for hunting DX with parboiled ears, but it can be the time to get out and check those aerial feeders or try a new configuration of wire before we're back in the shack cursing the bad weather, and twiddling the cat's whisker to find another rare station.

## Award claims

Talking about which, some of our regular lads and lasses have been logging some very choice stuff over the past month. Nathan Rosen W2-6893, of New Jersey, USA, has claimed a Continental award for 100 European amateurs logged. If you realise that logging Europeans in the States is akin to us logging the Yanks, it's a good first effort.

Ian Baxter ILA322, of Blackburn, claimed his Silver Prefix award for 500 prefixes logged including such mouthwatering items as: 4K0, VP5, TI5, YC0, KK4, HK6, BV2, HH7, 6W7, ZS5, 5R8, 7J6, 9J2, 9N1, VE7, HL88, XM3, TF6, 3W8, VK8, 9L3, 5W1 and A41, to name a few. Ian's claim for the Continental award for 100 European stations logged was exceptional in that it was for RTTY *only*. Add these to the first 'Frank Cookman 160 Award' for 160 broadcast stations logged, and it all adds up to a hell of a lot of listening. Nice one, Ian!

Mick Brown ILA344, of Dunstable, is hot in the chase with his latest offering of 500 prefixes for his Silver award, including: 5L2, KP2, TG9, HZ1, 6Y5, 6Y25, ZS6, ZB2, 8P9, 9K2, 5N9, ZC4, P29, ZP5, HK6 and YC6. A couple of nice RTTY

catches showed that Mick is having some success in that mode also. Well done, mate!

Dropped a thingy in the May issue when I credited Gordon Garraway of Keynsham with a Silver award. Soppy date! Should have been a *Gold* one! Our Gordon was right peeved... sorry, pal, one suitably engraved plaque on the way.

That chap Darrell Jacobs ILA152, of Reading, is persistent. His latest claim for the Continental award for Russia (all 10m) was accompanied by a letter explaining that he'd been neglecting his listening for a while and that he intended to catch up. Crikey, that means more sleepless nights at the sharp end (not him, *me!*). His latest count is thirty-eight awards, and he's been warned to cut down on his claims (I bet his dad has noticed those cracks in the wall!). Latest loggings include: LU1JHU/D, V29OA, HG3LU/DU, KC34XA, FY4, YV1, IG9, HP9, 4H1, VY5, 9X2, FP3 and TF3LB on RTTY.

Peter Bowles of Newhaven has also been busy logging some fine calls with the latest being: V85GA, ZB2FX, J52US, YC0WWL, J37AE, 9M2ZZ, 5Z4LL, 407PUR and TU2CJ.

## Calling the lonely

When scanning the bands, it is worth keeping your ears open for that lonely caller. It's not necessarily a local. I was looking around 21.250 for one of our ILA members, HB9AMZ, and stumbled on such a caller making his initial CQs. He was a good 5.5-5.7 signal with hardly any QRM about. I was surprised and delighted when I logged him as DU1DZA in Manila! We had a nice chat, during which he asked me to pass his best regards to a pal in Jersey. A quick phone call, and the old pals were in QSO.

It's amazing how some nice DX stations can call for ages without any response, yet a couple of turns up the band, people are fighting to get a QSO with a poor bloke who is wondering what hit him.

## Data scene

Meanwhile, on the data scene many readers are getting in on the act. The latest popular system is the Amiga computer coupled with the Amiga-Fax program and interface. Vic Eva of Blackpool and Charlie Morgan of Limsfield Chart, Surrey, have both been using the system with great success. Of course, the print quality depends on the equipment you are using at that end, but the on screen results are superb.

There are also many listeners who are taking advantage of the cheaper computers on the second-hand market. Those expensive games machines that cost dad an arm and a leg a year or so ago are finding their way into many a shack and doing sterling duty as RTTY/SSTV/fax decoders. Most popular amongst these are the Spectrums and Commodores which are changing hands at silly prices (according to the small ads in the local rag). When you are buying from one of these ads, make sure you see the unit up and running as, although you are entitled to your money back if you've been sold a dummy, you might have problems actually getting it.

There are plenty of programs available for these popular computers, but others suffered from a lack of support despite being of superior quality. Amongst these are the Atari eight-bit machines. Some of these are being sold as a package for less than £60.00, complete with data recorder and a couple of games. Unfortunately, radio-based programs are difficult to find, although the computers themselves are very good indeed.

## BARTG rally

While on this subject, the British Amateur Radio Teledata Group are holding their rally at the Esher Hall, Sandown Park racecourse, Surrey, on Sunday 27 August. Although they will be catering

for all spheres of the hobby, the emphasis will be on data communications. It's a special year for the BARTG, as it's their 30th anniversary. The group specialises in RTTY, fax, AMTOR and packet, and helps members with hardware and software problems as well as producing their own products. You can find out more about the BARTG from Pat Beedie GW6MOJ, 'Ffynnonlas', Salem, Llan-deilo, Dyfed SA19 7NP.

## Morse code

Before the advent of data modes and computerised communications, Morse code was the major component of radio communication. Now the navy have decided to push the code into the background and rely on more modern systems.

I think there can be few Morse operators who do not feel sorry to hear this. The Morse code is one of the few means of communication that has a personality. Although the code is international by design, each operator puts his own signature on the code he sends by the way he uses his key and communicates.

Long-time operators can often recognise individuals by their style and it would be a pity if the powers that be were to discontinue the code as part of the amateur radio licence. Listeners often learn Morse to enable them to log some of the rarer stations that only use this mode. Despite the feelings of some, the code is not particularly difficult to learn if you've a mind to. How you learn it is up to you, either, as I did, taking one letter at a time and getting the brain to accept the combination of dots and dashes as being a letter, or learning all the dot-only or dash-only letters first and then the rest.

After a couple of attempts (the first at the age of thirteen in the Scouts), I found that learning one letter at a time was easiest and learning to translate car number plates and advertising hoardings as I walked round was immensely

helpful. Funny, but I seem to do this automatically even now.

Once you have mastered the code, it is difficult to forget. Lack of use simply slows your reception speed, but this picks up again once you start using it regularly. The human brain can be very selective and a person can read Morse in conditions under which even the very best computer will not translate.

Although the code abbreviations are widely used, especially under contest conditions, many operators still transmit plain language when rag chewing with known contacts.

Morse is still worth learning and is one of the best modes of long-distance communication. Why don't you give it a try?

### Solent Fortifications

OK, hands up those who know anything about the Solent Fortifications. Yes, well, I thought as much! For your edification, chaps, these fortifications were built around the Solent to defend us against the French and Spanish who were trying to illegally import cheese and onions into this country between the 14th and 19th centuries.

The Solent Fortifications Amateur Radio Group, made up of clubs and societies in the area, is promoting a series of very nice awards that are available to listeners. There are some thirty-six forts and castles and these will be activated by volunteers under the call sign series GB\*CD\*. The third digit will depend on the licence allocation but the last letter will denote the fort or castle.

The awards are: 'A' (HF zone 14) = Basic, seven stations, Silver, ten stations, Gold, thirteen stations; 'B' (HF outside zone 14) = Basic, three stations, Silver, five stations, Gold, seven stations; 'C' (VHF/UHF up to fifty miles) = Basic, seven stations, Silver, ten stations, Gold, thirteen stations; 'D' (VHF/UHF fifty to 250 miles) = Basic, three stations, Silver, five stations, Gold, seven stations; 'E' (VHF/UHF over 250 miles) = Basic, one station, Silver, two stations, Gold, three stations. (Distances are measured from Cowes Castle, locator IO90IS.)

Scoring is one point for phone and two points for CW

or RTTY. Each station will only count for points once, regardless of call sign (GB1, GB2 etc).

You should apply for the Basic award as soon as possible; stickers being awarded for upgrading. There is a further 'Crystal' award for those already having the gold in any section, and requires double the gold standard (ie, twenty-six stations in the case of the 'A' award).

QSL cards are *not* required. A log-style list should be submitted to George Crawley G0IVW, 4 Ardington Rise, Purbrook, Hampshire PO7 5QP, with a £3.00 postal order or cheque made out to SFARG, with your name, address and call sign/RS number. The stickers are issued free on receipt of an SAE once the Basic award has been claimed.

### TDOTA

The Girl Guides Association has an annual event known as TDOTA (Thinking Day on the Air); a similar arrangement to the annual Scout JOTA (Jamboree on the Air), during which licensed Guides or volunteer amateurs use their stations to make contact with other Guides world-wide, to exchange greetings.

To encourage some of the younger element of the movement and under the flag of the International Listeners Association, I promoted an award for logs submitted for Guide stations heard during the weekend in February that the TDOTA was on, with the assistance of Jennifer Jackson G8WVO, the co-ordinator for the event in the United Kingdom.

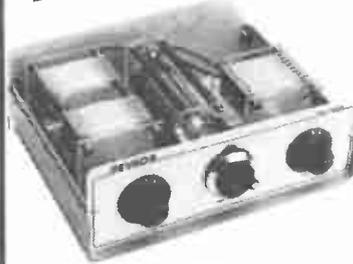
Fifteen logs were received from these youngsters and were of a very good standard; but one entry stood out from the rest, being beautifully presented in a manilla folder complete with photographs of the station and volunteer operators, a written report of the event, a map of the UK with contacts pinpointed and newspaper cuttings of reports by local press. Subsequently, the young lady, Miss Vanessa Turner of Regnum District Guides (aged ten) was presented with an Award of Merit plaque. All other entrants received a certificate.

The enthusiasm shown by these youngsters made the effort worthwhile, and the awards will be on offer again next year.

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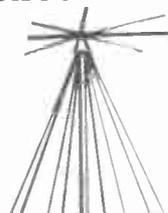
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## News and comment from Glen Ross G8MWR

### Where are you?

About two years ago I mentioned the fact that I would supply anyone with the Maidenhead locator for their QTH on receipt of the lat/long information and an SAE. A lot of people have taken up the offer and all has gone well; until now! Will the gentleman from South Wales, somewhere near Abergavenny I think, please get in touch with his details. Your information and that of a continental enquirer got mixed up. The locator given to you puts you somewhere in the middle of the Netherlands! Sorry.

### Anti-social

Over the last two or three months I have had several letters in which the writers have said, in effect, that it is anti-social to use a collinear aerial on 2m and that the more thoughtful operator would use a beam. I see that this fallacy is also propounded in a recent issue of **Rad-Com**. This is an old wives' tale that has been around for some years and is based on the idea that by using a collinear or other omnidirectional aerial, you squirt the RF equally in all directions rather than sending it in the favoured direction by using a beam.

### Levels

The idea is that by using the beam your signal causes less problems to other amateurs. In fact the opposite is true; the beam causes more problems. Why is this? Let us assume for a moment that you are running 10W to a vertical aerial which has no gain. Let us further assume that operators living one mile away from you receive a signal of  $500\mu\text{V}$ . An operator at four miles would get  $30\mu\text{V}$  and someone at ten miles would get a signal from you of about  $5\mu\text{V}$ . The actual levels are not accurate but the ratio between them is. This means that at a distance of five miles you are not going to cause anyone a problem.

### Beaming

Let us now assume that you are using a beam with a gain of 12dB. This means that

your radiated power in the favoured direction is nearly 200W. Let us use the same distances as before and see what the signal levels will now be; for convenience the previous figures are shown in brackets. At one mile your signal will be  $2000\mu\text{V}$  (500); at four miles  $120\mu\text{V}$  (30); and at ten miles it would be up to  $20\mu\text{V}$  (5). In fact you would have to go to a distance of twenty miles to get back to the original level of  $5\mu\text{V}$ .

### Results

If you thought the guy at one mile was getting a rough deal in the first example, what do you think of his chances now that you have put the beam on? The whole point, put in terms that are easily understood rather than absolutely accurate, is that a certain amount of power will cover a certain area of ground, or to put it another way, will give a certain 'footprint'. When you change to the beam the area of the footprint is going to be roughly the same as it was before, but is now going to be elongated in the favoured direction. The big difference is that the field strength near you can now be up to ten times greater than it was with the omnidirectional aerial. Not only are you now causing problems which are equal to your original ones at many times the original distance, but your near neighbours in the direction you are beaming are going to suffer problems they never dreamed of before.

### Under attack

Our friendly little mole is under attack from the UKFM Group (Northern). You may remember that we had a report from him about the bad behaviour on certain repeaters, and quoted extensively from a letter sent by the boss of the repeater management group to one of the repeater groups concerned, pointing out that it was their responsibility to clean up the goings-on. This seemed to clarify the whole thing. The fact that the RSGB has not queried the accuracy of the mole's information seems to confirm that he got it right.

### Now what?

The Northern group secretary says that many of the people who were supposed to be signatories to the original letters of complaint have asked to be disassociated from them. Fair enough, but that still leaves a lot of people who still say that things need cleaning up. G4UNA then goes on to say that GB3NA does not suffer more abuse than most other repeaters in the country. I can't remember ever suggesting that it did. He also claims that 'the legality of this [the DTI's] interpretation [of their own rules] is very much in doubt as it cannot be the responsibility of [a] group of amateurs to... monitor... another'. Why not? If that is what the rulebook says, and neither the RSGB nor the DTI is arguing with me over this interpretation which is contained in the RWG letter.

### Suggestions

To add further credence to his argument, G4UNA then goes on to accuse the mole of paranoia and megalomania and finishes by accusing him of being, possibly, one of the abusers of the repeater. The mole would be better employed by making 'a proper contribution to amateur radio'. I thought that by bringing things into the open, that various people would prefer to see swept under the carpet, he was doing just that.

### Bottom line

The whole point of the matter is that although the original complaints, sent from two major northern clubs and signed by nearly eighty people, may have been malicious, they did get an official statement from the RSGB in reply. Because of the importance of the RSGB statement, I quote the main point of that reply again for the benefit of anyone who missed it the first time round. 'The official view [of the DTI] is that the licensee is responsible for the content of traffic passing through the repeater'. The letter was signed by G4AFJ who is the chairman of the RSGB's repeater management group.

### Recording

In May's article I mentioned the requirement for all American repeaters to actually record on tape all traffic passing through the system. The tape had to contain dates and times so that any offence could be accurately sorted out. This is similar to the taped records that the IBA local radio stations keep in this country. The American repeater tapes had to be kept for six months, if my memory is correct, and involved a prodigious outlay in tape, even though they did run at incredibly slow speeds. Peter G6JNS writes to tell me that since the abolition of logbook-keeping in the States, the taped record requirement has been dropped, although the FCC (the American equivalent of the DTI) can impose the requirement if it feels that any infringement of the licence conditions is taking place.

### Watch this space

The first item is a little out of our normal routine. The space probe, Voya-

ger-2, is getting involved in a close encounter with the planet Neptune at about 0500GMT on 25 August. How does amateur radio get in on the act? Listen for W6VIO on 14.235MHz, the club station of the Jet Propulsion Laboratory in Pasadena. They will be sending slow scan amateur TV of the pictures of Neptune which are being sent back to earth by the probe. Tune in and see them as soon as the professionals do.

### Oscar 9

This satellite is equipped to send pictures via its CCD system. Pictures of the earth were sent on 3 May and, following diary software reloads, pictures will be sent every Wednesday. This will continue until 00.00GMT on Thursdays, when the clever device will switch on the digtalker and tell you all about what it has been up to and how it is feeling.

### Oscar 10

According to the command station VK5AGR, this satellite will be available for use until next September. Owing to the fact that the satellite will still be going through an eclipse period in every orbit until 13 July, the transponder will not be available between MA 226 and 24. From 14 July there will be full orbit availability. Please bear in mind that you should monitor the beacon frequency and, if there is any sign of frequency modulation on the carrier, do not attempt to use the satellite.

### Jas-1b

This is the new Japanese Oscar which it is planned will go into orbit with the MOS-1b marine satellite. Both of these are being sent aloft on an H-1 rocket which will be sent up from the Tanegashima Space Centre around the end of January or early in February 1990. It is intended that all the transponders, beacons carried and modes of operation will be similar to those on Oscar-12. The frequencies involved are JA uplink between 145.90 and 146.00MHz, with downlink between 435.90 and 435.80MHz with reversed sidebands, as usual. Mode JD has uplink on 145.85, 145.87, 145.89 and 145.91MHz; the downlink for these being on 435.91MHz. There will be a CW beacon running 1W output on 435.795MHz.

### Expedition

The following is for those of you needing contacts with the Island of Foula on any of the VHF bands; and who doesn't? The location details for Foula are IP80XD, YU70d or HT93-district of Walls; depending on which system you use or if you are a WAB hunter. An expedition by the Aberdeen VHF Group will take place between 9 and 14 August. The callsigns to listen for are GM4CAN on 144.08MHz CW and CW meteor scatter, and on 144.180MHz for SSB modes. They will be running 400W to a pair of seventeen-element aerials.

### Lower bands

On 70.17MHz GM4FRT will be using a

four-element yagi and all modes. To round it all off look for the same callsign on 50.160MHz where a six-element yagi will be providing the fire-power. You can make skeds via post to GM4AFF, Aberdeen Amateur Radio Society, 35 Thistle Lane, Aberdeen AB1 1TZ. Make sure you enclose an SAE for the reply. During the expedition dates you can make skeds by calling them on 14.33MHz between 1400 and 1600GMT daily. They will not take skeds via the phone so don't waste their time by trying it on.

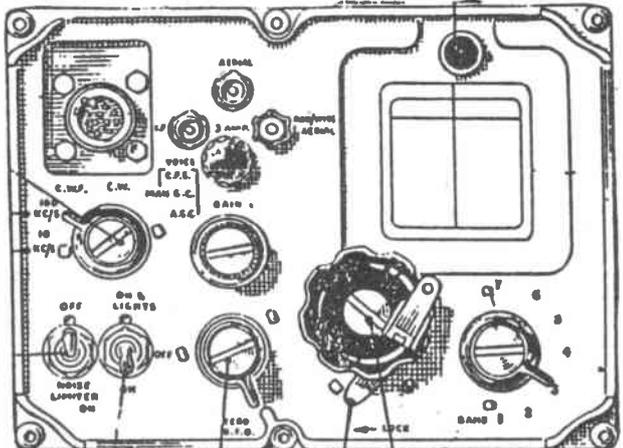
### Close-down

We are now getting well into the Sporadic-E season. Remember, do not waste time by giving the foreign operator details of your wife and family, what power and aerials you are using etc. He may only get through to the United Kingdom for a couple of minutes in any particular opening and there are a lot of people trying to get that new square. Keep it simple; just your call and locator, and a brief report on his signal strength. Keep it quick and then get out of the way. That way you will still stay friends with the brethren. Start chatting away to the DX station and surely the axeman will come and destroy your coax cable in the dark of night! May many new countries and squares come your way.

Remember, send all your news and views, particularly on the repeater problems, to me at 81 Ringwood Highway, Coventry CV2 2GT; or via packet at GB7NUN.

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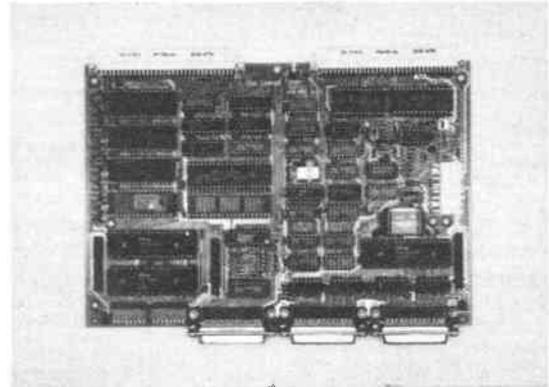
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# KENWOOD RC-10

## REMOTE CONTROLLER

by Steven Goodier G4KUB and John Goodier G4KUC

The Kenwood RC-10 remote controller is similar in appearance to a mobile telephone handset. It has been designed to remotely control most of the operating functions of the later series of Kenwood mobile transceivers, and is particularly suited to the TM-221 and TM-421 2m and 70cm transceivers. It will also function with the TM-721E dual-bander, which we used for the purpose of this review. When used in conjunction with these sets the RC-10 allows complete control of a number of functions including memory operation, tuning, frequency selection, scanning, repeater shift/tone-burst and volume adjustment. It is also possible to couple the RC-10 to two separate transceivers, thus allowing complete crossband and crossband repeater operation, with the handset functioning like a telephone.

The RC-10 is supplied with a base unit, which the handset attaches to when not in use. It arrives with two types of mounting bracket which can be used to attach the base unit to any convenient mounting position in the car. The first is a 'flat type' which can be fixed to an arm rest or to the dash; the second is an 'L' type bracket, which can be used to attach the base unit to the centre console. Both mounting brackets are supplied with all the necessary hardware to bolt them to almost any suitable surface, and both the handset and base unit can be easily removed from the vehicle when not in use.

### General description

The RC-10 can be split into two separate parts. The first is a base unit which carries most of the electronics. It connects to the transceiver via a two metre length of cable terminated with a standard Kenwood eight-pin microphone plug. Removing the bottom plate reveals two sandwiched printed circuit boards, with a number of smaller, self-contained PCBs connected to each. The construction is of the highest quality and makes full use of surface mounted components, which enable a lot of electronics to be packed into a very small area. The board contains two user-adjustable variable resistors, which are used to adjust the squelch threshold of each transceiver. These are accessible via two holes in the bottom plate.

At one end of the base unit is an eight-pin mic socket. This can either take a second microphone, or be used to couple a second transceiver to the RC-



RC-10 base unit and handset

10. An optional extension cord (PG-4G) is available from Lowe Electronics for this job. The RC-10 takes its power source from the main transceiver, and data to and from each transmitter is also sent backwards and forwards along this coupling lead.

The base unit is connected to the handset by a length of curly lead. It carries the microprocessor and LCD drivers, along with the keypad and the necessary input/output devices needed for remote control operation. The case is a tough plastic, snap together unit, and no attempt was made to gain access. The LCD display shows the frequency in full minus the first MHz digit; it also indicates a number of other functions such as repeater operation, scan, duplex, dial lock, and second-function operation. The display is back-lit from both sides at all times, making it easy to read at night.

On the side of the handset is a three-position slide switch, which controls the amount of volume entering the earpiece.

The three settings give a low, medium and high output, but most people would probably leave it set in its central position. The volume control has no effect on the audio level of the handset; the only way to increase its output is by using the slide switch, but having said that, there appeared to be ample volume from the earpiece. Also located on the side is the PTT switch, which is similar in size and feel to a hand-held transceiver.

The keypad is numbered 1-0. Some of the keys have two functions, which can be accessed by first pressing 'F' followed by the required second key (see Table 1 for a complete list of second-function operations). Confirmation of the key's use is indicated by a small 'F' appearing on the LCD readout. Second functions are not printed on the keys, but a reminder of each second operation is printed on the handset's base unit. The bottom two keys allow up and down tuning of the main display or the transceiver's memories, depending upon which has been selected. It is also possible to enter frequencies directly from the keypad. This is done by first entering the MHz digit followed by the three remaining kHz digits; the transceiver will then change to the newly entered frequency.

Just below the main keypad are two orange buttons and two slide switches. The first key has already been dealt with and selects the second function when necessary. The next button is labelled 'M' and can be used to remotely enter frequencies into the transceiver's memories. The first slide switch is labelled VOL MAIN/RMT; this selects whether the main volume control on the transceiver is active or not. If the switch is in the RMT position, the main volume control on the transceiver is disabled; the audio output is then controlled by the two push switches located on the handset. If the switch is set to VOL MAIN, the main volume control on the transceiver is reactivated.

### Memory operation

The key labelled VFO/M allows you to toggle between memory and VFO operation. When in memory mode, each channel can be selected by using the UP/DOWN tuning keys which allow you to clock up or down one memory at a time. Alternatively, each memory can be directly accessed via the keypad; for example, to recall memory 2, press the number 2 on the keypad. This allows

# KENWOOD RC-10 REMOTE CONTROLLER

Key	Function
F and 1	Transmit on the SUB band, TM-721E only
F and 2	Squelch ON/OFF
F and 3	Repeater shift selection
F and 4	Reverse repeater ON/OFF
F and 5	Toneburst ON/OFF
F and 6	CTCSS ON/OFF
F and 7	Memory channel lock-out
F and 8	RC-10 key lock
F and 9	Crossband repeater ON/OFF
F and 0	Duplex operation

'F' = second function of the RC-10 keypad

Table 1

quick and simple access to any stored frequency, with the minimum of effort.

Each memory channel can also be 'locked out' if you wish to scan only selected frequencies. This is done by first entering memory mode and then pressing 'F' followed by key 7. In the case of the TM-721E, a small '\*' is then displayed in the memory window indicating lock-out during memory scan. Repeating the operation a second time will clear the lock-out option.

The RC-10 will also allow you to program a memory with a new frequency. First, dial up the new frequency and select any other option you wish to store such as toneburst or repeater shift. Next, press the orange key labelled 'M'; a small 'M' will appear on the LCD display, and pressing any number after this on the keypad will store the displayed frequency in the chosen memory. This must be carried out within five seconds of selecting the second function.

## Two transceiver operation

The RC-10 will allow control and operation of two transceivers. It is best suited to the Kenwood TM-221 and TM-421 as it allows automatic crossband operation and acts as the medium between the two. Transceiver A is coupled to the RC-10 in the normal way, with transceiver B being coupled by the optional extension cable PG-4G. Once connected you can switch between the two transceivers by using the rig selector switch on the RC-10 handset labelled 'A/B'. If you plan to operate two transceivers whilst mobile, the two mounting brackets must be coupled together with the earthing strap supplied, to reduce any alternator noise.

Crossband operation is initialised by using 'F' and key 0. Once these have been pressed the DUP indicator will light on the handset's display to remind you that you are now working crossband duplex. The currently selected transceiver operates as the receiver, and you transmit on the second rig. If at any time you change the rig selector switch whilst transmitting, you are automatically returned to receive mode, and duplex must be reselected. When in duplex mode the handset acts precisely like a normal telephone, therefore you are able to hold a two-way conversation and reply to comments instantaneously.

Since the TM-721E has automatic crossband operation built in, ie, there are no other keys to press, trying to select crossband operation with the RC-10 had no effect on the rig. Having said that, it was still possible to hold full duplex QSOs with the RC-10 connected, by simply selecting the receive and transmit frequencies as normal, then keying the TM-721E via the RC-10 remote unit. In practice this worked extremely well, and by using 'F' followed by key 1 you are able to transmit on the TM-721E's sub-band, thus reversing the transmit and receive frequencies. It is not normally possible to transmit on the sub band when using the TM-721E, so this is one of the added benefits of the RC-10.

## Crossband operation

Connecting a 2m and 70cm transceiver to the RC-10 remote unit and pressing 'F' followed by key 9 activates the crossband repeater mode. This feature is similar in operation to the TM-721E repeater mode, and allows automatic retransmission of signals on the opposite band. Without doubt, this is an innovative idea.

Before crossband operation is entered into, you are advised to adjust the squelch settings on each transceiver to around 20 to 30° higher than their normal



RC-10's handset showing the LCD display and keypad functions



RC-10 and TM-721E combination

# KENWOOD RC-10 REMOTE CONTROLLER

settings. The reason for this is that the RC-10 checks to see if either squelch is open, and then uses this information to start transmitting the signal on the opposite band. Thus, when the squelch opens on either transceiver the other transmitter will begin to retransmit the incoming signal. The idea of increasing the level of the squelch is to stop electrical noise being retransmitted.

Once repeater mode has been activated the letters 'RPT' will appear on the display as a reminder, and each rig will go into listening mode. The hang-up time is set to three seconds, and if any station continually transmits for more than three minutes, the transmitting rig will be switched back to receive, thanks to the automatic time-out clock.

## Summary

For those of you who require a telephone style handset, the RC-10 is ideal. It offers total control of all the transceiver's functions plus direct access to any memory via a single key-press. Connection to the equipment is simple and straightforward with only one cable to plug into the transceiver's microphone socket. The added benefit of being able to connect a second transceiver, and then work full duplex, will be very appealing to many operators. Kenwood must also be congratulated on

## KENWOOD RC-10 – FACT FILE

**Product:** Kenwood RC-10 remote controller

**Price:** £169.00

**Supplier:** Lowe Electronics Ltd. Tel: (0629) 580800

**Features:**

- \* Keyboard entry of frequency, memories and tuning
- \* Remote operation of transceiver's volume, squelch, tuning, repeater option and memories
- \* Back-lit LCD display, indicating operating frequency and four different functions
- \* Possible to connect two transceivers with optional PG-4G coupling cable
- \* A/B transceiver selector switch
- \* Full crossband duplex operation with the handset acting like a telephone
- \* Crossband repeater operation
- \* Choice of two mobile mounting brackets
- \* Compatible with the Kenwood TM-221, TM-421 and TM-721E dual-bander
- \* Runs from 8V dc, supplied via the transceiver's microphone connector

providing the crossband repeater mode, which will be beneficial to members of RAYNET.

The RC-10 remote controller complete with two mounting brackets and necessary hardware is priced at £169.00, and

can be obtained from Lowe Electronics Ltd, Chesterfield Road; Matlock, Derbyshire DE4 5LE. Tel: (0629) 580800. We would like to take this opportunity to thank Lowe Electronics for the loan of the review unit.

**NEXT MONTH**

# Amateur RADIO

**Don't miss the August issue on sale 27 July**

## ■ Bits to Build

George Dobbs G3RJV constructs a QRP CW transmitter from a Jandek kit

## ■ Shunt Feed Your Tower!

Don Field G3XTT tells you how to go about it

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# A TRAPPED DIPOLE FOR THE DX BANDS

by David Taylor G4EBT

Many amateurs and SWLs, particularly those who are new to the hobby, have the urge to do something practical, though the question which often arises is 'where do I start?' One answer could be to make your own antenna.

Probably the most popular choice for the HF bands is the trapped dipole antenna. Therefore the purpose of this project is to explain how a trapped dipole works and how a novice can build their own effective array.

The design in Fig 1 shows the traps, which are parallel-tuned circuits that resonate at 14.1MHz. They also offer a high impedance to the centre portion of the antenna, acting almost like switches to disconnect the outer portions. This enables the antenna to resonate at 14 and 28MHz. At 7MHz the traps act as inductances. One advantage of the trapped dipole antenna is that the loading effect of the traps shortens the 'physical' length of the antenna, compared to that of an untrapped dipole.

Complete trapped dipoles can be bought for about £25.00, and traps are available on their own for about £12.00 a pair should you wish to add wire to finish the job. However, it is quite easy to make your own inexpensive traps from readily available materials. The first stumbling block when building a transmitting antenna is the difficulty in obtaining capacitors which will cope with the power involved. These seem to have disappeared, even at rallies in recent years, so a little ingenuity is called for.

The dielectric qualities of double-sided PCBs have been exploited in a number of designs for antenna tuning units and filters. So it occurred to me that capacitors made from this material would function in antenna traps. Consequently, a successful design was evolved which is easily duplicated.

Cut a piece of double-sided fibreglass PCB to the shape shown in Fig 2, and then carefully cut through the copper cladding on the front and rear to allow an overlapping area of 34mm x 19mm. The capacitance should be close to 22pF. Two pieces are required, one for each trap, and they should be cut to exactly the same size so that the traps are well-matched.

## Making the spacers

Cut and drill four strips of fibreglass without copper cladding (see Fig 3) for each trap so that they act as spacers for the coils. Initially, wind the coils using 16swg (1.5mm) enamelled wire fifteen times around any suitably sized con-

tainer (such as an aerosol can), until they are 15mm in diameter when threaded through the spacers. The coils must be threaded through the spacers to ensure that the diameter is kept even, as shown in Fig 4. The turns should then be secured on to the spacers with glue.

Solder 50mm of brazing rod to the ends of each capacitor to form the terminals. Place a capacitor inside the coil and solder each end of the coil on to opposite sides of the capacitor. Fig 5 shows how

the traps should look after the capacitor and terminating wires have been fitted.

## Adjusting the traps

A GDO is required to adjust the traps to the correct resonant frequency, as shown in Fig 6. Initially the trap will be lower in frequency than desired. One end of the coil should be shortened a bit at a time (while checking the traps with the GDO) until a dip is obtained at 14.1MHz. The end can then be permanen-

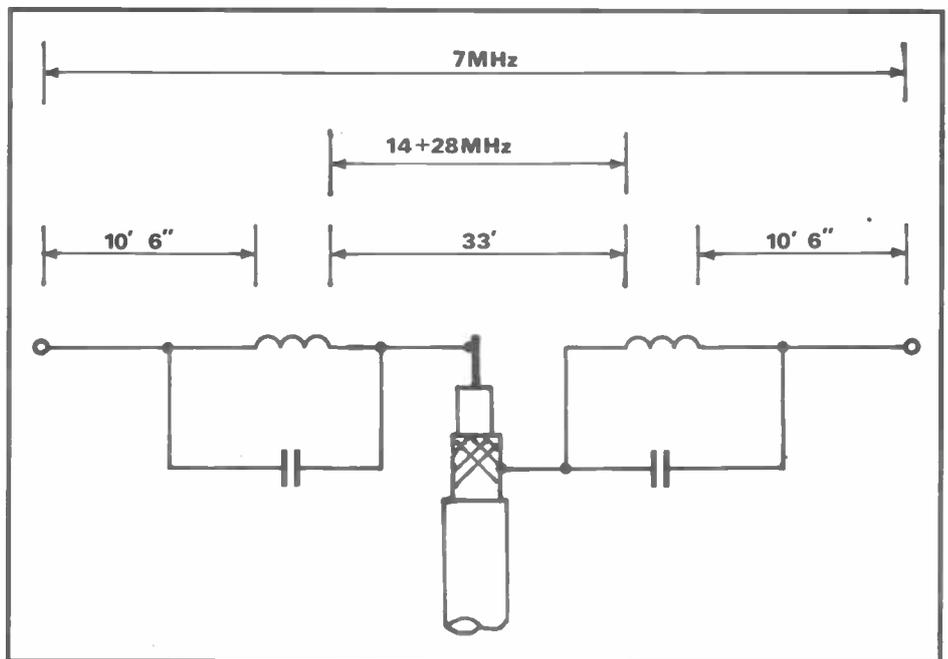
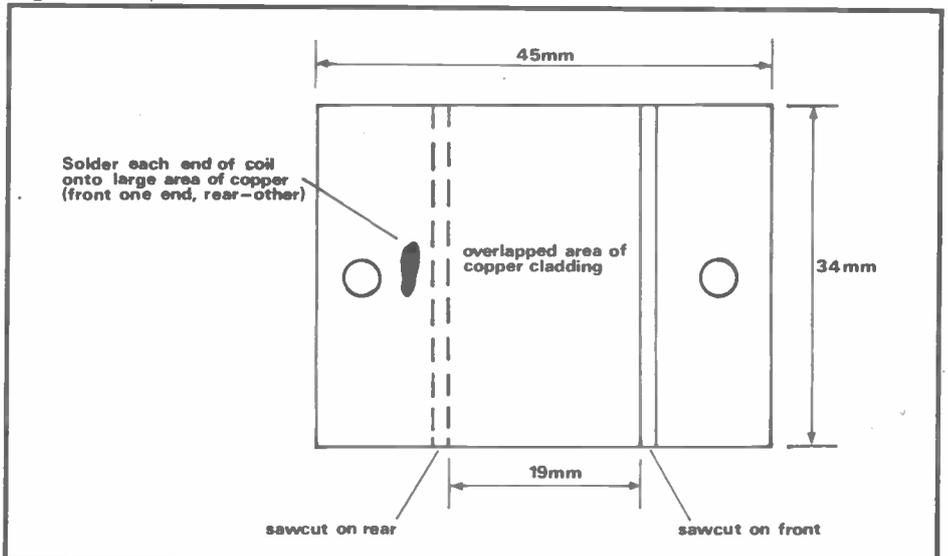
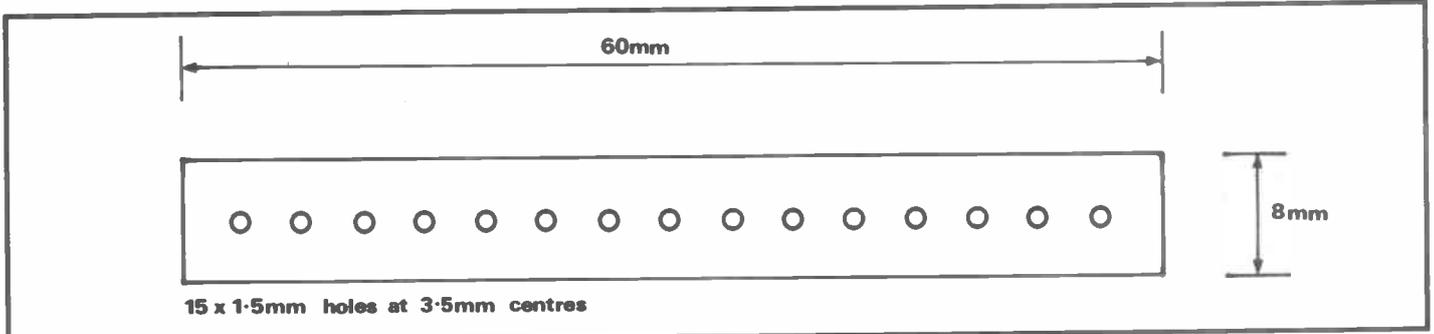


Fig 1: The traps

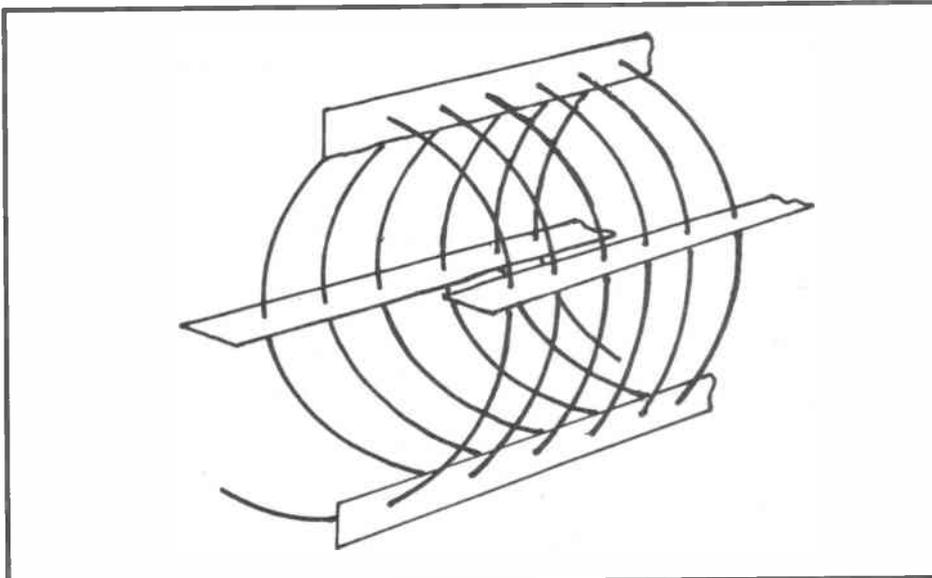
Fig 2: The capacitors



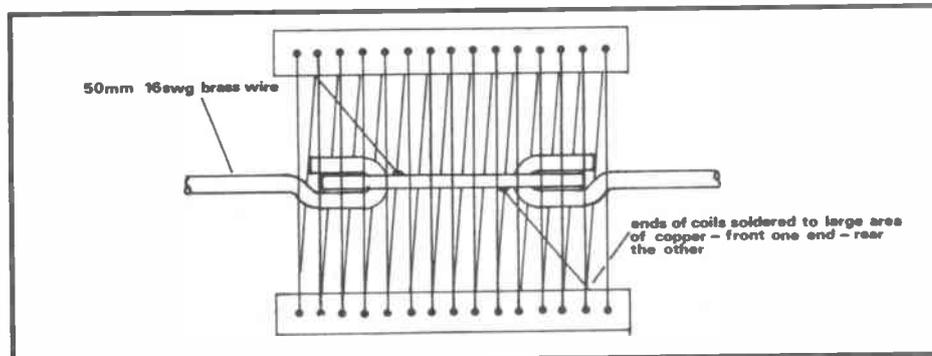
# A TRAPPED DIPOLE FOR THE DX BANDS



**Fig 3:** Spacers for the coils



**Fig 4:** Winding the coils

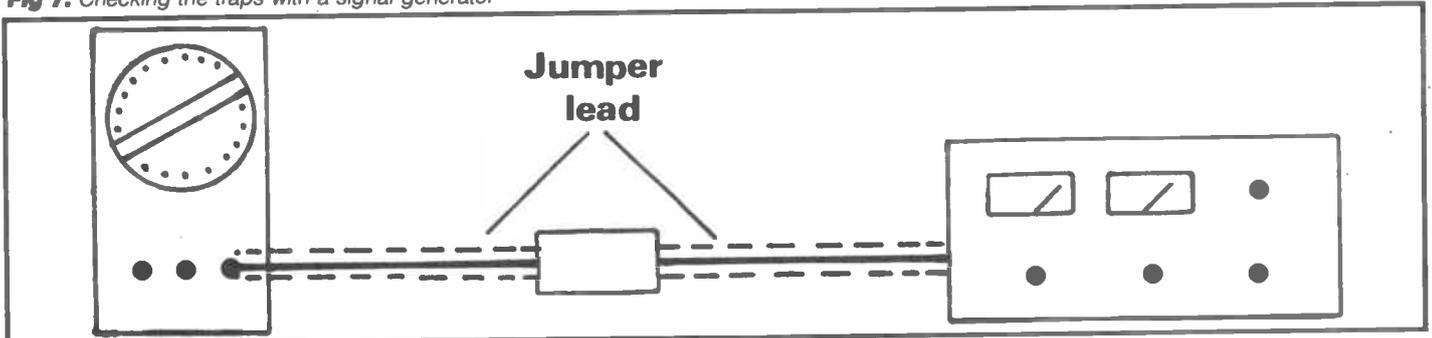


**Fig 5:** The finished trap ready for checking

tly soldered into place. If a digital frequency meter is available, the GDO can be checked against it for added accuracy.

Check the traps before inserting them

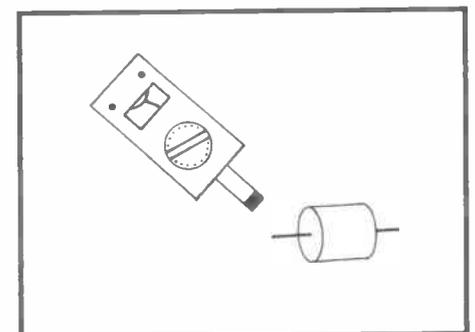
**Fig 7:** Checking the traps with a signal generator



signal to read S9 on the 'S' meter of the receiver. Now remove the jumper lead. If all's well, a marked reduction in the signal strength should be noted. If there is only a little reduction in strength, then the trap is not resonant on the desired frequency. If you still have problems, check that you have soldered the capacitor correctly.

## Housing the traps

A 70mm length of PVC drainpipe with a diameter of 68mm (a standard size) is used to house each trap, and discs of Perspex, or any similar material, are used to seal the ends. An electric glue gun is ideal for sealing the discs into place. The finished traps will weigh about 125 grammes each. Loops are formed on the terminals on to which wire of the dimensions shown in Fig 1 is soldered. The best type of wire to use is 16 or 18swg hard-drawn copper. A centre plate or balun completes the antenna which should be erected as high as conditions allow. It may be necessary to trim the wire to length to obtain the best SWR results; in which case, only a few centimetres at a time should be cut off. Remember, it's much easier to cut off than to stick back on!



**Fig 6:** Checking the traps with the GDO

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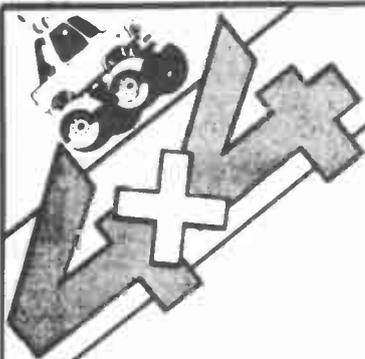


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# GET DIRTY WITH 4x4

# 50MHz

by Ken Ellis G5JKW

From the end of the spring equinox TE and north/south propagation until the beginning of the summer Es' season, the 6m band is normally quiet with little or no excitement. This year, however, the most extensive aurora since records began is believed to have taken place on 13 March.

## Progress of solar cycle 22

Solar cycle 22 continues to rise as predicted, and some exciting openings are expected over the next few months. 'Smithy' G8KG has promised an update and another comparison of cycle 22 with 19 and 21 in time for next month's issue.

There is still a lot being written and discussed concerning 50MHz propagation by those who do not have the suitable facilities to prove or disprove current theories. There is no need to depart from the established theory of Es and F region propagation, except with the true TEP phenomenon in which 6, 4 and 2m and even 70cm signals are weakly received over great distances on symmetrical paths around dusk. A complete description of F2 recognises that at the higher frequencies and near the MUF, the mechanism is more a matter of gradual refraction with signals following a curved path (in the vertical plane) and sometimes covering as much as 7,000km in a single hop. The maximum frequency that can be used on such a path is higher than that yielded by established prediction methods. Note that this brings much of North America into the potential single-hop category, especially as the steep gradient of ionisation which follows the sun across the Atlantic provides ideal conditions for long hops.

F2 propagation at 50MHz is not similar to HF. Nature does not recognise the arbitrary division at 30MHz but sees a gradual rise in frequency with ionospheric attenuation decreasing with F-squared, and the ionospheric needed to turn a ray back to earth increasing with rising frequency. This means that the accepted model of the ionosphere, properly used, is just as helpful in predicting and explaining what happens at 50MHz, as it is at 28.21 or 14MHz. The openings to South America from March to April are a case in point. These months are the most likely to yield good conditions to South America on 50MHz around midday. With high solar indices the median-predicted MUF for a two-hop F2 path is in the low forties, so a lift of around 20° is more than enough. The tendency for such openings to be localised is typical when the band is about to open. In fact, the majority of DX results achieved from G in the past winter season fits in perfectly well with

F2 characteristics, excluding aurora and evident short-haul Es. The sun was unexpectedly (for most of us) active with F2 conditions approaching – if not exceeding – those of the cycle 21 peak.

The month and time of day of the VK and Vs6 contacts, as well as the various one and two-hop openings to Africa and the South Atlantic were as expected. The JA openings also fit in as F2, but *not* over the direct path. The relevant median MUF on the latter was only in the low thirties, but the fact that Gs observed a variety of beam headings well to the south of the direct heading of 30° points to the signals being scattered, probably from the region south of the Caspian Sea. Soviet TV sidebands were very strong at that time, and there were strong backscatter signals in the UK from some of the G8s who are normally inaudible. The geometry of the path is similar to that by which we work North America via scatter from the Caribbean or South Atlantic when the direct path is not open. JAs would have had to beam around 295°, rather than the 336° of the direct path.

So, to summarise: the European winter season was almost all F2 with the band behaving like 28MHz when near the minimum of the cycle.

## Summer Es' season on schedule

Last year the Es' season opened around 4 May. This year a few isolated openings occurred during April, but the main opening appeared to be around 5 May. Many contacts took place with Scandinavian and Mediterranean stations. There were also some two-hop Es' contacts with African stations, giving indications of a good season in store for us again.

A welcome addition to the DX countries' list on 17 May was 5H1HK from Tanzania, giving many of us a new country. My own total is now thirty-nine but I hear via the grapevine that Geoff GJ4ICD now has forty-seven. I will confirm the top scores as soon as details are available.

## UK Six Metre Group AGM

The UK Six Metre Group held a well-attended AGM at the VHF Convention, Sandown Park, on Sunday 16 April 1989; Steve G4JCC was in the chair.

The President of the RSGB, Dr J Gannaway, answered many questions from the floor, mainly about licensing restrictions and the future of 6m in the UK. He assured members that the RSGB would support 6m at forthcoming international conferences. The guest of honour, who was greeted by Dr Gannaway, was Tom Kirby W1EJ, Chairman of the ARRL VHF Committee.

The following members were elected for 1989: Chairman, Steve G4JCC; Vice Chairman, Mike G3JVL; Secretary, Alan GW3DLH; Treasurer, Peter G4ILL; Committee, Mike G3SED and Bill GM4DGT.

## All-time first auroral QSO

We now have full details of the historic QSO between Dr Dave Newman G4GLT and Dave McManus KA1MFA.

Dave G4GLT, writes: 'On 13 March 1989, I kept my beam permanently aimed at the USA, despite the lure of another country in the form of SM on 6m.

'Between 2153 and 2157hrs I heard VE1BPY at RST 559 on 50.101MHz and at 2211hrs, I heard VE1YX on 50.110MHz on SSB RST 53. At 2234hrs, I contacted KA1MFA on 28.885; he was 559 on this frequency. At 2234hrs, on 50.008MHz Dave KA1MFA and I made a CW QSO. The CW was a pure note, but very fluttery – just like pure TEP. I gave him 579 and he gave me 559.

'K1JRW . . . heard me at RST 549 while I was working KA1MFA. I have looked for these auroral conditions for several years now, especially during the massive auroras like this one.

'On 28MHz, VE3TEN and W3VD beacons were both 579 around 2300hrs, and W3VD was last heard at 0022hrs. Both of these 28MHz beacons had fluttery notes. This seems to confirm the work done by SM6PU that auroral E MUF rises to 6m during massive auroras . . . Some have described it as "the aurora of a lifetime". These are Stateside stations who have monitored auroras for thirty years or more on 6m.'

## From the mailbag

Between 15 and 29 March, Mike Devereux G3SED, of Portsmouth, had twenty-nine QSOs with South African stations as well as eleven other DX QSOs including ZS3E, TR8CA, ZS6BMS, ZS6XL, ZS6AXT and ZS3AT.

Brian Booth G3SYC, from Pontefract, West Yorkshire, has had QSOs with G3GJQ/5NO, J52US, TR8CA, ZS3AT, PA0YOP, GM4DGT and eight ZS among others, during February and March. During the same months G4GAI from Rochdale reports working VE2DFO, J52US, ZS6BMS, ZS6WB, ZS6CE and LU8MBL.

Johnny Stace G3CCH, of Scunthorpe, who is one of the most active and successful stations in the north of England, sent a very long and interesting report with over sixty two-day DX QSOs from the beginning of February to 24 April. They include: KA1DE, K1TOL, VE1BPY, HC5K, HC2FG, G3GJQ/5NO, ZS6XJ, ZS6BMS, J52US, JA4MBM, ZS6LN and GW3LDH.

Steve G4JCC, of Hayling Island, sent his usual computer print out listing forty-one QSOs and 104 stations heard on the band. The reason for the large number of stations heard but not worked is that, unless there is a special reason, stations already worked are left alone for those

who still require their first contact. This is very commendable, considering that some DX openings only last for a short time and that there is always a big pile-up of stations waiting in the queue.

I had a telephone call from Steve on 17 May alerting me to 5H1HK on 50.110. After

thirty-five minutes in the queue, I made it for my thirty-ninth country – thanks, Steve.

That concludes another interesting month. Send your reports to: Ken Ellis G5KW, 18 Joyes Road, Folkestone, Kent CT19 6NX.

## FLUKE 87 METER

### Reviewed by Samuel Dick

Fluke is one of the world's leading makers of digital meters, so when they wave the flag about a new hand-held meter, you might expect that it would be worth a look. But what makes a good meter worth buying?

First on the wish list is a comprehensive set of features. The 87 measures current and voltage (both ac and dc) from 1000V to 100 $\mu$ V and 10A to 0.1 $\mu$ A, and resistance from 40M $\Omega$  to 0.01 $\Omega$ . These are measured at 10M $\Omega$  impedance in parallel with less than 100pF. As an option, the mV dc range can be selected to have an input impedance exceeding 4000M $\Omega$ ! To these basic functions are added frequency (to 200kHz), capacitance (from 5nF to 5 $\mu$ F, with explanations of how to measure up to a few thousand  $\mu$ F), duty cycle, fast continuity check, diode check and a recording mode.

The recording mode enables the meter to calculate the minimum, maximum and average voltage or current which passes during the time the meter is connected. Therefore, you can leave the meter watching over a circuit that occasionally goes wrong! The 87 will record high or low transients lasting for around 1mS or, for greater accuracy, those which last for 100mS or 1S. A hold mode is also offered. This means that you can concentrate on getting the meter's probes in the right place without having to worry about missing the value when it appears on the display. Once a steady display is available, the meter holds it until the 'hold' button is pressed.

For those who frequently measure voltage or current about a steady offset, a relative mode is provided. Once this has been selected, the reading on the meter is subtracted from future readings; very useful for checking small departures from a (large) steady value.

One of the main considerations of any piece of test equipment is its ease of use. The 87 is certainly easy to use. The rotary dial on the front is simpler and less prone

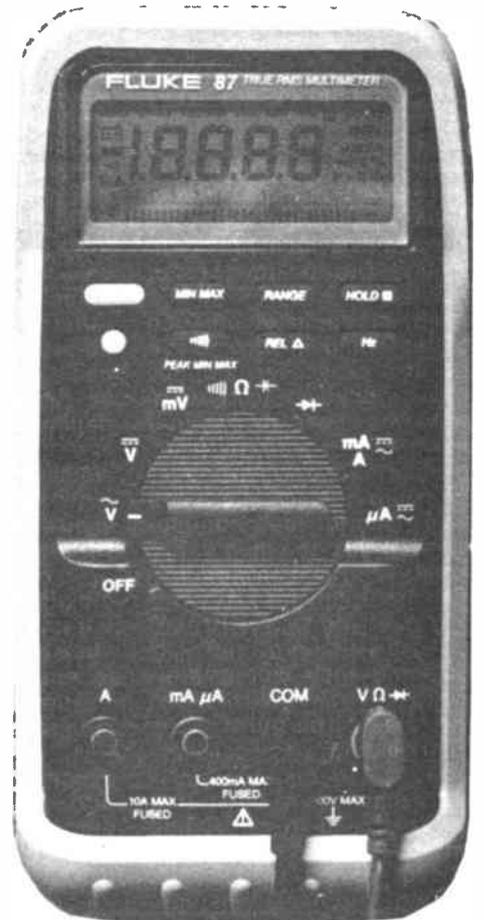
to incorrect setting than the column of push-switches with which earlier Fluke meters were supplied. The meter obligingly 'ticks' if you select a current range while having the test leads plugged into the voltage socket; so the meter 'intelligently' watches over what you try to do. The display is very clear and the units (V or mV, for example) are clearly displayed. The push-buttons also have their own visual annunciators in the display so, for example, you can tell at a glance that the hold feature is enabled.

The meter's bar-graph display is highly spoken of by Fluke but I do not normally find it very useful, except when looking at slowly changing logic levels. Then, the fast response of the bar-graph does make life much simpler because it reaches the correct value some time before the numerical display.

Another worry which pops up when buying such an expensive meter, is how long it is going to last. The 87 has a sturdy feel to it and the bright yellow holster, which comes as standard, is soft enough to absorb most of the shock from the average drop; the colour should ensure that there is little chance of the meter being accidentally left behind, too!

Does the meter offer value for money? Well, that depends on how often it is used. A keen hobbyist might find it rather expensive compared with some of the cheaper (and lower specified) meters which are available. However, the 0.1% accuracy is very useful for setting up test equipment.

In the shack, the frequency range can be used for testing AFSK equipment and other signalling tones. Components (R C diodes) are easy to test, too. A little ingenuity should enable transistors and inductors to be measured. The 87 is a true RMS meter with a response to ac signals up to 20kHz. This makes it an ideal instrument for checking out the audio sections of your equipment. Digital signals may have their duty cycle



checked (a useful indication of fault conditions). With its wide range of abilities, the 87 appears to be a good companion to have in today's digital/analogue shack.

The Fluke 87 costs £215.00. For further information contact Philips Scientific, Test and Measurement Division, Colonial Way, Watford, Herts WD2 4TT. Tel: (0923) 240511.

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■ Several Morse tuition tapes, £9.95 each. Tel: (0689) 58825 ask for Rodney Tomlinson

■ Yamaha PSS17D 100 voice synth, boxed with PSU, plus Toshiba HX10 computer with two joysticks, data recorder, games, etc. All vgc. Exchange for scanner; must have 200-400MHz. Possible cash adjustment. Tel: (04068) 426

■ Kenwood TW-4100E dual-bander, purchased March 1989, genuine reason for sale, £375.00. Yaesu FT-708R 70cm FM portable with speaker/mic, charger, soft case, £150.00. Sommerkamp TS-802 2m FM portable with speaker/mic, dry cells, Ni-Cad charger, fully synthesized, auto scan, 2W/0.1W, £105.00. Realistic DX400 general-coverage receiver, £60.00. VHF portable auto scanning receiver, six 2m channels fitted, £30.00. G0FAJ QTHR. Tel: (0305) 789022

■ Yaesu FRG-7700 Rx, 0-30MHz, FRT-7700 ATU converter, FRV-7700, £310.00 ono. Tel: (0684) 298298

■ Yaesu FT-290R, excellent condition, soft case, Ni-Cads and charger, all for £260.00 ono. Also, Yaesu FT-709R with case and charger, plus spare aerial, bargain at just £190.00. Sony music system, twin tape deck, digital radio graphic equaliser, cabinet, no speaker, £250.00. Tel: (0602) 260234 after 6pm

■ FDK 750XX 2m multimode, workshop manual, for spares or repair, £80.00. Microwave Modules, 100W linear, 10W input, £100.00. Storno three-channel hand-held, leather case, helical, OK for 4m, £15.00. Howes 20m Rx, £12.00. Nombrex signal generator, £10.00. Tel: 091-370 1429

■ Fifty-five HMV and Marconi service manuals, circa 1934-1940, dealing with 105 models, offers. Also, forty-five duplicate manuals, 170 Pye manuals, twenty Hacker manuals and 100+ Ferguson manuals. Exchange for anything related to radio. Write to: WE Stedman, 133B Lynton Road, Bermondsey, London SE1 5QX

■ Yaesu FT-102 HF 100W transceiver with FM, FC-102 ATU, FTV-107R 2m transverter, 12 amp PSU, all in excellent order and boxed, sell complete, £800.00. Tel: (0905) 640672

■ Video monitor: Honeywell 12in green screen, perfect order, ideal for amateur use or computer, also video input, offers. Tel: (0242) 514357

■ Tower sections: three x 10ft, lightweight, £25.00 each, £65.00 all three. Heathkit HX20 and HR20, 80-40m, 20-15m, 10m, manual for Rx (Tx needs attention), and power supply, £85.00 ono. Tel: (0844) 53737. Buyer collects

■ Yaesu FT-707, FC707, FC707, YM34, mic, as new; Trio TR-2300 2m FM, complete with Ni-Cads, soft case, strap, helical, and built-in antenna, boxed; 30W multimode linear with preamp; five-element Hi-gain beam, £850.00. Will split or take Icom IC-321F or similar in part exchange. Tel: (0623) 514396 QTH

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- BD49 10 Neon valves, with series resistor, these make good night lights.
- BD56 1 Mini unisector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
- BD59 2 Flat solenoids—you could make your multi-tester read AC amps with this.
- BD67 1 Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
- BD91 1 Mains operated motors with gearbox. Final speed 16 rpm, 2 watt rated.
- BD103A 1 6V 750mA power supply, nicely cased with mains input and 6V output leads.
- BD120 2 Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers, etc.
- BD122 10m Twin screened flex with white pvc cover.
- BD128 10 Very fine drills for pcb boards etc. Normal cost about 80p each.
- BD132 2 Plastic boxes approx 3in cube with square hole through top so ideal for interrupted beam switch.
- BD134 10 Motors for model aeroplanes, spin to start so needs no switch.
- BD139 6 Microphone inserts—magnetic 400 ohm also act as speakers.
- BD148 4 Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making n/o relays and other gadgets.
- BD149 6 Safety cover for 13A sockets—prevent those inquisitive little fingers getting nasty shocks.
- BD180 6 Neon indicators in panel mounting holders with lens.
- BD193 6 5 amp 3 pin flush mounting sockets make a low cost disco panel.
- BD196 1 in flex simmerstat—keeps your soldering iron etc. always at the ready.
- BD199 1 Mains solenoid, very powerful, has 1in pull or could push if modified.
- BD201 8 Keyboard switches—made for computers but have many other applications.
- BD210 4 Transistors type 2N3055, probably the most useful power transistor.
- BD211 1 Electric clock, mains operated, put this in a box and you need never be late.
- BD221 5 12V alarms, make a noise about as loud as a car horn. Slightly soiled but OK.
- BD242 2 6in x 4in speakers, 4 ohm made from Radiomobile so very good quality.
- BD252 1 Panostat, controls output of boiling ring from simmer up boil.
- BD259 50 Leads with push-on 1/4in tags—a must for hook-ups—mains connections etc.
- BD263 2 Oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into patress.
- BD268 1 Mini 1 watt amp for record player. Will also change speed of record player motor.
- BD283 3 Mild steel boxes approx 3in x 3in x 1in deep—standard electrical.
- BD293 50 Mixed silicon diodes.
- BD305 1 Tubular dynamic mic with optional table rest.

**CAMERAS.** Three cameras, all by famous makers, Kodak, etc. One disc, one 35mm and one instamatic. All in first class condition, believed to be in perfect working order, but sold as untested. You can have the three for £10 including VAT, which must be a bargain—if only for the lenses, flash gear etc. Our ref 10P58

**675 VOLT MAINS TRANSFORMER** PCB mounting, 20VA. A very well made (British) transformer. Ideal for laser power supply, etc. Price £4 our ref 4P38.

**EXTRA SPECIAL CROC CLIPS** Medium size, just right for most hook-ups. Normally sell for around 10p to 15p each. These are insulated and have a length of spring rod connected to them but this is very easy to snip off if you do not need it. 20 for £1. Our ref BD117A.

**COPPER CLAD PANEL** for making PCB. Size approx 12in long x 8 1/2in wide. Double-sided on fibreglass middle which is quite thick (about 1.16in) so this would support quite heavy components and could even form a chassis to hold a mains transformer, etc. Price £1 each. Our ref BD683.

### POWERFUL IONISER

Generates approx. 10 times more IONS than the ET1 and similar circuits. Will refresh your home, office, workshop etc. Makes you feel better and work harder—a complete mains operated kit, case included. £12.50 + £2 P&P. Our ref 12P5.1



**ORGAN MASTER** Is a three octave musical keyboard. It is beautifully made, has full size (piano size) keys, has gold plated contacts and is complete with ribbon cable and edge connector. Can be used with many computers. We can supply information sheet Brand new only £15 plus £3 postage. Our ref 15P15

**MIDI SPEAKERS** Stereo pair, made by the famous Bush Radio Company. One way BASS reflex system, using a full range 4in driver of 4ohms impedance. Mounted in very nicely made black finished walnut finish cabinets. Cabinet size approx 8 1/2in wide, 14in high and 3 1/2in deep. Fitted with a good length of speaker flex and terminating with a normal audio plug. Price £5 the pair plus £1 post. Our ref 5P14.

**CAR SECURITY ALARM.** Protect your car against vandals and thieves. Our ultrasonic burglar alarm on the back shelf of your car would sound off with a terrific noise if anyone opened the door, broke a quarter light or opened the boot. Complete equipment comprises the ultrasonic transmitter, receiver and siren housed in a very neat case, size 7in wide x 2 1/4in high x 4in deep, and its separate siren. The mains power supply which is included to operate the separate siren would not be required as the 12 volts could be obtained from the car battery. The price is £30. Our ref 30P5

**COMPUTER COMPATIBLE CASSETTE RECORDER** For playing games or for listening to music cassettes. It has a built-in condenser microphone and loudspeaker (muted if you use the extension socket). Has the following controls: pause, stop/eject, fast forward, rewind, play and record. Also has built-in tape counter, extension headphone and microphone socket and volume control. Built-in power supply enables it to run from the mains but provision also for battery operation. In 'as new' condition, but customer returns so may have fault. Price only £10 and if you order 4 you get a fifth one free. Our ref 10P65.

**3 1/2in FLOPPY DISC DRIVE—DOUBLE SIDED, DOUBLE DENSITY, 80 TRACK** Shugart compatible, has 34 way IDC connector and will interface with almost any computer. Made by the famous Japanese NEC Company. Price £59.50 plus £3 insured post.



**ATARI 65XE COMPUTER** At 64K this is most powerful and suitable for home and business. Complete with PSU, TV lead, owner's manual and six games. Can be yours for only £45 plus £3 insured delivery.

**65XE COMPENDIUM** Contains 65XE Computer its data recorder, XC12 and its joystick with ten games for £62.50 plus £4 insured delivery.

**CATHODE RAY TUBE** The Philips 9in black and white, makers' reference M24 306W, which in addition to being a high resolution tube is also X-ray and implosion protected. Regular price will over £30, our price £12 plus £2 post, and if you order during May, June and July you will get the deflection coils free. Our ref 12P7

**1/8th HORSEPOWER 12 VOLT MOTOR.** Made by Smiths, the body length of this is approximately 3in, the diameter 3in and the spindle 5/16th of an inch diameter. It has a centre flange for fixing or can be fixed from the ends by means of 2 nuts. A very powerful little motor which revs at 3,000 rpm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for at least two years. Price £6. Our ref 6P1. discount for quantities of 10 or more.

### PHILIPS LASER

This is helium-neon and has a power rating of 1.6mW. Completely safe so long as you do not look directly into the beam when eye damage could result. Brand new, full spec, £30 plus £3 insured delivery. Mains operated power supply for this tube gives 8kV striking and 1.25kV at 5mA running. Complete kit with case £15. Battery operated P.S.U. now available at £15.

**BATTERY DRIVEN LASER POWER SUPPLY** This is available in three versions. First: is a case unit which holds the power supply and is fed from a separate 12 volt battery and drives the laser through extension leads. Kit complete with ABS case. Price £15. Our ref 15P22. Second: is a metal cased unit which holds the power supply and the laser out is driven from an external 12 volt battery. This unit, in kit form, costs £18. Our ref 18P2. A conversion kit from 15P22 to 18P2 is £6. Our ref 6P14. Third: is a metal cased unit which holds the laser, its power supply and 2x6 volt rechargeable batteries which feed it, also the mains driven unit to recharge the batteries. Complete kit is £24. Our ref 24P2.

**MONO RADIO CASSETTE RECORDER** AM-FM with all the normal controls. In 'as new' condition but customer returns or shop rejects, so may need attention. Price £10. Order 5 of these and get a sixth one free. Our ref 10P66.

**PRETTY CASSETTE PLAYER** in handy carrying pouch with silk type shoulder cord. Ideal present for a young girl. New, tested and in perfect order. Just needs headphones and batteries. Price £4. Our ref 4P35.

**HIGH RESOLUTION MONITOR.** 9in black and white, used Philips tube M24 306W. Made up in a lacquered frame and has open sides. Made for use with OPD computer but suitable for most others. Brand new. £16 plus £5 post. Our ref 16P1

**12 VOLT BRUSHLESS FAN.** Japanese made. The pop art square shape 4 1/2in x 4 1/2in x 1 3/4in. The electronically run fans not only consume very little current but also they do not cause interference as the brush type motors do. Ideal for cooling computers, etc., or for a caravan. £8 each. Our ref 8P26

### FDD BARGAIN

3 1/2in made by Chicon of Japan. Single sided, 80 track, Shugart compatible interface, interchangeable with most other 3 1/2in and 5 1/4in drives. Completely cased with a pin power lead and 34 pin computer lead £40 plus £3 insured delivery. Our ref 40P1.

**OUR ALADDIN'S CAVE.** You may be a new reader and now know that we have a shop at 12 Boundary Road, Hove, where you can go and have a browse around at our assortment of 'goodies'. Unfortunately, because of staff shortages we cannot be open on Saturdays yet, so the hours are 9.30am to 5pm, Monday to Friday. We of course still serve callers at 250 but request that you bring a completed order form as 250 is really the main order depot.

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MAIL ORDER TERMS: Cash, PD or cheque under order. Orders under £20 add £1.50 service charge. Monthly account orders accepted from schools and public companies. Access and B/card orders accepted. Minimum £5. Phone (0273) 734648 or 203500

### POPULAR ITEMS

Some of the many items described in our current list which you will receive if you request it

**EHT TRANSFORMER** 4kv 2mA Ex-unused equipment £5. Our ref 5P139

**FOIL CAPACITORS** Axial ended 33uf 1 000v 4 for £1. Our ref BD672. Many other sizes in stock, send for May newsletter.

**4 CORE TINSEL COPPER LEAD** As fitted to telephones, terminating with flat BT plug. 2 for £1. Our ref BD639.

**EHT TRANSFORMER** 8kv 3mA £10. Our ref 10P56

**DOUBLE MICRODRIVES.** We are pleased to advise you that the Double Microdrives which we were offering at about this time last year as being suitable for the 'QL' 'OPD' and several other computers are again available, same price as before namely £5. Our ref 5P113

**SOFTWARE FOR REMAKING.** Just arrived. Large quantity of mainly games. All are on normal tape spool in cassette holders and should be suitable for wiping out and re-making into games or programmes of your own design. We offer 5 different for £2 or 100 assorted for £20. Important note: We cannot say which titles you will get nor accept orders for specified titles or 'so many, all different', etc., so only order if you can take them as they come. Order ref 5 for £2 is 2P224. 100 assorted is 20P10

**VERY USEFUL MAGNETS.** Flat, about 1in long, 1/2in wide and 1/4in thick. These are polarised on their faces which makes them ideal to operate reed switches in doors and windows or to hold papers or labels, etc., to metal cabinets, or even to keep cupboard doors firmly closed. Very powerful 6 for £1. Our ref BD274(a)

**ACORN COMPUTER DATA RECORDER REF ALF03** Made for the Electron or BBC computers but suitable for most others. Complete with mains adaptor, leads and handbook. £10.00. Ref 10P44

**FREE POWER!** Can be yours if you use our solar cells—sturdily made modules with new system bubble magnifiers to concentrate the light and so eliminate the need for actual sunshine—they work just as well in bright light. Voltage input is 45—you join in series to get desired voltage—and in parallel for more amps. Module A gives 100mA, Price £1. Our ref BD063. Module C gives 400mA, Price £2. Our ref 2P199. Module D gives 700mA. Price £6. Our ref 6P3

**SOLAR POWERED NI-CAD CHARGER** 4 Ni-Cad batteries AA (BP7) charged in eight hours or two in only 4 hours. It is a complete, boxed ready to use unit. Price £6. Our ref 6P3

**METAL PROJECT BOX** Ideal size for battery charger, power supply, etc. sprayed grey, size 8in x 4 1/4in x 4in high, ends are louvred for ventilation other sides are flat and undrilled. Price £2. Order ref 2P191

**4-CORE FLEX CABLE.** Cores separately insulated and grey PVC covered overall. Each copper core size 7/0 2mm. Ideal for long telephone runs or similar applications even at mains voltage 20 metres £2. Our ref 2P196 or 100 metres coil £8. Order ref 8P19

**6-CORE FLEX CABLE.** Description same as the 4-core above. Price 15 metres for £2. Our ref 2P197 or 100 metres £9. Our ref 9P1

**13A PLUGS** Pins sleeved for extra safety, parcel of 5 for £2. Order ref 2P185

**13A ADAPTERS** Takes 2 13A plugs, packet of 3 for £2. Order ref 2P187

**20V 0-20V Mains transformers** 2 1/2 amp (100 watt) loading, tapped primary, 200-245 upright mountings. £4. Order ref 4P24

**BURGLAR ALARM BELL**—6" going OK for outside use if protected from rain. 12V battery operated. Price £8. Ref 8P2

**VERY RELIABLE CAPACITOR** 4.7uF 400v not electrolytic so not polarised, potted in air can, size 1 3/4x 3/4x 1 1/2in high. A top grade capacitor made for high class instrument work. Ideal for PCB mounting. 2 for £1. Our ref BD667

**CAPACITOR BARGAIN**—axial ended, 4700uF at 25V. Jap made, normally 50p each, you get 4 for £1. Our ref 613

**SINGLE SCREENED FLEX** 7.02 copper conductors, pvc insulated then with copper screen, finally outer insulation. In fact quite normal screened flex. 10m for £1. Our ref BD668

**M.E.S. BULB HOLDERS** Circular base battery type fitting, 4 for £1. Our ref BD127a

**SPRING LOADED TEST PRODS**—Heavy duty, made by the famous Bulgin company, very good quality. Price 4 for £1. Ref 40597

**3-CORE FLEX BARGAIN No. 1**—Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. Ref 2P189

**3-CORE FLEX BARGAIN No. 2**—Core size 1.25mm so suitable for long extension leads carrying up to 13 amps, or short leads up to 25A. 10m for £2. Ref. 2P190

**ALPHA-NUMERIC KEYBOARD**—This keyboard has 73 keys giving trouble free life and no contact bounce. The keys are arranged in two groups, the main area is a QWERTY array and on the right is a 15 key number pad, board size is approx 13" x 4"—brand new but offered at only a fraction of its cost, namely £3, plus £1 post. Ref. 3P27

**WIRE BARGAIN**—500 metres 0.7mm solid copper tinned and p.v.c. covered. Only £3 plus £1 post. Ref 3P31—that's well under 1p per metre, and this wire is ideal for push on connections

**1/8th HORSEPOWER 12 VOLT MOTOR** Made by Smiths, the body length of this is approximately 3in, the diameter 3in and the spindle 5/16th of an inch diameter. It has a centre flange for fixing or can be fixed from the end by means of 2 nuts. A very powerful little motor which revs at 3,000rpm. We have a large quantity of them so if you have any projects in mind then you could rely on supplies for at least two years. Price £6. Our ref 6P1. discount for quantities of 10 or more.

**3 VOLT MOTOR** Very low current so should be very suitable for working with solar cells. £1 each. Our ref BD681

**MINI SPEAKERS** to use instead of headphones with your personal stereo—simply plug in to earphone socket. Excellent sound quality, only £4 per pair. Our ref 4P34

**SEALED LEAD ACID BATTERIES** Japanese made re-chargeable and maintenance-free. Leak-proof construction, so could be used in any position. Long life expectancy—usually four to five years. 12V 2.6Ah, £10 each. Our ref 10P59. 6V 1Ah, £5 each. Our ref 5P135

**INNER EAR STEREO HEADPHONES** Ideal for lady listeners as they will not mess up your hair! Do! Come complete in a neat carrying case. Price £3. Our ref 3P56

**STEREO HEADPHONE AMPLIFIER** Very sensitive. A magnetic cartridge or tape head will drive it. Has volume control and socket for stereo headphones. 3V battery operated. £1 each. Our ref BD680

**FET CAPACITOR MICROPHONE** EAGLE CI 200. Output equivalent to a high class dynamic microphone while retaining the characteristics of a capacitor microphone. Price £1. Our ref BD646

**SUB-MIN TOGGLE SWITCH** Body size 8mm x 4mm x 7mm SBDT with chrome dolly fixing nuts. 4 for £1. Our ref BD649

**SUB-MIN PUSH SWITCH** DPDT. Single hole fixing by hexagonal nut. 3 for £1. Our ref BD650

**DISPLAY 16 CHARACTER 2 LINE** As used in telephone answering and similar machines. Screen size 85mm x 36mm x 9.3mm. Alpha-numeric, dot matrix module with integral CMOS micro processor. LCD display. Made by the EPSON Company, reference 16027AR. Price £10. Our ref 10P50



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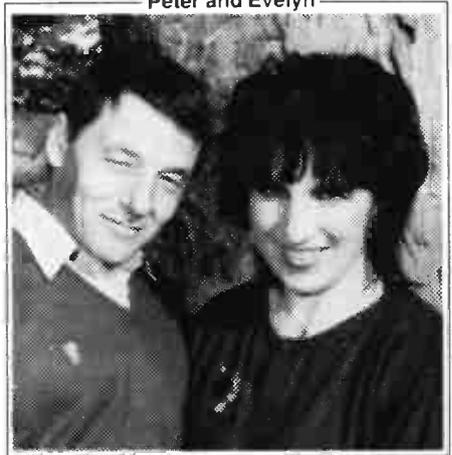
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